Vol. 11 No. 1 SPRING 2025

THE MAGAZINE FOR THE METAL ADDITIVE MANUFACTURING INDUSTRY

METAL AM

in this issue

MATERIALS SOLUTIONS: TEN YEARS ON
AI AND AM: A CEO'S PERSPECTIVE
AMS 2025 NEW YORK | DEPOWDERING

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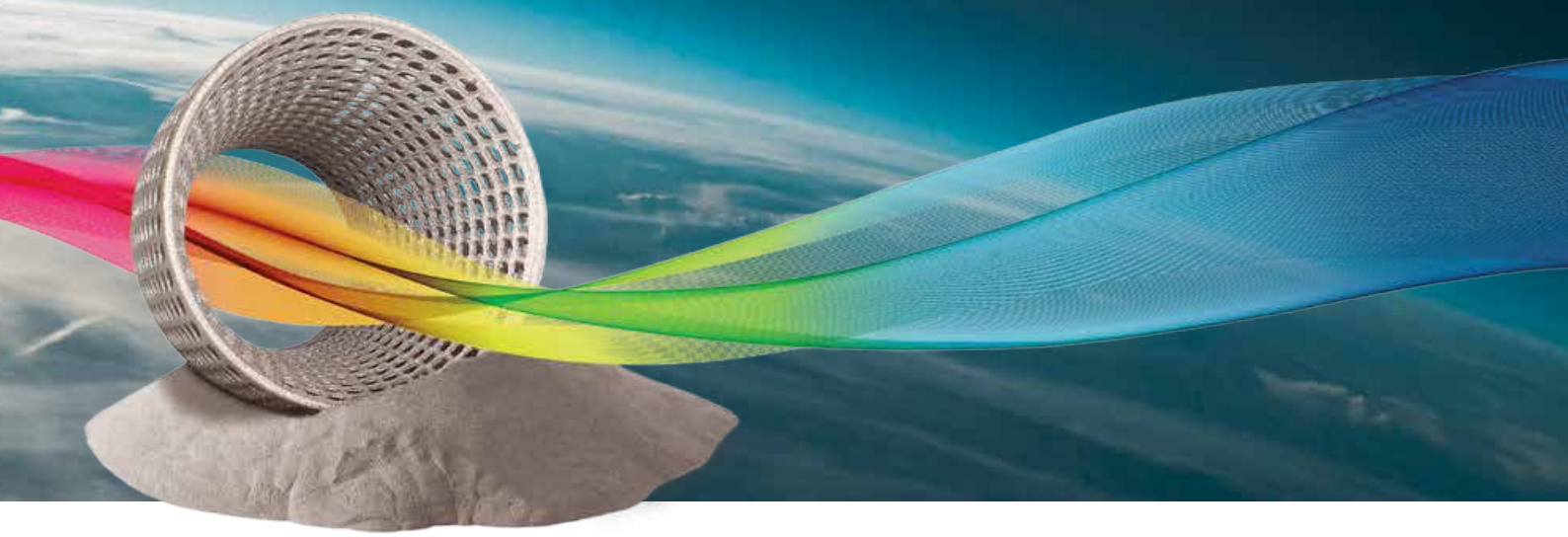

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METAL ADDITIVE MANUFACTURING MAGAZINE

Celebrating ten years of *Metal AM* magazine

Ten years ago, in the spring of 2015, we published the first issue of *Metal Additive Manufacturing* magazine. It was a time of high hopes for AM technology, with a palpable collective ambition for success driven by AM machine companies. This collaborative spirit proved to be a powerful force behind the first Formnext exhibition, with which we are very happy to share this ten-year anniversary.

But what of the industry's progress? While some express frustration about the slow pace of the 'industrialisation' of Additive Manufacturing, how much has really changed over the period?

In that first issue of *Metal AM*, we profiled Materials Solutions, a UK-based company then working at the cutting edge of AM thanks to its focus on mastering the Laser Beam Powder Bed Fusion (PBF-LB) of high-temperature alloys. For this tenth anniversary issue we returned to the company to consider what its story can tell us about wider industry progress.

Thankfully, the story is one of success, driven by an unwavering focus and a commitment to the highest levels of engineering rigour, whilst leveraging remarkable developments in AM machine technology, materials and post-processing. It is a story of industry success that rises above the noise surrounding the financial failures of a small number of overambitious and overpromising AM technology companies.

As for the next ten years? It feels as if the industry is now on more solid ground, but the pace of innovation appears to be faster than ever as Artificial Intelligence pushes digital manufacturing in directions that, ten years ago, we could never have imagined.

Nick Williams
Managing Director

Cover image
The assembly of PBF-LB gas turbine vanes produced by Materials Solutions (Courtesy Materials Solutions Ltd)

What can Cold Spray Additive Manufacturing do for you?

This new Buyer's Guide for High-Speed Metal 3D Printing is an essential resource for organizations looking at new technologies for the manufacturing of heavy-duty metal parts.

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Ten years ago, in the first-ever issue of *Metal AM* magazine, Materials Solutions was featured as one of the industry's rising stars. A decade on, with ongoing questions about the wider industry's progress, we returned to see what the company's journey reveals. Much has changed, including its acquisition by Siemens Energy (formerly Siemens AG), which fuelled significant growth. Yet the company remains firmly focused on its core expertise: processing nickel-base superalloys for high-temperature applications.

Martin McMahon reports on its journey to large-scale series production, including a milestone agreement with Rolls-Royce Civil Aerospace and a major investment in Nikon SLM Solutions' NXG XII 600 machines. >>>

137 Win or lose: A CEO's reflections on Artificial Intelligence and Additive Manufacturing

Artificial Intelligence is reshaping industries, and Additive Manufacturing is no exception. For CEOs, the challenge isn't just understanding AI's potential but strategically integrating it to drive efficiency, innovation, and competitive advantage.

In this article, Henning Fehrmann, chairman and CEO of FEHRMANN Tech Group, considers AI's real-world impact on AM. Drawing from personal experience, he offers insights on how AM industry leaders can leverage AI to strengthen their businesses, adapt to market shifts, and stay competitive. >>>

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145 **AMS 2025 New York: A reality check for the Additive Manufacturing industry**

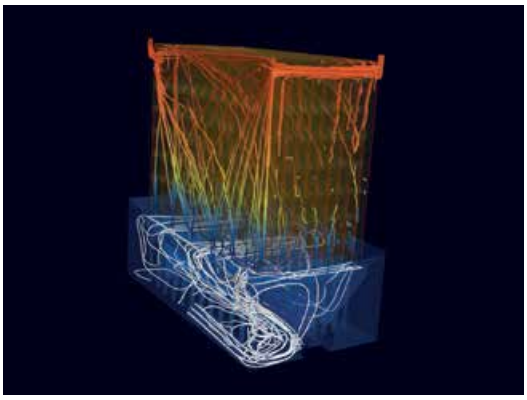
AMS 2025, organised by 3Dprint.com and Additive Manufacturing Research, delivered a stark wake-up call for the Additive Manufacturing industry. Once hailed as a disruptive force, AM is struggling to meet high expectations, with large-scale industrial adoption progressing more slowly than anticipated. The event revealed a disconnect between bold financial projections and market realities, leading to a crisis of confidence among investors and stakeholders.

Tali Rosman reports on an industry at a crossroads, facing hard truths and recalibrating for the future. >>>

153 **Optimising powder removal in PBF-LB Additive Manufacturing: A Digital Twin approach**

As Additive Manufacturing pushes the boundaries of design, post-processing remains a major challenge – in particular powder removal in Laser Beam Powder Bed Fusion (PBF-LB). But what if the digital twin of a part could not only optimise its design, but also predict and streamline powder removal?

Here, Joseph Kowen explores how Solukon's SPR-Pathfinder software achieves this, using advanced simulation to map powder flow and automate depowdering, ensuring that even the most intricate designs remain manufacturable. >>>



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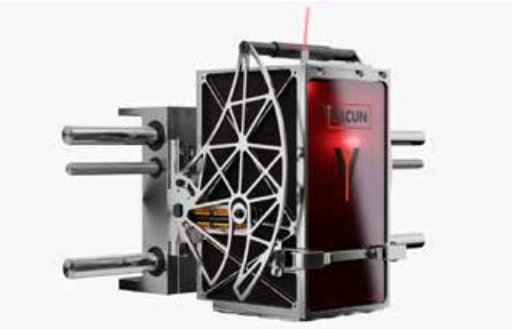
163 ValCUN's MMD: A robust, wire-based aluminium AM technology for defence and industrial applications

ValCUN's Molten Metal Deposition (MMD) technology is a wire-based Additive Manufacturing solution designed to improve deployability and cost efficiency in aluminium part production. While applicable across various industrial sectors, it is also being explored for defence applications due to its potential for in-field manufacturing.

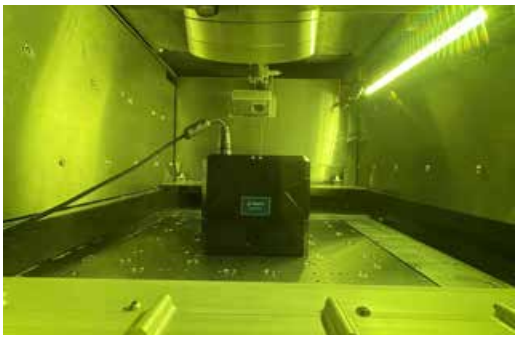
With its inherent robustness, and the elimination of powder handling, MMD offers a deployable, user-friendly solution for producing critical parts in remote or demanding environments, as well as for seamless integration into industrial production settings. >>>



171 Enhancing quality and reliability in metal Additive Manufacturing: The role of laser calibration

In metal Additive Manufacturing, precision and reliability are critical, particularly in highly regulated industries. Ensuring consistent quality requires meticulous laser calibration and process control. 3D Systems addresses this need by integrating advanced laser beam analysis and power measurement solutions from MKS's Ophir brand.

As the company reports, by leveraging Ophir's high-precision sensors, 3D Systems enhances laser performance monitoring and process stability, helping its customers meet stringent industry standards and produce the highest-quality metal AM components. >>>



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Our advertisers' index serves as a convenient guide to suppliers of AM machines, materials, part manufacturing services, software and associated production equipment.

In the digital edition of *Metal AM* magazine, available at www.metal-am.com, simply click on a company name to view its advert, or on the weblink to go directly to its website. >>>

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Industry news

To submit news please contact Paul Whittaker, Group News Editor: paul@inovar-communications.com

New Nikon Advanced Manufacturing Technology Centers in the US and Japan reflect bold ambitions

Nikon Corporation has officially opened two Advanced Manufacturing Technology Centers, located in the US and Japan, reflecting its ambitions to be the global leader in the Additive Manufacturing industry.

The grand opening of the Nikon Advanced Manufacturing Technology Center in Long Beach, California, USA, took place on January 14. This 8,400 m^2 facility brings together Nikon, Nikon SLM Solutions, and Nikon AM Synergy (formerly Morf3D) under one roof. The facility will support industries, including the aerospace, defence and energy sectors, with advanced Additive Manufacturing technologies including Laser Beam Powder Bed Fusion (PBF-LB) and Directed Energy Deposition (DED).

The Long Beach facility provides comprehensive AM application engineering and development services, as well as manufacturing solutions that include prototype and series production capabilities which are housed in an ultra-secure location. The facility is equipped with state-of-the-art metallurgy and metrology capabilities to support Nikon Advanced Manufacturing's business initiatives.

The grand opening was celebrated with invited guests including Admiral Mike Mullen (Ret., USN), Long Beach Mayor Rex Richardson, Consul-General of Japan Kenko Sone, and other notable leaders. The centre, it was stated, underscores Nikon's commitment to sustainability and innovation. By streamlining processes and reducing waste, the facility aligns with modern industry demands for environmentally-friendly manufacturing solutions.

Nikon opened its Advanced Manufacturing Technology Center in Japan, located in Gyoda, Saitama Prefecture, Japan, on February 28. As with the California location, this new 922 m^2 facility brings Nikon's AM portfolio together under one roof. The centre is similarly equipped with the ultra-large format NXG XII 600 Additive Manufacturing machine from Nikon SLM Solutions, reportedly the first of its kind in Japan. The NXG series features twelve lasers with a build platform that, depending on the model, allows printing parts up to a maximum of 1.5 m and will be pivotal

The official opening of Nikon's Advanced Manufacturing Technology Center in Long Beach, California, USA, took place on January 14 (Courtesy Nikon)

Nikon's Advanced Manufacturing Technology Center in Gyoda, Saitama Prefecture, Japan, which was officially opened on February 28, houses an ultra-large format NXG XII 600 Additive Manufacturing machine from Nikon SLM Solutions (Coutesy Nikon)

Hans Ihde, founder of SLM Solutions, with Nikon's president, MuneAki Tokunari, and Sam O'Leary, CEO, Nikon SLM Solutions, at the company's Lübeck headquarters (Courtesy Nikon SLM Solutions via LinkedIn)

in enabling the most demanding AM applications, especially for the defence, space and aviation sectors.

The new facility will also house high-precision DED machines, including the Lasermeister LM300A, for repair and maintenance applications across various industries, along with X-ray CT inspection equipment and other key solutions to advance metal AM technology development and processing for customers throughout Asia.

Nikon president in Lübeck, O'Leary reports strong growth

Highlighting the strategic importance of Additive Manufacturing to Nikon Corporation, MuneAki Tokunari, Representative Director, President, COO & CFO, visited the headquarters of Nikon SLM Solutions in Lübeck, Germany, in December. During a tour of the facility, Tokunari met with Hans Ihde, founder of the company, and Sam O'Leary, CEO.

"Last week I had the pleasure of visiting Nikon SLM Solutions for the first time, located on the outskirts of the beautiful city of Lübeck in Northern Germany. I had the pleasure of meeting the founder Hans, the CEO Sam and other wonderful people. The Nikon Group will continue to innovate in the world of manufacturing and strive for a better society," Tokunari stated.

Nikon SLM Solutions recently reported revenue of €150 million for 2024, representing 36% growth on 2023. This was attributed to the company's innovative AM technology developments and strong industry demand, supported by the decision to expand production of the NXG XII 600 Additive Manufacturing machine in the US. "We've been relentless and laser focused in pushing the art of what's possible in metal Additive Manufacturing, and that has allowed us to once again deliver strong results," O'Leary stated.

Nikon AM Synergy adds three directors to its board

In January, Nikon announced the appointment of James (Hondo) Geurts, Brett T Williams, and Robert E Bruck to the Nikon AM Synergy Board of Directors. As independent directors to Nikon AM Synergy, it was stated that these appointments aim to reinforce the company's commitment to serving the critical needs of the defence, space, and energy industries.

"With the strategic transformation of Nikon AM Synergy and the recent launch of the Nikon AM Technology Center, Nikon Advanced Manufacturing is positioned to lead in catalysing onshore industrial manufacturing," said Nikon Advanced Manufacturing CEO Hamid Zarringhalam. "The Nikon AM Synergy Board of Directors are trusted leaders that bring a wealth of hands-on, real-world expertise that will enable us to meet the critical needs of the defence, space, and energy industries, and beyond."

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Indo-MIM to add five more HP Metal Jet S100s to expand production capacity

Based on the success of its collaboration with HP, INDO-MIM, headquartered in Bengaluru, India, is adding five additional HP Metal Jet S100 to its fleet of Additive Manufacturing machines. Two of the new metal Binder Jetting (BJT) machines have already been installed at the company's US facility in San Antonio, Texas. The remaining systems will be delivered throughout 2025 and 2026.

INDO-MIM initially partnered with HP in late 2023, purchasing three HP Metal Jet S100s. In April 2024, the company opened its Additive Manufacturing production cell, supported by the HP metal AM machines. The partnership has combined the technical expertise of both companies to advance Binder Jetting applications and accelerate the development of new materials for the HP Metal Jet S100 platform. INDO-MIM reports having used the machines for a wide range of applications, both for internal use in tooling and for OEMs in various industries.

"The quality of the HP Metal Jet S100 platform, combined with our extensive experience in sintering and robust in-house processing capabilities, has enabled us to rapidly adopt and optimise the BJT process," stated Jag Holla, Senior Vice President at INDO-MIM Ltd.

INDO-MIM has ordered five more HP Metal Jet S100s, with the first two of these installed at its US facility in San Antonio, Texas (Courtesy INDO-MIM)

A key advantage for the company is its ability to produce its own metal powders. INDO-MIM currently offers 17-4PH, SS 316, and M2 Tool Steel powders for the HP S100 platform. The additional machines will not only enable the company to grow its metal Additive Manufacturing business, but will be used to support its in-house powder development capabilities. INDO-MIM stated that in 2025 it plans to introduce additional material options, further expanding the versatility of the Binder Jetting process.

The Metal Jet S100 has an effective build volume of 430 x 309 x 140 mm. The Metal Jet workflow includes a powder management station, the Metal Jet S100 AM machine, a curing station and a powder removal station.

INDO-MIM is the world's largest Metal Injection Moulding company, with over 3,000 employees producing over 150 million MIM parts annually. As a leading BJT service provider, the company added that it is poised to launch multiple serial production programmes utilising its BJT technology in 2025.

www.hp.com
www.indo-mim.com

ADDiTEC launches AMDROiD X for in-situ demanding manufacturing environments

ADDiTEC, headquartered in Palm City, Florida, USA, has launched its AMDROiD X, a self-contained and portable laser-based Directed Energy Deposition (DED) Additive Manufacturing machine. The turnkey solution is designed for rapid deployment in demanding environments.

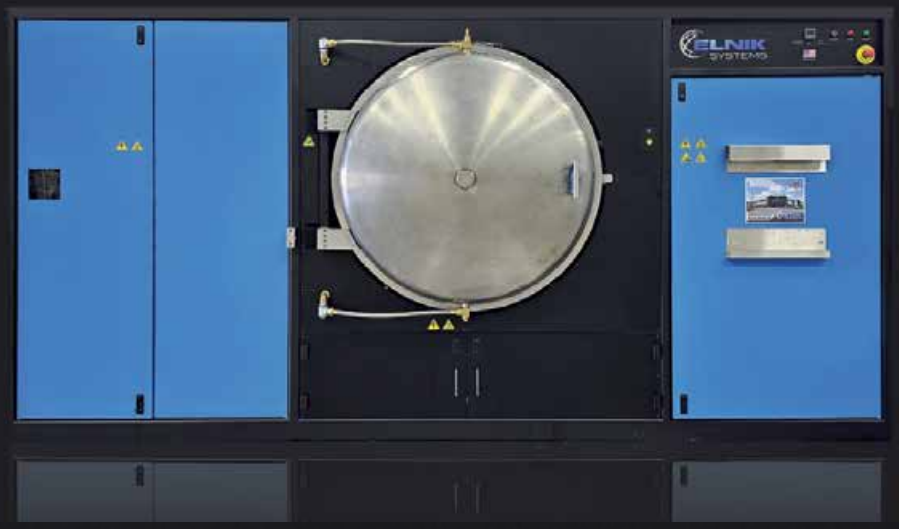
The AMDROiD X, with either a 6 kW or 12 kW fibre laser, enables the in-situ production of large-scale metal components. The DED machine can process wire feedstock, including stainless steel, aluminium and copper, with high deposition rates.

The robotic architecture is housed in a portable 3.05 m modular container. It has four powerwalls which provide 54 kWh of usable energy that can be recharged via the solar-panelled roof.

The AMDROiD X also comes with software tools able to accommodate complex multi-axis geometries in an effort to make DED Additive Manufacturing technology more accessible to new users.

AMDROiD X is the company's latest in-situ DED machine (Courtesy ADDiTEC)

www.additec3d.com



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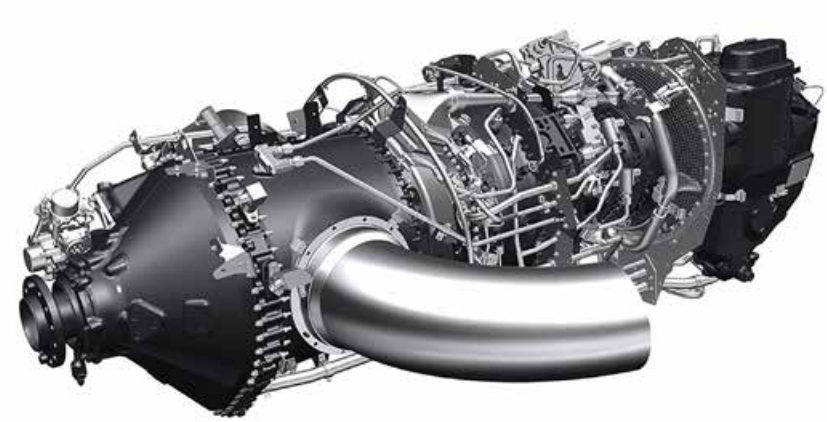
GE Aerospace's Catalyst turboprop engine with additively manufactured parts receives FAA certification

GE Aerospace has announced that its Catalyst turboprop engine, featuring a high number of additively manufactured parts, has been certified by the US Federal Aviation Administration.

Almost 30% of the internal metal parts of the Catalyst engine are reported to be additively manufactured, reducing the total part count from 855 to just twelve. The AM parts help shave off more than 45 kg in weight and are produced by Avio Aero, a GE Aerospace company based in Brindisi, Italy.

"The certification of the Catalyst engine is a significant milestone for our company and a proud moment for all our team members who have dedicated their efforts to the design, development, and testing of this brand-new European turboprop engine," stated Riccardo Procacci, President and CEO, Propulsion and Additive Technologies at GE Aerospace. "We are now fully committed to supporting the production ramp-up of the engine towards the entry into service in support of our customers."



GE Aerospace's Catalyst turboprop engine, with almost 30% additively manufactured parts, has been certified by the US Federal Aviation Administration (Courtesy GE Aerospace)

Additive Manufacturing has helped enable the Catalyst engine to achieve a 16:1 overall pressure ratio, resulting in up to 18% better fuel consumption and up to 10% higher cruise power compared to other engines in the same class. The Catalyst introduces two stages of variable stator vanes and cooled high-pressure turbine blades.

Paul Corkery, Catalyst General Manager at Avio Aero added, "Catalyst has been through a rigorous certification and testing process. We are pleased with the performance of the engine throughout its ground and flight test campaigns, and we remain fully focused on supporting Textron Aviation as they complete the certification process and prepare for entry into service of the Beechcraft Denali."

The Catalyst engine belongs to the GE Aerospace suite of next-generation engines. It was designed, developed, and manufactured at GE Aerospace sites in Europe, including Avio Aero in Italy, Czechia, Poland, and Germany.

The FAR (Federal Aviation Regulation) Part 33 certification involved testing over twenty-three engines and more than 190 components. During the certification process, the test engines completed more than 8,000 hours of operation, demonstrating and meeting their key performance targets.

www.geaerospace.com

Sandvik celebrates 50 years of Osprey at its South Wales metal powder facility

Sandvik AB, headquartered in Stockholm, Sweden, is celebrating fifty years of manufacturing its Osprey line of products at its Neath, South Wales, UK, facility. From humble beginnings, the unit has evolved to become a leading manufacturer of gas-atomised metal powders and a novel range of controlled expansion (CE) alloys.

"This milestone is a testament to the dedication, hard work, and innovation of all employees, partners, and customers who have been part of the journey," stated Andrew Coleman, VP Business unit Additive Manufacturing at Sandvik. "It demonstrates Sandvik's long-term experience that makes us a trusted partner for customers in areas such as Additive Manufacturing and Metal Injection Moulding (MIM), and across a range of demanding industries."

Today, the Neath production site is the cornerstone of Sandvik's metal powder manufacturing capability. The company states that the Osprey range of metal powders is the broadest on the market with over 2,000 different alloys, specialising in fine and mid-fraction sizes.

This scope of its atomising technology also enables Sandvik to manufacture its range of HIPed CE alloys which are suitable for various applications, including those with extreme temperature variations.

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Globus introduces high-strength Alloy-X metal powder

Globus Metal Powders Ltd, based in Middlesbrough, UK, has introduced its Alloy-X metal powder, a nickel powder composed of alloying elements including molybdenum and tungsten, said to provide superior strength and durability compared to traditional materials. Its ability to maintain structural integrity under high heat makes it useful in sectors such as aerospace and automotive.

The alloy's combination of molybdenum and tungsten provides a barrier against various forms of corrosion, including oxidation and sulfidation, stated Globus. This also makes Alloy-X suitable for use in chemical processing, marine environments and other corrosive settings.

In the aerospace sector, Globus expects to see increased adoption of Alloy-X for components like turbine blades and structural parts subjected to high temperatures and mechanical stress. The alloy's lightweight nature also contributes to fuel efficiency, a critical factor in modern aerospace engineering.

Alloy-X is also ideal for manufacturing high-performance components (e.g. exhaust systems, turbochargers and other engine components) in the automotive industry. The material meets demanding requirements for components that must withstand high temperatures while maintaining superior performance.

In the energy sector – and the Oil & Gas industry, in particular – Alloy-X is well-suited for drilling equipment and components exposed to harsh conditions, the company added. Its resistance to corrosion and wear enables components to remain functional and safe over extended periods.

Globus also highlighted Alloy-X's weight-to-strength ratio and longevity in comparison to traditional materials.

Costs

While the initial cost of Alloy-X metal powder may be higher than traditional materials, Globus stated, the long-term savings outweigh the upfront cost. This saving is realised through the longer service life of components made by Alloy-X, reducing the frequency of replacements and repairs, thus reducing costs associated with downtime, maintenance and labour.

Alloy-X can also enable cost savings through increased efficiency (i.e. a component can be made lighter with Alloy-X, increasing fuel efficiency in the aerospace sector) and the ability to rely on fewer materials to achieve the same or better performances.

The future of Alloy-X

One area of research that has shown much potential is the optimisation of manufacturing processes integrated with Additive Manufacturing technology. Globus anticipates that the combination of this technology with Alloy-X will result in new opportunities for applications across a variety of industries.

Alloy-X is also being researched to help engineers better understand its behaviour in different environmental conditions, especially extreme ones. This area of research is intended to aid in the development of new applications and refine existing processes.

Globus intends the future of Alloy-X metal powder to be in sustainability. Researchers are exploring ways to enhance the recyclability of the material and reduce the environmental footprint of its production. By focusing on sustainable development, Globus hopes to position Alloy-X as a material of choice for industries that prioritise ecological responsibility alongside performance.

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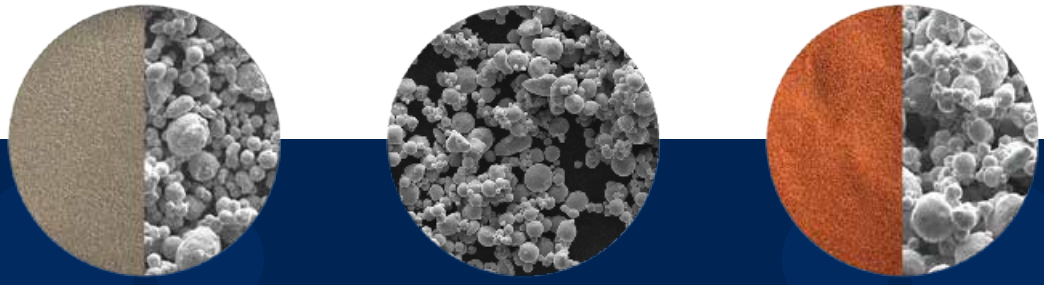

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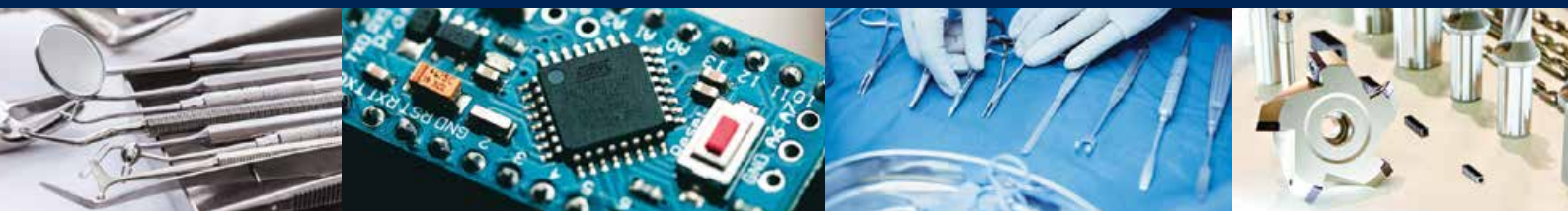

NOVAMET

With partner Novamet, Ultra Fine's high quality powders can be further enhanced through coating or other post-atomization treatments.

novamet.com

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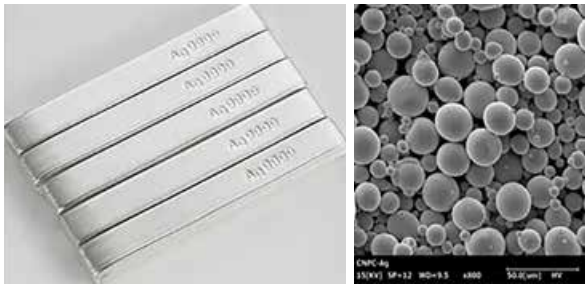
CNPC Powder establishes silver powder production line for EV manufacturer

CNPC Powder, headquartered in Vancouver, Canada, with metal powder production based in Fengyang, Anhui, China, reports it has officially launched a proprietary intelligent production line (Ag-AMP) for the manufacturing of ultra-high quality silver powder, designed and customised for a leading manufacturer of new energy vehicles. The line has an annual capacity of 30 metric tons, with products tailored for Additive Manufacturing and other advanced applications. Ag-AMP is also scalable to accommodate growth in the EV market and other advanced industries.

Silver's unmatched electrical conductivity ($6.3x10^7$ S/m) makes it ideal for high-frequency and precision electronic components. Its low-temperature processability prevents thermal damage to substrates, giving it unique advantages in Cold Spray and Binder Jetting Additive Manufacturing technologies.

In Additive Manufacturing, silver powder demonstrates potential in the electronics, new energy and medical sectors, enabling applications such as conductive circuits, 5G/6G radio frequency devices, biosensors and Cold Spray coatings. This technology is said to excel in creating complex porous or lattice structures to improve thermal management and minimise material waste, a key advantage for cost-sensitive precious metal applications.



CNPC Powder has established a production line for the manufacturing of ultra-high quality silver powder for a manufacturer of electric vehicles (Courtesy CNPC)

CNPC Powder's innovative production line delivers premium silver powder with:

- Ultra-high purity (Ag >99.99%)
- Superior sphericity (>92%)
- High apparent and tap density
- Minimal satellite particles and hollow powder
- Customisable particle sizes: 0-25 µm, 15-45 µm, 45-150 µm

The fully automated Ag-AMP line integrates quality control systems. CNPC Powder notes the following key technological advantages as driving industrial improvements:

- Digital management: MES system enables full-process traceability from raw materials to finished products
- Purity assurance: 100,000-class cleanroom guarantees impurity-free production
- Precision grading: Airflow classification technology achieves particle size distribution CV <15%
- Customisation: Supports tailored specifications across 0-150 µm particle ranges

Ag-AMP incorporates a number of eco-friendly innovations, such as a closed-loop water cooling system that has a 30% reduction in energy consumption. CNPC Powder's full life-cycle silver management system achieves a material recovery rate of over 99%, which significantly reduces customers' precious metal costs.

CNPC Powder offers a comprehensive portfolio spanning materials based on aluminium, titanium, iron, nickel, copper and precious metals. These products meet a variety of advanced manufacturing needs in AM, MIM and cutting-edge technologies. Looking ahead, the company said it intends to sustainably drive innovation in high-end materials, offering customised solutions to accelerate technological progress and industrial transformation around the world.

www.cnpcpowder.com

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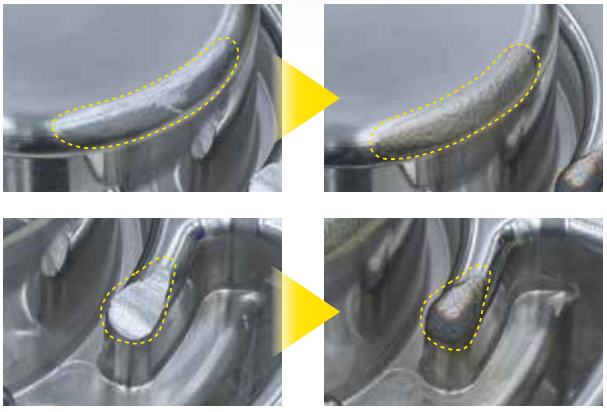

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HBD inaugurates Guangdong PBF-LB AM machine manufacturing facility

Metal Additive Manufacturing machine maker Shanghai Hanbang 3D Tech Co, Ltd (HBD) has announced that its new Guangdong facility is now fully operational. The facility will act as a production hub and support the further development of the company's Laser Beam Powder Bed Fusion (PBF-LB) metal AM solutions.

The Guangdong facility is expected to drive HBD's growth in key sectors such as aerospace, automotive, energy, and healthcare, offering both enhanced production capacity and expanded design capabilities. With an emphasis on digitalisation, Artificial Intelligence, and sustainable manufacturing practices, HBD expects the facility to allow it to provide customers with customised solutions that improve production efficiency, reduce lead times, and lower costs while developing a more open and dynamic ecosystem that encourages cross-industry adoption of Additive Manufacturing.

Manufacturing and development operations at the new HBD facility in Guangdong (Courtesy HBD)

During the opening ceremony, HBD CEO Liu Jianye emphasised that the new facility represents HBD's vision of long-term innovation and commitment to smart manufacturing. He also noted that this new site will not only meet the increasing demands for high-quality metal AM but also offer advanced services such as factory planning, process optimisation, and operational support tailored to customers.

The new facility's strategic significance is expected to extend beyond HBD's internal growth. For customers, the factory will provide access to AM technologies and expert support that will help them optimise their own operations. With multi-model batch production capabilities and enhanced research and development support, customers are anticipated to receive higher-performance and more reliable parts for critical applications.

HBD states that its focus on sustainability at the new site aligns with global trends towards greener manufacturing practices. The facility incorporates low-carbon technologies and is built to meet the rising demand for environmentally friendly, efficient production processes.

en.hb3dp.com

Tekna's fourth quarter results highlight continued growth in powder business

Tekna Holding ASA, Sherbrooke, Quebec, Canada, has announced its results for the fourth quarter of 2024, reporting growth across nearly all customer segments in its metal powder Advanced Materials business. Despite this growth, the company reported headwinds in its Systems business and posted overall revenue of CA $9.6 million, down 15.4% from Q4 2023.

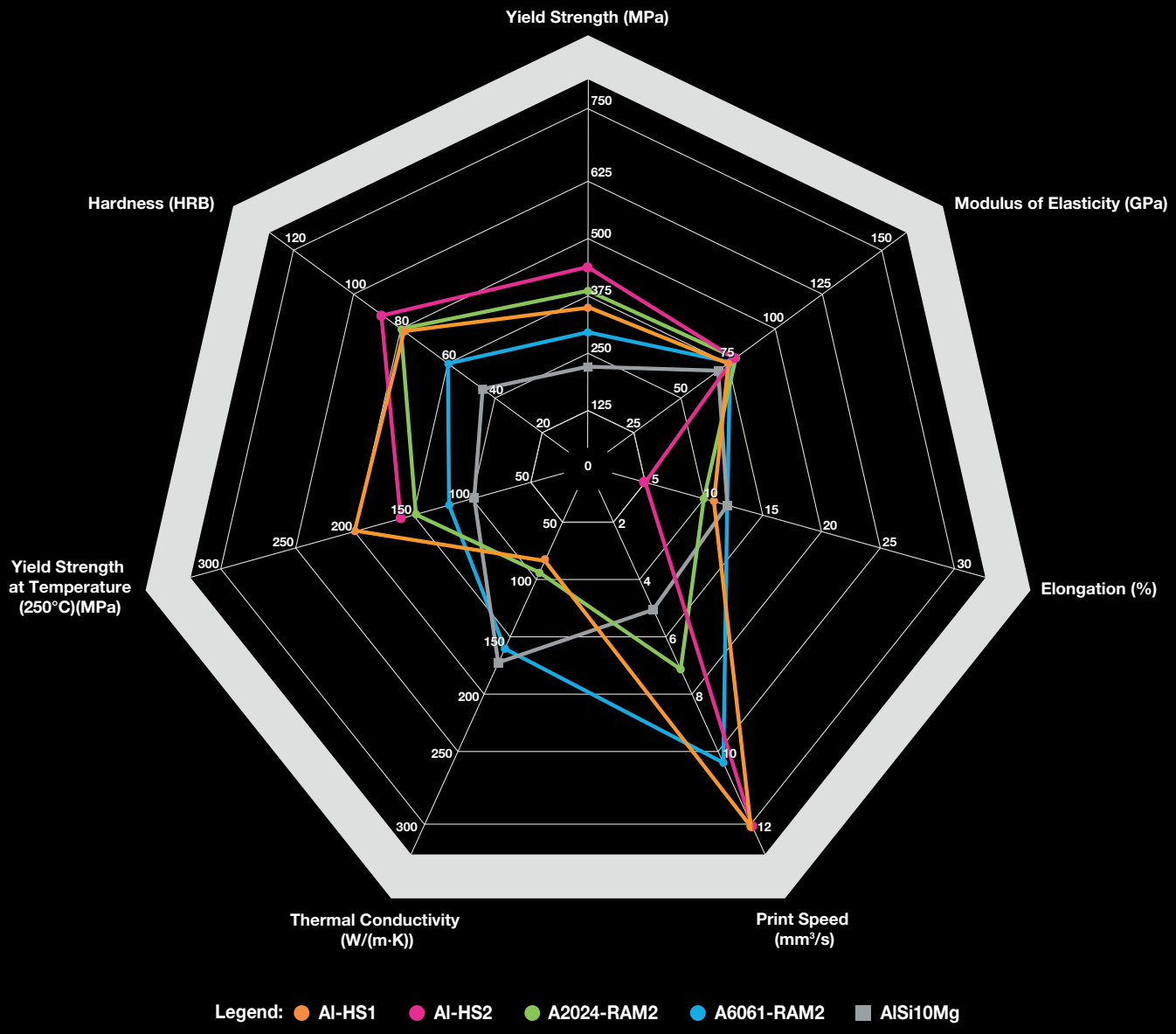
"Our Plasma Systems product line faced headwinds, with reduced order intake and revenues as some projects in the pipeline have been delayed. However, our focus on operational efficiency and price management has resulted in sustained contribution margins in 2024 YoY," said Luc Dionne, CEO of Tekna Holding ASA.

Dionne continued, "In Advanced Materials, the industry dynamics remained positive despite challenges stemming from global economic conditions, interest rates, and market fluctuations. In 2024, we have experienced growth across nearly all customer segments, with Medical up 29%, Aerospace up 24%, and Consumer Electronics up 24%. However, sales to 3D printer manufacturers reduced by 40%."

The company's adjusted EBITDA for Q4 2024 stood at negative CA $1.4 million (compared to negative CA $0.5 million in Q4 2023), reflecting the challenges in the Systems business. In 2024, cash flow from operations improved by CA $10.4 million compared to 2023, much due to a reduction of net working capital by CA $5.1 million during the year and CA $2.9 million from litigation settlement. This achievement comes despite the negative impact of CA $2.9 million on EBITDA due to a substantial reduction in Plasma systems revenue in the year.

www.tekna.com

Höganäs Aluminum Powder Properties Comparison Chart



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Titanium Additive Manufacturing hinge components used in world's thinnest foldable smartphone

OPPO, headquartered in Dongguan, Guangdong, China, has announced the global availability of its Find N5 foldable smartphone featuring additively manufactured titanium hinge components. The new Titanium Alloy Flexion Hinge features an additively manufactured titanium alloy casing and wing, helping make the phone the first book-style foldable less than 9 mm thin when folded.

The AM components have been produced using Xi'an Bright Laser Technologies Co, Ltd (BLT) Laser Beam Powder Bed Fusion (PBF-LB) machines. After Additive Manufacturing, the parts undergo CNC machining to meet exacting tolerances.

Both Find N5's hinge cover, which protects the internal folding components, and the wing plate connecting the hinge to the folding display are additively manufactured using Grade 5 titanium alloy.

The Find N5 hinge cover, which protects the internal folding components, and the wing plate connecting the hinge to the folding display, are additively manufactured (Courtesy OPPO)

AM has helped the Find N5 become the world's thinnest book-style foldable smartphone (Courtesy OPPO)

The hinge's load-bearing parts are made using ultra-high strength steel with a yield strength of 2,000 MPa. Although not specified, MIM is widely used across the industry for this type of component.

Using Additive Manufacturing has helped OPPO to create the world's thinnest book-style foldable smartphone. When closed, the Find N5 is no thicker than a traditional phone, measuring just 8.93 mm thick and weighing just 229g.

With over 700 million users worldwide, OPPO was ranked fourth in global smartphone shipments for 2024, with 60% of its shipments coming from markets outside of mainland China.

www.oppo.com

Sintavia secures $10M investment for aerospace manufacturing expansion

Sintavia LLC, based in Hollywood, Florida, USA, has announced that it has received a $10 million subordinated debt investment from the Stifel North Atlantic AM-Forward Fund. The investment, the first from the recently launched SBIC fund, will be used to refinance existing equipment loans and provide general working capital for the business.

"We are honoured and humbled to be the launch investment out of the new Stifel North Atlantic AM-Forward Fund," said Brian R Neff, Sintavia's founder and CEO. "It is great to see Stifel's strong commitment to funding profitable, high-growth users of additive technology, and this new fund will certainly have a positive impact across the industry."

"Sintavia is a fantastic fit for the mission of our fund and Brian has proven to be a visionary leader for Sintavia, and the Additive Manufacturing sector more broadly," Mark Morrissette, Managing Director of North Atlantic Capital, a wholly-owned subsidiary of Stifel, shared. "The entire Sintavia team has done a terrific job since 2015 in building a vertically integrated, all-digital aerospace component supplier that leverages the positive benefits of additive technology, and we look forward to working with Brian in the coming years as a partner." With this investment, Morrissette joins Sintavia's board of directors.

The Stifel investment comes nine months after Sintavia announced its $25 million expansion plan, which included investments in facilities, larger industrial AM machines, and additional post-processing equipment.

www.sintavia.com

Oerlikon partners with Northrop Grumman to boost large-scale AM

Oerlikon AM, the Additive Manufacturing division of Oerlikon, headquartered in Pfäffikon, Switzerland, is partnering with Northrop Grumman to increase the Additive Manufacturing capabilities at Oerlikon AM's Huntersville, North Carolina, USA, production facility. The partnership will include the installation of an AMCM M4K-4 large bed, multi-laser metal Additive Manufacturing machine.

The move is reported to be in response to the growing demand for complex, large-scale components, particularly in the defence, aerospace, and semiconductor industries.

The new AMCM M4K-4 AM is a high-productivity machine designed for demanding Additive Manufacturing applications and equipped with four 1,000 W lasers as part of its advanced quattro optical setup. Based on the proven EOS M 400 platform, the M4K-4 allows builds of up to 450 x 450 x 1,000 mm in size. The addition to Oerlikon's Additive Manufacturing facility not only increases its capacity for large-scale parts, but also seamlessly integrates into existing manufacturing workflows, offering greater flexibility in production, the company stated.

"Demand for large, complex AM components is growing, especially in the aerospace, defence, and semiconductor industries," added Dan Haller, Head of Commercial at Oerlikon AM. "The AMCM M4K-4 system is the ideal expansion to our existing capabilities, enabling us to respond to this demand while opening up opportunities to explore new Additive Manufacturing applications."

The AMCM M4K-4 will enable parts up to 1,000 mm in height (Courtesy Oerlikon AM)

Oerlikon AM will be immediately employing the M4K-4 to develop and manufacture large, complex aerospace and defence components for Northrop Grumman.

www.northropgrumman.com
www.oerlikon.com

DEEP awarded DNV 'approval in principle' for large-scale AM pressure vessels for human occupancy

DEEP Manufacturing Limited, a large-scale component parts manufacturer headquartered in Bristol, UK, has secured DNV approval in principle (AiP) for its use of Wire Arc Directed Energy Deposition (DED) Additive Manufacturing in the production of steel pressure vessels for human occupancy. An Approval in Principle is an independent assessment of a concept within an agreed framework, confirming that the design is feasible and no significant obstacles exist to prevent the concept being realised.

Launched in January 2025, following a period of extensive research and development, the company now has twenty Wire Arc DED machines at its Advanced Manufacturing Centre of Excellence in Avonmouth, UK. The facility is home to one of the largest concentrations of Wire Arc DED machines globally. Each individual robotic machine can produce metal parts up to 3 m in diameter, while the six-arm synchronised configuration supports the production of parts up to 6.1 m in diameter and 3.2 m in height.

Initially developed as a solution to the underwater pressure vessel manufacturing requirements of DEEP, the business has the capability and capacity to offer its rapid production process and expertise in large-format metal Additive Manufacturing to projects in the offshore, maritime and energy industries.

The company is now in the final stages of the audit process to obtain DNV approval to produce pressure vessels for human occupancy.

"Achieving DNV approval in principle for our manufacturing processes demonstrates our commitment to high standards and uncompromising quality. Partnering with DEEP Manufacturing provides customers with the rapid delivery of long-term cost-effective subsea manufacturing solutions, driven by superior quality," stated Peter Richards, DEEP Manufacturing's CEO. "We are the only company in Europe with this AiP, and we are already in the process of working towards final DNV approval for the production of steel pressure vessels.

This six-arm synchronised configuration supports the production of parts up to 6.1 m in diameter and 3.2 m in height (Courtesy DEEP Manufacturing Ltd)

Our combined subsea engineering resources, knowledge and experience across DEEP means we can deliver manufacturing projects at an unprecedented scale, faster and at lower life of project costs compared to traditional manufacturing processes."

"Using DEEP Manufacturing's Additive Manufacturing process allows companies to stay ahead of the game in their subsea projects. Additive Manufacturing is the fast, safe solution to manufacturing large-scale, complex metal parts."

"If subsea companies are still relying on traditional forge and casting methods, they risk falling behind. There is a need for a mindset shift toward innovation and proactive measures to enhance industry-wide resilience. As we move forward, we want to support our customers to embrace innovation and build more adaptable, resilient operations. This is a tipping point for our industry, and it is time to fully leverage the benefits that Additive Manufacturing offers," Richards concluded.

Dr Eva Junghans, Senior Principal Engineer, and Practice Lead for Materials & Welding, Additive Manufacturing at DNV Maritime, added, "It is a great pleasure to award DML this AiP and is another step forward in utilising Additive Manufacturing at the cutting edge of the maritime industry. This AiP shows that DML has demonstrated the feasibility of AM in the manufacture of large-scale components that can fulfil maritime quality standards – further expanding the potential uses of AM for our industry."

Thorsten Lohmann, Head of the Materials & Welding Section at DNV Maritime, said, "At DNV we have been working with manufacturers on safely realising the unique capabilities of Additive Manufacturing for many years with our class framework, rules and guidelines. Going forward we will continue to help our customers show that AM produced parts can be accepted under the class regime, driving progress and acceptance of this exciting technology."

www.deepmanufacturing.com

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Rolls-Royce recycles RAF Tornado parts into powder for jet engine components

Rolls-Royce has reported its involvement in the 'Tornado 2 Tempest' programme, a recycling initiative that is turning old Royal Air Force Tornado components into metal powder. The powder is then used to additively manufacture new parts for the company's Orpheus small engine concept. Orpheus is part of Europe's Future Combat Air System (FCAS) project and demonstrates that the technique has the potential to be used for the next-generation Tempest combat air platform – a cornerstone of Rolls-Royce's Grow Combat strategic initiative.

Many of the UK's Ministry of Defence's surplus assets, such as spare or broken components, contain strategic metals, including high-quality steel, aluminium and titanium. The Tornado 2 Tempest project team came together to identify whether some of these could be atomised into feedstock for the AM of new parts.

Tornado components containing high-quality titanium, including jet engine compressor blades from a low-pressure air compressor, were cleaned and successfully atomised resulting in an additively manufactured nose cone and compressor blades being created from recycled parts. Working as one team, Rolls-Royce installed the additively manufactured nose cone onto an Orpheus test engine and ran it at test conditions to demonstrate the part's suitability and safety for future use, with positive results.

The project was led by Defence Equipment and Support's (DE&S) Defence Recycling & Disposals Team (DRDT) in partnership with the MOD FCAS team, Rolls-Royce and Additive Manufacturing Solutions Limited (AMS) based in Lancaster, UK. Funded by UK Strategic Command's Defence Support Organisation in relation to its Circular Economics for Defence Concept Note, the project shows that turning old parts into new is viable and could bring huge benefits to the MOD and wider defence sector, especially through increasing the accessibility of strategic metals to the UK defence industry and suppliers.

Rolls-Royce has been involved in a recycling initiative that has turned old Royal Air Force Tornado components into metal powder used for AM components for the Orpheus engine (Courtesy Rolls-Royce)

The team also demonstrated a Digital Product Passport by capturing and recording material allocation and protecting against the use of counterfeit materials.

"Not only can this solution reduce the costs and burden of sourcing critical and high-value metals, but it can also produce components that are lighter, strong and longer lasting than those made through traditional forging techniques, thereby further enhancing the MOD's overall sustainability and effectiveness," stated Thomas Powell, DRDT's Strategic & Submarine Recycling Senior Commercial Manager.

A team of more than eighty people participated in this project, including DRDT's commercial graduates and Rolls-Royce graduate apprentices, combining current skills and innovative technologies to deliver and maintain future capabilities.

Squadron Leader Rob, FCAS' Sustainability Requirements Manager stated, "Innovative technology initiatives such as Tornado 2 Tempest could reduce the RAF's dependence on lengthy and costly supply chains, allowing us to sustain operations for longer, with the associated benefit of reduced emissions and waste."

"Through the expected lifecycle of the UK's FCAS, we expect access to critical materials to be challenged, as global supply chains become increasingly disrupted and competitive. In parallel, there is a societal need to make the best use of the raw materials we already have," Rob added.

The MOD's Chief of Defence Logistics and Support (CDLS) recently awarded the Tornado 2 Tempest Rolls-Royce a CDLS Commendation in recognition of their commitment and dedication to the delivery and improvements of support to the frontline.

www.rolls-royce.com

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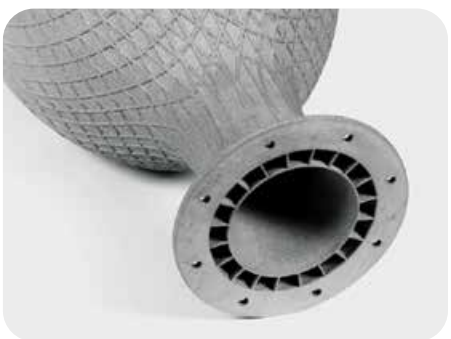

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www.waylandadditive.com

China's Zoltrix using HP Metal Jet Binder Jetting to produce hundreds of thousands of consumer electronics parts

Zoltrix Material International Limited, one of China's leading Metal Injection Moulding (MIM) companies, is reported to be using Binder Jetting to additively manufacture hundreds of thousands of metal components for consumer electronic applications. On display at HP's booth at Formnext 2024 were a number of end-use parts manufactured by Zoltrix using HP's Metal Jet technology. The parts, made from 316L and 17-4PH stainless steel, included smartwatch cases post-processed to achieve a 'best-in-class quality.'

According to a video published by Chinese AM media platform *Panda3d-printing*, Zoltrix has been using HPs Metal Jet technology since 2019 and has shipped 'hundreds of thousands' of parts made by AM.

Asia's consumer electronics sector has been a key target market for Binder Jetting technology suppliers, with companies such as Apple and Samsung using huge volumes of highly complex precision metal components. It was the adoption of MIM technology for key applications by Apple more than a decade ago that led to a surge in growth for the MIM industry, and there is an expectation that Binder Jetting will follow.

According to information displayed with the part, Zoltrix delivers 'end-to-end mass production solutions with HP Metal Jet for customers in the consumer electronics, industrial and medical device sectors.' It was stated that the primary benefits of Binder Jetting for Zoltrix's customers are cost and weight reduction, rapid production development and optimisation, and greater design freedom – including reduced material usage.

The post-processing of MIM and BJT parts at Zoltrix is a key part of its success, and after debinding and sintering, processes such as Hot Isostatic Pressing, sandblasting, polishing and PVD surface finishing are routinely used. The company is also reported to have more than 500 CNC machines.

Zoltrix's Technology and Application Design Center is based in Guangzhou, whilst its toolmaking and MIM parts manufacturing operations are located in Southern China. It is owned by CN Innovations Holdings Limited (CNI), headquartered in Hong Kong and with other production sites spread across China. CNI has over 11,000 employees and has frequently appeared on the Apple Suppliers List.

www.zoltrix-intl.com
www.hp.com

On display at HP's booth at Formnext 2024 were a number of end-use parts manufactured by Zoltrix using HP's Metal Jet (Courtesy PIM International)

toolcraft launches SupportBlaster dry ice metal support removal system

toolcraft AG, based in Georgensgmünd, Germany, has developed a new support removal system that uses a dry ice blasting process to remove the support structures from metal additively manufactured components. The new SupportBlaster 320-HA is a semi-automatic solution that, depending on specific requirements, can reduce the machining time per component by around 80%.

The automation provided by the SupportBlaster 320-HA dry ice blasting system not only reduces production times and costs, but can also improve working conditions by minimising physically strenuous work.

Conventional methods, such as using a hammer and chisel, are not just time-consuming and physically demanding, but also increase the risk of damaging the component, explained toolcraft.

"Companies that continue to rely on traditional, manual processes are going to find themselves under pressure in the future. The market is increasingly demanding automated solutions supported by technology," stated Christoph Hauck, Chief Technology and Sales Officer at toolcraft AG. Hauck believes that the combination of Additive Manufacturing and modern finishing techniques is an important competitive advantage, particularly in high-tech sectors such as aerospace and the semiconductor industry.

The SupportBlaster 320-HA has been developed to reduce bottlenecks in the AM process. In addition to increasing overall productivity and improving quality, it also prioritises the health & safety of employees.

www.toolcraft.de

Solukon's new ultrasonic depowdering system selected for rocket parts manufacturing

Solukon, based in Augsburg, Germany, has announced that The Exploration Company, Planegg, Germany, has purchased an SFM-AT350-E machine, as well as the SPR-Pathfinder software, to depowder rocket components.

Solukon CEO Andreas Hartmann and Hélène Huby, CEO of The Exploration Company in front of the Solukon SFM-AT350-E (Courtesy Solukon)

The SFM-AT350 range is the company's best-selling depowdering system for medium-sized components weighing up to 100 kg. The E-version of the depowdering system used by The Exploration Company uses piezoelectric ultrasonic excitation to clean laser-melted metal parts particularly quickly and gently. This newly developed technology enables a silent and efficient cleaning process.

The production of rocket components for the Nyx space capsule requires maximum precision in all production steps, explains Solukon. To ensure that everything runs smoothly during the flight of the space capsule, additively manufactured components must be completely free of powder.

"With the SPR-Pathfinder software, we calculate in advance how the component must be moved so that all the powder runs out. This enables us to achieve reliable cleaning results and clean components in series," said Senior Additive Manufacturing Engineer Maxi Strixner.

Cleaning can also be pre-simulated with the SPR-Pathfinder. This allows developers to see whether the components can be completely cleaned or whether the geometry needs to be adapted for better post-processing as early as the design phase.

"Our main focus is on the development of reusable space capsules for the transportation of payloads and people into space," explained CEO and founder Hélène Huby.

The production process is also able to be more sustainable through the addition of the SFM-AT350-E. During the cleaning process, the powder is collected without contamination and can be reused for further presses after sieving, resulting in significant material savings.

In addition, piezoelectric frequency excitation is said to offer an advantage over conventional pneumatic vibrators as significantly less compressed air is required, which enables further savings.

www.solukon.de
www.exploration.space

Eplus3D partners AM Futures to bring custom Additive Manufacturing machines to UK market

AM Futures, based in Coventry, United Kingdom, has been named as the agent for China's Eplus3D in the UK. Working closely with companies across the UK's advanced manufacturing sector, AM Futures will offer a wide range of customised metal Additive Manufacturing machines from Eplus3D.

To date, Eplus3D has installed over one hundred metal Additive Manufacturing machines in Europe, with customers in the aerospace, medical, and mechanical engineering sectors.

"We are thrilled to work alongside the team at Eplus3D to bring their high-performance metal PBF machines to the UK market," stated Nigel Robinson, founder and Director at AM Futures. "I have been impressed at the way the Eplus3D team helps to enable customers with their technology. When it comes to AM, quality and reliability should be a given. As the industry has expanded and technology evolved, we see more customers seeking greater value in the supply chain to achieve the best possible 'piece part price'. Eplus3D is now offering the step change required."

Eplus3D's Laser Beam Powder Bed Fusion (PBF-LB) Additive Manufacturing machines have a wide range of build volumes, from 260 x 260 x 390 mm to 2,050 x 2,050 x 1,100 mm (with a customisable Z-axis up to 2,000 mm), as well as configurations varying from single laser to 64 lasers. The company's metal AM machines are compatible with a wide array of materials, including aluminium alloys, titanium alloys, cobalt chrome, nickel-based alloys, stainless steels, tool steels, copper alloys, and other micro-grade metals.

Martin Bizot, Account Manager at Eplus3D's European base in Ludwigsburg, Germany, added, "The UK is a highly advanced market in metal Additive Manufacturing, and with AM Futures' expertise in metal AM, combined with the productivity and technical advantages of our machines, we are ready to unlock new opportunities and push the boundaries of metal AM production."

www.eplus3d.com
www.am-futures.com

Renishaw and IDEKO establish advanced manufacturing R&D facility in Spain

Renishaw, headquartered in Wotton-under-Edge, Gloucestershire, UK, and IDEKO, a research centre based in Elgoibar, Spain, have established a new Renishaw Solutions Centre in Spain. Located within the premises of IDEKO, the new facility forms part of a collaboration agreement signed between the two organisations at the 2024 International Machine Tool Exhibition in Bilbao, Spain.

The inauguration was attended by Jaione Ganzarain, Deputy Minister for Technology, Innovation and Digital Transformation of the Basque Government; Pedro Durán, Managing Director of Renishaw Ibérica; and Rafael Lizarralde, Managing Director of IDEKO. During the event, a multitude of technologies for three-dimensional measurement, production process control, metal Additive Manufacturing, machine tools and the calibration of machines and industrial robots, were presented.

"We have enjoyed a close relationship with Renishaw for many years, both as users of their autonomous equipment and as suppliers of components. This agreement strengthens our relationship by offering Renishaw the chance to use this new facility, where they can not only promote their technologies, but also support our R&D activities," explained Lizarralde.

Durán, meanwhile, said that Renishaw Ibérica shares "the same innovative DNA as IDEKO," adding that the company "will demonstrate this by sharing technologies, equipment and, most importantly, experiences with them over the coming years. The Solutions Centre showcases some of our most advanced innovations, which are already being used in the industry and play a crucial role in improving manufacturing processes."

A long-term partnership agreement between the two organisations marks the beginning of a partnership that also involves Danobatgroup, an industrial group in the field of machine tools. The Solutions Centre looks to drive innovation for this group, while Renishaw has been a long-term technology supplier across several of its product lines.

"Despite signing a three-year agreement, we are seeking a broader collaboration that will involve both Danobatgroup and Renishaw UK. We feel that this would help to ensure that our technological solutions are implemented in the industry and applied in machines and production lines," added Lizarralde.

www.renishaw.com
www.ideko.es

Materialise opens first Additive Manufacturing Aerospace Competence Center at TU Delft Innovation Hub

Materialise, headquartered in Leuven, Belgium, has announced the opening of an Aerospace Competence Center in the Aerospace Innovation Hub in Delft, the Netherlands. Delft was chosen as it is considered a key location for aerospace in Europe, and this marks the first dedicated Additive Manufacturing space within the hub.

"The opening of our new Aerospace Competence Center aligns with our commitment to support the aerospace industry through more than three decades of experience in Additive Manufacturing and software solutions, as well as our pioneering role in producing certified parts," said Brigitte de Vet-Veithen, CEO of Materialise. "By joining this selective aerospace network, we can strengthen our capabilities, expand partnerships, and enable other aerospace leaders in this hub to accelerate innovation and explore new possibilities with AM."

The Aerospace Innovation Hub at TU Delft aims to foster innovation by connecting startups, students, academics, government and industry professionals in the heart of TU Delft's Aerospace Engineering Faculty. Materialise and TU Delft will collaborate on projects where students and researchers can gain hands-on experience with AM while advancing developments in sustainable aviation. Materialise joins Airbus and Collins Aerospace, among others, at the Hub.

"We are proud to welcome Materialise to Delft, a city where innovation and collaboration thrive," said Vice Mayor Maaike Zwart of the City of Delft. "By joining the Aerospace Innovation Hub, Materialise strengthens our dynamic Aerospace Delta ecosystem and the Innovation District Delft, paving the way for groundbreaking advancements in 3D printing and sustainable aviation. I'm truly excited to see the partnerships, ideas, and innovations that will grow from your presence here. Together, we are shaping the future of technology."

Materialise has delivered over 500,000 additively manufactured aerospace parts, with about 4,000 different types of parts manufactured per year. The company holds a comprehensive set of flight-ready accreditations, including Production Organization Approval (POA) from EASA and EN 9100 certification for flying parts. It serves the entire aerospace value chain, from OEMs to airlines and MROs to supplier tiers.

"At TU Delft, our mission is to create impact for a better society through education, research, life-long learning, and innovation. With the Aerospace Innovation Hub we support this mission by accelerating innovations and bringing them to market. The arrival of Materialise at the Hub marks an exciting step toward deeper collaboration and new opportunities to drive Additive Manufacturing expertise to the growing aerospace community," said Henri Werij, Dean of the Faculty of Aerospace Engineering TU Delft.

In addition to existing certified aerospace processes, Materialise helps companies develop and qualify new AM applications and materials. The company also maintains a data lake that provides access to performance data from hundreds of aerospace builds, enabling users to make informed decisions based on real-life components.

www.aerospaceinnovationhub.nl
www.materialise.com

From left to right: Niels Krol, Sr Account Manager Aerospace, Aerospace Delta; Maaike Zwart, Delft Vice Mayor; Brigitte de Vet-Veithen, CEO, Materialise; Henri Werij, Dean of the Faculty of Aerospace Engineering, TU Delft; Femke Verdegaal, Strategic Partnership Manager Aerospace Engineering, TU Delft/ Aerospace Innovation Hub (Courtesy Materialise)

Materialise and TU Delft will collaborate on projects where students and researchers can gain hands-on experience with AM (Courtesy Materialise)

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Over 1,000 turbine blades produced with Gefertec's wire arc AM

Gefertec GmbH, based in Berlin, Germany, has reported the successful adoption of its Wire Arc Additive Manufacturing (WAAM), also known as wire/arc Directed Energy Deposition (DED), to produce turbine blades for a leading manufacturer. The journey started in 2018, when Gefertec's client first began considering the use of Additive Manufacturing, and to date has resulted in over 1,000 turbine blades produced by this method.

Challenges in production planning

Traditionally, the client would machine turbine blades from flat material. This was sourced from China and, due to supply chain issues, lead times could often extend to several months. Furthermore, because the blades have a twisted profile, the machined volume can be as high as 70%. As well as significant cost, this manufacturing method also requires extensive machining time and results in tool wear.

Gefertec's client began considering the use of Additive Manufacturing for the production of stator blades measuring 300-700 mm long. The first AM technology considered was Powder Bed Fusion (PBF). However, the initial investment costs and slower manufacturing times meant that desired cost savings could not be achieved, stated Gefertec.

Following this, the client began discussions with Gefertec on the suitability of its WAAM technology.

Qualification of the process

The turbine manufacturer selected a Gefertec WAAM machine that uses a high-alloy, heat-resistant solid wire as feedstock. With a thickness of 1.2 mm, the wire is readily available.

However, before serial production could begin, the processes needed qualification and, since there were no existing standards, extensive groundwork was required to move forward. In the first production batches, all turbine blades underwent CT scans to detect any potential porosity. Destructive testing was then conducted to measure hardness and bending strength, along with metallurgical examinations and chemical analyses.

The outcome was stable enough to qualify the WAAM process as suitable for serial production. These extensive quality control measures during the qualification phase meant that the client now only conducts occasional sample inspections during ongoing production, an approach used for cast components.

Over 1,000 turbine blades already produced

Although the journey from initial concept to qualification and serial production was long, Gefertec reported that the turbine manufacturer is now fully convinced of WAAM for series production. To date, well over 1,000 turbine blades have been produced this way.

In series production, either nine or sixteen turbine blades are manufactured simultaneously. This represents optimal utilisation of the WAAM machine's capacity while also eliminating idle times for cooling the top layer, explained Gefertec. Manufacturing operates around the clock in a three-shift system, with the process being largely automated.

The material and cost savings are significant. Gefertec stated that instead of wasting some 70% of material through machining, now only around 20% is removed. The client reported cost savings of around 15% due to reduced material expenses and shorter milling machine times. The use of Additive Manufacturing also resulted in delivery times reduced by up to 75%.

The turbine manufacturer is now working closely with Gefertec to further enhance the process. Areas of focus include increased automation and additional in-situ sensors for quality assurance. Future research is expected to explore new design opportunities enabled by AM and integrate them into new products.

Gefertec's WAAM machines

Gefertec's 3DMP WAAM machines are available in three- and five-axis configurations with various size options. The largest model features a build volume of 8 m³, enabling the production of components weighing up to 8,000 kg.

All of the company's machines operate with Siemens controls similar to those used in conventional machine tools. Specialised CAM software converts CAD data into instructions for precise CNC-controlled positioning of the welding head, enabling the automated fabrication of near-net shape components.

www.gefertec.de

Turbine blades produced using WAAM (Courtesy Gefertec)

AscendArc secures $4M funding to develop small GEO communication satellites, wins $1.8M AFWERX contract

AscendArc, a startup based in Portland, Oregon, USA, emerged from stealth at the end of January after raising $4 million to enter the expanding market for small geostationary communication satellites. The company also announced that it has secured a $1.8 million Phase II Small Business Technology Transfer (STTR) contract from AFWERX, the innovation arm of the US Air Force. This contract will support the development of technology aimed at improving high-bandwidth satellite communications.

"Their innovative approach holds the potential not only to revolutionize commercial satellite communications - providing even lower cost satellites for the commercial market - but also to provide crucial solutions for countries' national security," said Seraphim investor Lewis Jones.

The company raised $505,000 in a pre-seed round and $3.45 million in seed funding. Investors include Seraphim Space, Everywhere Ventures, Portland Seed Fund, Thermo, and Hunter Communications.

Founder and president Chris McLain, who has also worked on geostationary communications solutions at Boeing, Lockheed and Panasonic, said AscendArc's goal is to "provide scalable, cost-effective solutions that address the US military's growing demands for advanced satellite systems."

The company announced a collaboration with Portland State University under the AFWERX contract to enhance its technology for the US Department of Defense.

The startup is challenging the LEO trend, believing that low-cost and high-bandwidth small GEO satellites could provide better cost-efficiency. Traditionally, GEO satellites have been quite large, often exceeding 5,000 kg, and are expensive to develop. In contrast, LEO connectivity necessitates the deployment of extensive satellite constellations, which often remain underutilised over oceans.

AscendArc believes that the ideal market is in smaller (sub-1,000 kg) GEO satellites, which can provide continuous coverage over a specific region, although at slower connectivity speeds compared to LEO satellites.

Investors are reportedly focusing on the small GEO satcom sector, believing that low-cost manufacturing and strong connectivity speeds can provide attractive economic benefits.

www.ascendarc.com

Doosan acquires EOS M 400-4 to additively manufacture gas turbine nozzles

Doosan Enerbility, based in Changwon, Korea, has acquired an EOS M 400-4 Laser Beam Powder Bed Fusion (PBF-LB) Additive Manufacturing machine for the production of gas turbine nozzles, a critical component used to achieve precise air-fuel mixing for cleaner combustion.

This addition comes in response to the energy sector's shift towards cleaner, more efficient technologies in line with increasingly stringent government guidelines on pollution and air quality. For large-scale enterprises like Doosan, meeting these regulations may require more than just a few tweaks to traditional manufacturing, explains EOS in a recently published case study.

Gas turbines, which play a central role in power generation, require incredibly complex internal designs to ensure cleaner combustion and lower emissions. Conventional methods like casting and CNC machining often fall short of delivering the required level of detail. These methods also tend to have aspects (e.g. assembling components made in multiple parts, post-processing) that necessarily drive up cost and production time, states EOS.

By using STS 321 stainless steel, a material noted for its durability at high temperatures and Additive Manufacturing, Doosan was able to produce components able to withstand the conditions of power generation whilst preventing intergranular corrosion. This meant that unmixed fuel was reduced by 68%, bringing NOx emissions down to 15 ppm and CO emissions to 10 ppm.

"The high productivity and utilisation of the EOS M 400-4 have led to remarkable customer satisfaction, thanks to its quality, reliability, the use of optical tomography, and excellent technical support provided, such as field service and technology downloads," stated Doosan Enerbility's AM Business Team.

Doosan hopes that their success can act as a playbook for how companies everywhere can adapt to new regulations while staying ahead of the technological curve. By cutting production lead times and streamlining operations, companies can focus more on research and development, speeding up innovation. For example, Doosan reportedly cut production lead time by 50%.

Doosan is currently exploring EOS technology for other turbine components, like blades and vanes.

The full Doosan Enerbility and EOS case study is available here: 3d.eos.info/case-study-doosan

www.doosanenerbility.com

www.eos.info

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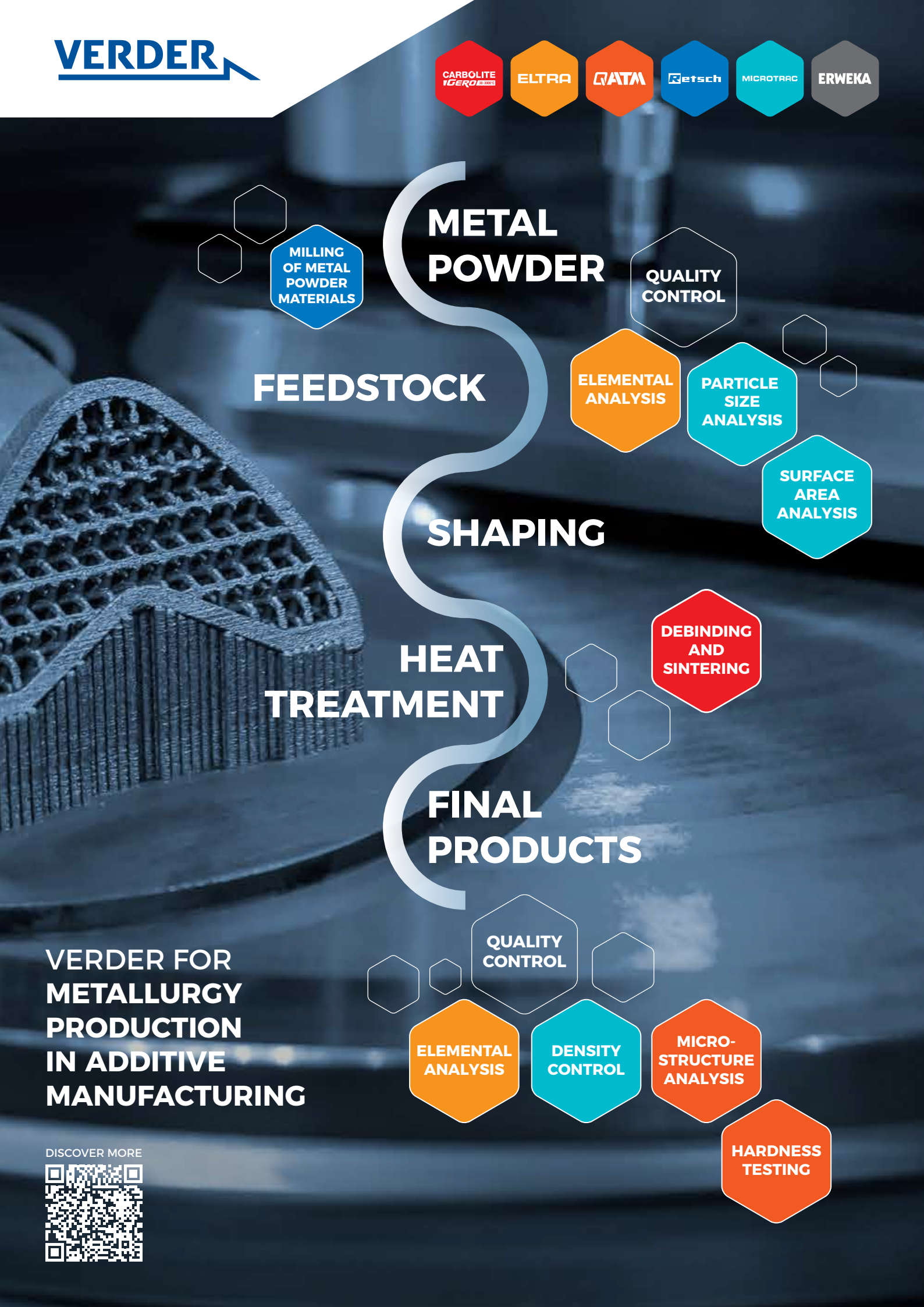

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ELEMENTAL ANALYSIS eltra.com

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- CARBONIZATION furnaces to enhance the mechanical properties
- AGING to enhance mechanical properties such as hardness and strength

METALLOGRAPHY qatm.com

- METALLOGRAPHIC ANALYSIS, microstructure analyses includes cutting, mounting, grinding, polishing, and etching to reveal the microstructure
- MACRO HARDNESS TESTING, Vickers and Rockwell hardness tests to measure the material's hardness
- MICROHARDNESS TESTING is used in small areas, e.g., in the various phases or thin sections of the material, which provides detailed insights into the mechanical properties of the material

ENABLING PROGRESS

EOS aluminium alloy powder now from 100% recycled feedstock

EOS GmbH, headquarted in Krailling, Germany, has announced that one of its most popular metal powders, EOS Aluminium AlSi10Mg, is now produced with 100% recycled feedstock.

Demonstration part built on an EOS M 290 using AlSi10Mg (Courtesy EOS)

The company reported that increasing the recycled content to 100% has resulted in a 77% CO2e reduction from the prior material, and it now achieves an 83% CO2e reduction compared to AlSi10Mg made from 100% virgin raw material.

EOS Aluminium AlSi10Mg was first added to EOS' Responsible Products portfolio in April 2024 when it began incorporating 30% recycled feedstock, achieving a 25% CO2e reduction. While EOS Aluminium AlSi10Mg now employs 100% recycled feedstock, the resulting material maintains the same properties, characteristics and performance in additively manufactured parts, ensuring existing customers do not need to requalify applications.

"We're proud to have developed our first EOS metal material made with 100% recycled feedstock and to have achieved so much in less than a year. We will continue to explore ways to reduce the carbon footprint of our customers' applications with every EOS product – from materials and hardware to design optimisation – they all add up to a more responsible end-use product for our customers and the climate," stated Sophia Heyl, product specialist at EOS.

Björn Hannappel, head of sustainability at EOS, added, "We are continuing our path towards Responsible Manufacturing and expanding our portfolio of Responsible Products stepwise. By minimising waste, reducing the environmental footprint and prioritising eco-friendly materials, organisations can both protect our planet and create a more efficient and resilient business model."

www.eos.info

Boom Supersonic's XB-1 jet featuring AM parts breaks sound barrier

Boom Supersonic reports that its XB-1 demonstrator aircraft broke the sound barrier on January 28, 2025, reaching a top speed of Mach 1.122 during a test flight lasting 34 minutes. The aircraft features a number of metal additively manufactured parts, many of which relate to channelling air via complex vanes, ducts and louvres.

"XB-1's supersonic flight demonstrates that the technology for passenger supersonic flight has arrived. A small band of talented and dedicated engineers has accomplished what previously took governments and billions of dollars. Next, we are scaling up the technology on XB-1 for the Overture supersonic airliner. Our ultimate goal is to bring the benefits of supersonic flight to everyone," Boom Supersonic founder and CEO Blake Scholl, shared.

The additively manufactured parts are reported to include manifolds for the variable bypass valve (VBV) system that routes air released by the engine compressor to the aircraft's outer mould line (OML); exit louvres for the environmental control system (ECS) that cools the cockpit and systems bay; louvres that direct the centre inlet's secondary bleed flow to the OML; and NACA ducts and two diverter flange parts. NACA ducts are frequently used in high-speed aircraft to capture exterior air and channel it into the aircraft to cool the engine bays.

Following its first flight in March 2024, XB-1 completed a rigorous series of eleven human-piloted test flights under increasingly challenging conditions to evaluate systems and aerodynamics. Throughout the flight test campaign, the XB-1 team systematically expanded the flight envelope through subsonic, and supersonic speeds – while taking smart risks and prioritising safety.

Historically, supersonic aircraft have been the work of nation states, developed by militaries and governments. XB-1's supersonic flight marks the first time an independently developed jet has broken the sound barrier.

Tristan 'Geppetto' Brandenburg, Chief Test Pilot for Boom Supersonic, stated, "It has been a privilege and a highlight of my career to be a part of the team that achieved this milestone - every single member of this team was critical to our success. Our discipline and methodical approach to this flight test programme created the safety culture that made a safe and successful first supersonic flight possible. With the lessons learned from XB-1, we can continue to build the future of supersonic travel."

www.boomsupersonic.com
www.velo3d.com

Boom Supersonic's XB-1 broke the sound barrier on January 28, 2025 (Courtesy Boom Supersonic)

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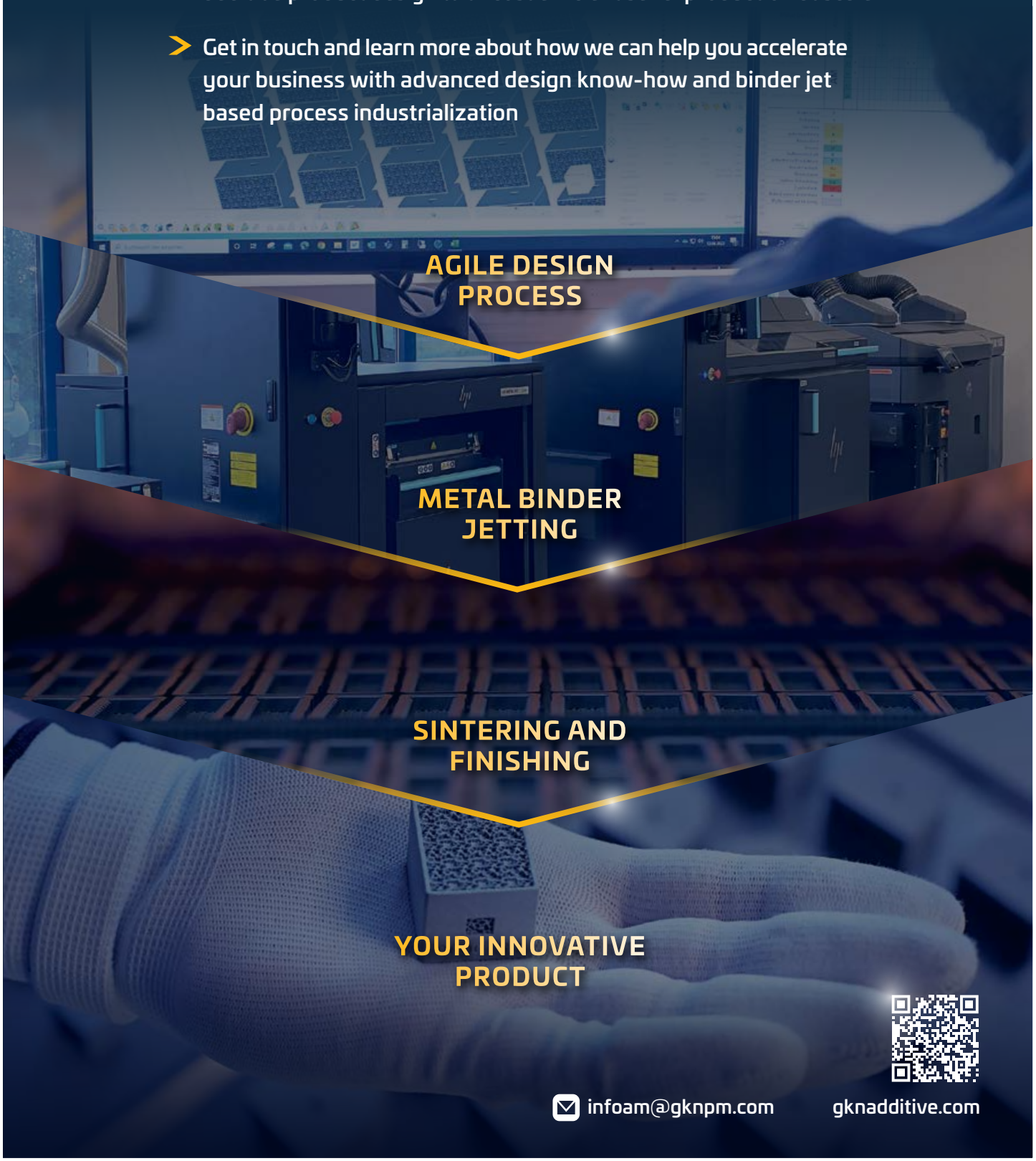

infoam@gknpm.com
gknadditive.com

UK Government invests £20M in Orbex space company to boost British orbital launch capabilities

The UK Government has invested £20 million in Orbex, a spaceflight company headquartered in Forres, Scotland, UK, as part of its Series D fundraising. The investment comes as the UK government vows to develop Britain's mission to regularly launch into orbit from its shores using UK-manufactured rockets, supporting growth in its expanding space industry and attracting investment from across the globe.

Orbex, reportedly the only UK-owned launch services company in the UK, is developing both small- and medium-sized space rockets. Initial launch operations will take place from SaxaVord Spaceport in Shetland, Scotland.

The company uses Additive Manufacturing for the production of the Prime's rocket engines. These are powered by a renewable bio-fuel, which significantly reduces carbon emissions compared to other similarly sized rockets. In 2021, Orbex commissioned an industrial AM machine from AMCM, at the time said to be the largest in Europe, to enable it to rapidly build the complex rocket engines.

Technology Secretary Peter Kyle said, "By investing £20 million in this rocket launch, we are not only helping the country to become a leading destination for small satellite launches in Europe but bringing highly skilled jobs and investment to communities and organisations across the UK, as part of our Plan for Change."

"Supporting Orbex's launch will also turbocharge the country's position in the space sector and inspire our next generation of space professionals, who will be able to design, test, build and launch British rockets, carrying British satellites, from British soil," Kyle added.

As Orbex is currently engaged in an intensive testing programme, the new funding will help expedite the development of Prime rocket. The Prime is a two-stage rocket, a 19 m long, two-stage rocket designed to transport small satellites into Low Earth Orbit. Orbex anticipates launching its first Prime rocket toward the end of 2025.

Phillip Chambers, CEO of Orbex, shared, "This first of a kind investment by the UK government demonstrates its confidence in the UK's space rocket manufacturing and launch sector and is an exciting start to the opening of our Series D fundraising. We are entering the final preparations to deliver the most flexible and environmentally sustainable launch services to the global satellite industry. This investment paves the way not only for us to launch our first rocket this year but also to develop a larger rocket to enable us to compete in the European Launcher Challenge. These development goals are crucial to our longer-term development."

In addition to the UK Government, the Export & Investment Fund of Denmark (EIFO), Octopus Ventures and private investor Sohaib Abbasi have also contributed to Series D so far. The total raised currently stands at £23 million.

www.orbex.space

The Prime rocket is powered by a renewable bio-fuel (Courtesy Orbex)

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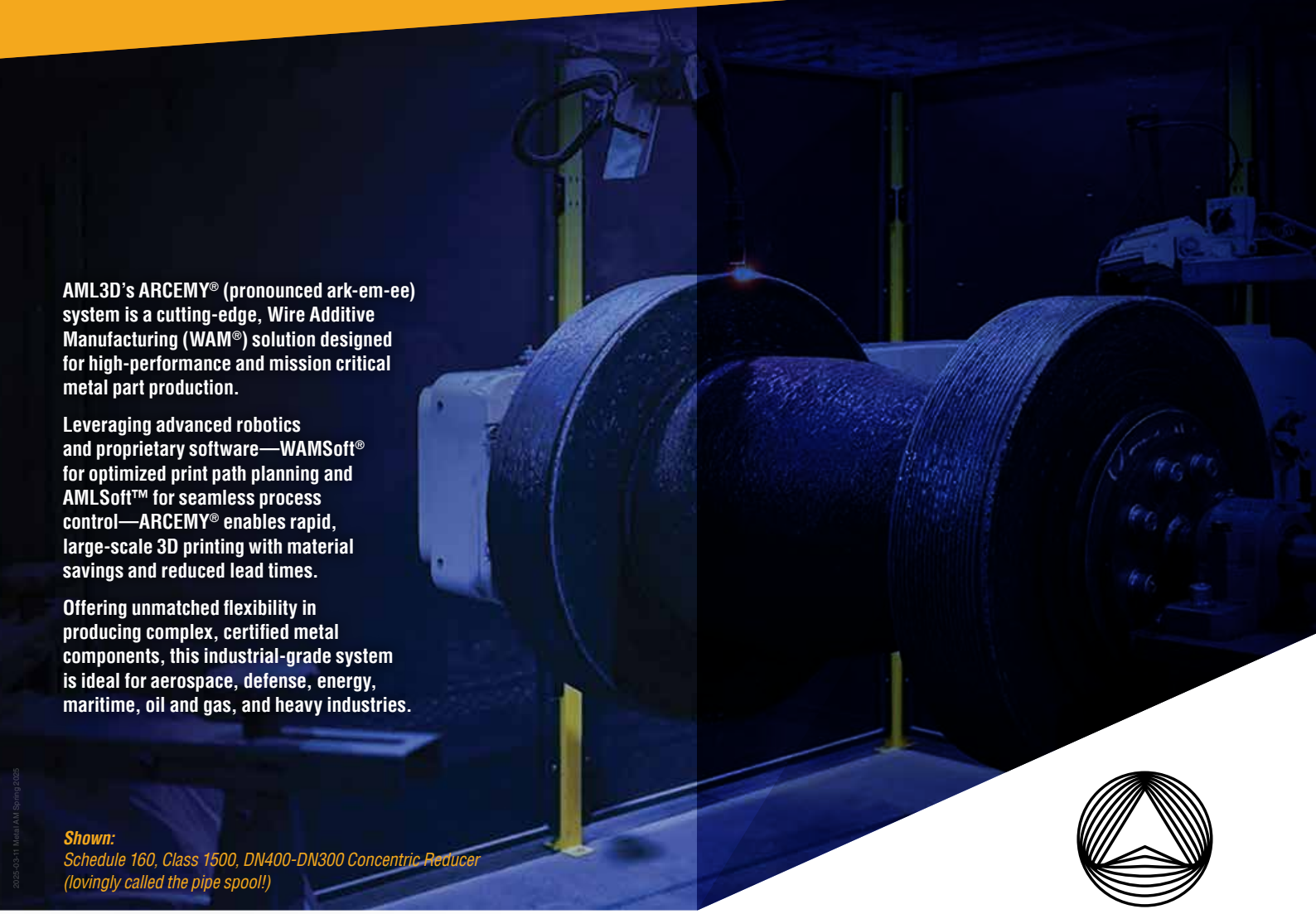

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AM parts testing underway for 2026 Ford and Red Bull F1 debut

Ford Motor Company reports it has already begun work testing for its first Formula 1 race in two decades. Reported to be utilising testing methods similar to those in the aerospace industry, the team is producing additively manufactured components for the racing team in preparation for the partnership's 2026 on-track debut.

"It's not things like nuts and bolts and easy stuff," explained Christian Hertrich, Ford Performance Motorsports Powertrain Manager, who estimated Ford has already produced around 1,000 parts for the Red Bull team. "These are complex metal and polymer parts that get tested to extremes so they can withstand races that average 200 miles an hour."

Keith Ferrell works on Ford's manufacturing technology development team and leads the relationship between Ford and the Red Bull team related to Additive Manufacturing. He said this level of Additive Manufacturing allows Ford to build parts for racing that cannot be made by traditional methods, including cold plates for batteries and cooling plates for other parts. Ford is utilising its more than 100 years of manufacturing experience to produce components for the power unit, including both the internal combustion engine and hybrid system.

Every part is tested by the Additive Manufacturing team for critical measures such as mechanical strength, hardness and geometric compliance (3D scanned). The parts are also X-rayed and CT scanned by the Non-Destructive Evaluation team, which creates and examines digital models of components, before heading to the metrology or measurement lab at Ford's Product Development Center.

Ford has already produced around 1,000 parts for the Red Bull team (Courtesy Ford)

Hertrich said that contributions are coming from employees outside of Additive Manufacturing, including those responsible for new vehicle models, thermal systems, and battery development.

"We're pulling in all of these Ford teams with all of these areas of expertise to help in the programme," he said. "It's not just the motorsport group working on this. It's amazing to see how many different areas of the company have already been involved."

Ferrell said this increased testing is trickling down to other Ford teams for testing on the parts used in consumer models.

One example of how this technology transfer can be seen in the F-150 programme. The Non-Destructive Engineering team used advanced scanning techniques to quickly identify a glue overflow issue in headlamps that caused condensation and pricey repairs. This problem had eluded traditional inspection methods for months but was reportedly uncovered in just one day of testing.

Ford expects to expand these rigorous quality control processes to other models to improve vehicle reliability.

www.ford.com

Forward AM to serve US customers from its German HQ following closure of US operations

Following its announcement of insolvency proceedings, Forward AM Technologies GmbH has officially shuttered its operations in the United States.

In a LinkedIn post, Jeremy Vos, Business Development Manager – Powderbed, Automotive and Aerospace stated that US-based customers will be served from the company's German facilities. "(There is) potential to open back up in the US later in 2025," he added.

Forward AM, the former Additive Manufacturing business of BASF, underwent a management buyout in July 2024. The acquisition included Forward AM's materials and solutions, as well as its Sculpteo service business. The company offers a range of Ultrafuse metal filaments, including 17-4 PH and 316L stainless steels, for the Material Extrusion (MEX)-based Additive Manufacturing process Fused Filament Fabrication.

forward-am.com

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- US patent pending

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Air Products appoints Eduardo Menezes Chief Executive Officer

Air Products has announced the appointment of Eduardo F Menezes as Chief Executive Officer (Courtesy Air Products)

Air Products, headquartered in Allentown, Pennsylvania, USA, has announced the appointment of Eduardo F Menezes as Chief Executive Officer, effective February 7, 2025. Menezes will succeed Seifollah Ghasemi, who is leaving the company after over ten years of service. Menezes will also join the Air Products Board.

The company's board of directors has also appointed Wayne T Smith as chairman and Dennis H Reilley as vice chairman. As part of the full board, they will collaborate with Menezes and the leadership of Air Products in an effort to advance the company.

Commenting on the appointment of Eduardo Menezes, Smith stated, "After evaluating various exceptional candidates for the CEO role, the Board determined that Eduardo's knowledge, skills and extensive experience in the industrial gases sector, including more than three-and-a-half decades in progressively senior roles at Linde plc and operating experience across the world, make him uniquely qualified to take Air Products forward and maximise value for shareholders."

Menezes added, "Air Products is a fantastic company with a great future, and I am honoured to have this opportunity to work with the talented team to build on the company's strong positions. I look forward to applying the experiences and perspectives I've gained in working across various sectors of industrial gases in different countries around the world. With our collective focus and discipline, I am confident in our ability to drive superior value."

Menezes brings international experience in all key sectors of industrial gases, including on-site, merchant liquid, packaged gases and hydrogen. In his last position, he was the Executive Vice President (EVP) of Linde plc for Europe, the Middle East and Africa, with responsibility for operations in more than forty countries with over $8 billion in sales and 18,000 employees. Prior to that, Menezes worked for Praxair in a variety of senior roles, including as EVP accountable for North America, and in a series of general management and business development positions in the US, Spain, Mexico and Brazil.

Menezes holds an MBA from the State University of New York and a chemical engineering degree from the Federal University of Rio de Janeiro, Brazil.

www.airproducts.com

Aibuild opens Silicon Valley headquarters to advance AI-driven Additive Manufacturing

Aibuild has announced the opening of its new office in Silicon Valley (Courtesy Aibuild)

Aibuild, headquartered in London, UK, has announced the opening of a new office in Silicon Valley, San Francisco, USA. The strategic move is further strengthened by its partnership with Nikon, one of Aibuild's key investors.

The new US headquarters is located within Nikon's research campus and is expected to foster deeper collaboration between the two companies, while accelerating advancements in AI-driven Additive Manufacturing.

The US office will serve as a hub for research, development, and collaboration, allowing the company to expand its customer base and forge new partnerships with manufacturers across North America.

Daghan Cam and Michail Desyllas, the founders of Aibuild shared, "Expanding into the United States with a new office in Silicon Valley is a pivotal moment for Aibuild. Getting closer to our key customers and partners in the region will allow us to respond to their needs faster. Working alongside Nikon in our new location will also deepen our partnership and accelerate our efforts to bring AI-driven automation into manufacturing."

Yuichi Shibazaki, Corporate Vice President at Nikon and the Co-CEO of Nikon Advanced Manufacturing Inc said, "We are excited to support Aibuild's expansion into the US and welcome them as our neighbour on the West Coast. As a technology partner, we have great confidence in their vision and innovation. This close proximity will strengthen our collaboration and accelerate synergies, driving innovation together in this dynamic market."

www.nikon.com
www.ai-build.com

3D Lab's ATO Induction Melting System enables single-step alloying

3D Lab sp zoo, based in Warsaw, Poland, recently highlighted the use of its ATO Induction Melting System (IMS) – an optional module intended to enhance the company's ATO ultrasonic metal atomisers – to design and manufacture metal powders in a single-step process.

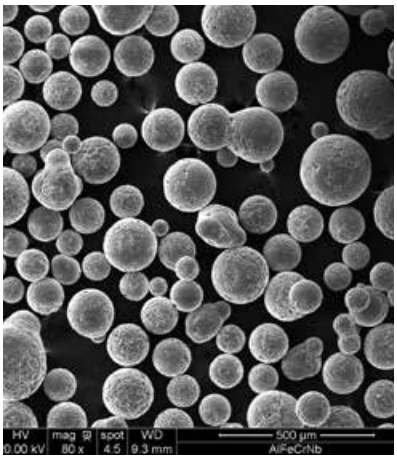
By adding the IMS module, materials can be melted at temperatures of up to 1,700°C, enabling advanced material processing and alloy development. The module is also said to be highly effective when atomising materials with low melting points (e.g., copper and aluminium). 3D Lab's ATO process is also said to prevent element evaporation during atomisation, enabling the stability of the alloy's chemical composition.

The crucible configuration allows melting and atomisation of feedstock in various forms, including chips, powders, pellets, and irregularly shaped materials, making it well-suited to material recycling and sustainable manufacturing.

Each crucible has a hole drilled in it that is not closed during the entire process, thus eliminating the possibility of contamination of the material via the plug. The material is then dosed from the crucible onto the atomisation platform using the pressure difference.

The rod version minimises contamination risk by eliminating contact with crucible materials, enabling the production of a high-purity powder suitable for demanding applications (e.g. in the medical industry).

3D Lab's ATO Induction Melting System allows users to design and manufacture metal powders in a single step (Courtesy 3D Lab)



SEM of unsieved raw AlFeCrNb metal powder produced and designed on the ATO Induction Melting System (Courtesy 3D Lab)

Alloying

In addition to processing conventional materials, IMS enables the development of alloys via a single-step process combining preparation, melting, and atomisation. This technology is said to result in powders with good sphericity and controlled particle size distribution (PSD), allowing users to produce different powder sizes suitable for various Additive Manufacturing technologies and applications.

An example highlighted by 3D Labs is the recent development of high-entropy aluminium using its IMS technology. The process went as follows:

1. Pure aluminium, iron, chromium and niobium were loaded
2. The aforementioned pure elements were melted and fully homogenised via stirring and argon gas
3. Molten metal was poured onto the atomiser via a pressure differential
4. Ultrasonic atomisation converted the molten material into fine powder

When the resultant HE aluminium alloy was analysed via SEM-EDS, the company reported its precise chemical composition, ideal sphericity and narrow particle size distribution, making it well-suited to Additive Manufacturing and other advanced metallurgy technologies.

www.metalatomizer.com

HP partners with Structure for 3D scanning SDK integration in Additive Manufacturing solutions

Structure, a developer of 3D scanning systems and software based in Boulder, Colorado, USA, has signed a software licencing agreement with HP Inc. Under the agreement, HP will offer the AI-powered Structure Software Development Kit (SDK) to provide 3D scanning application development services tailored to the needs of its Additive Manufacturing clients.

The agreement is said to be part of HP's initiative to provide end-to-end 3D scanning and Additive Manufacturing services to its clients, accelerating adoption across diverse applications.

"Our agreement with Structure provides our clients with access to the industry's leading 3D scanning software development tools and is an important step in enabling companies to maximise our technology," said Pierre Kaiser, Head of 3D Design for HP. "This is the perfect blend of Structure's 3D scanning and imaging expertise combined with HP's global 3D printing leadership. The winners will be our clients, who now have access to the industry's leading app development technology to move their 3D printing vision forward."

Structure, launched as a spin-off from Occipital in 2022, provides 3D scanning technology through its Structure 3 scanner and Structure Capture iOS mobile application. The latter enables mobile, highly accurate 2D scanning through iPads and iPhones.

"HP continues to lead the industry in empowering its customers to develop cutting edge 3D printing solutions. We look forward to supporting HP in this effort by providing access to our Structure Software Development Kit," said Ravi Shah, CEO of Structure. "The SDK platform gives developers access to easy-to-use software tools to create new and innovative 3D scanning applications. Enabling the creativity of today's 3D printing developers will have long-term positive impact on patient outcomes throughout the global healthcare industry."

www.structure.io
www.hp.com

Structure, a developer of 3D scanning systems and software, has signed a software licencing agreement with HP Inc (Courtesy Structure)

ATI opens metal Additive Manufacturing facility for aerospace and defence

ATI Inc, Dallas, Texas, USA, has now commissioned its new Additive Manufacturing Products facility. The vertically integrated greenfield build includes design, manufacturing, heat treating, machining and inspection capabilities for large-format AM. Along with a ribbon-cutting ceremony, grand opening attendees were able to tour the 12,250 m^2 facility to see the advanced manufacturing operations in action, including Laser Beam Powder Bed Fusion (PBF-LB).

"Layer by layer, Additive Manufacturing gives us the ability to produce high-performance, highly complex components for our customers – faster, with less waste," said Kimberly A Fields, ATI President and CEO, commemorating the grand opening with customers, community supporters and industry leaders.

The new operation – built on nearly a decade of experience in Additive Manufacturing – is reportedly capable of manufacturing parts up to 1.5 metres tall in geometries previously considered impossible.

"ATI is a metallurgical leader, developing new alloy powder materials specifically for Additive Manufacturing. In this new facility, we've brought our materials science and forging expertise together with Additive Manufacturing production acumen, delivering high-quality production at scale," said Fields. "From design to finished product, we've formed a powerhouse that solves our customers' most difficult challenges for the most demanding markets: aerospace, defence and space."

Bechtel Plant Machinery Inc awarded ATI its first contract to be produced at the new facility. The order was reported to be for highly engineered part solutions in support of the US Naval Nuclear Propulsion Program.

Kim Fields, ATI President and CEO and Joe Thompson, General Manager of ATI Additive Manufacturing Products, alongside other ATI employees at the ribbon-cutting ceremony (Courtesy ATI)

Additive Manufacturing Products has implemented a comprehensive quality system that meets the standards of both ISO 9001 and AS9100D. The investment, announced in late 2023, is included in the company's existing capital expenditure guidance.

www.atimaterials.com

Velo3D appoints Darren Beckett as Chief Technology Officer

Velo3D, headquartered in Fremont, California, USA, has announced that Darren Beckett has joined the company as Chief Technology Officer. With more than twenty-five years of experience in technology leadership, innovation and organisational transformation, including two decades at Intel Corporation, Beckett will oversee the development and implementation of all internal and external technology initiatives across the company.

"We are excited to have Darren join the company as his proven track record of building and leading next generation technology teams to create innovative solutions aligns perfectly with Velo3D's mission to accelerate our leadership position in Additive Manufacturing," said Arun Jeldi, CEO of Velo3D. "His ability to blend technical expertise with strategic leadership will be instrumental in executing our new corporate vision and driving our next phase of growth."

Prior to rejoining Velo3D, Beckett was the VP of Engineering at Woodruff Scientific as well as the Chief Technology Officer at Sigma Additive Solutions where he was instrumental in aiding in the development of its Additive Manufacturing quality control IP portfolio. Prior to Sigma, Beckett spent more than twenty years at Intel in various technical and engineering leadership roles focused on Additive Manufacturing and next-generation technology development.

Darren Beckett, former VP of Engineering at Woodruff Scientific, has joined Velo3D as its Chief Technology Officer (Courtesy Woodruff Scientific)

"I am thrilled to join Velo3D and contribute to its vision of enabling customers to utilise Additive Manufacturing to rapidly scale the production of their most complex parts," said Beckett. "I look forward to collaborating with the talented team here as the company expands its leadership position in 3D printing technology."

Velo3D was founded in 2014 to help engineers manufacture their most challenging designs using metal Additive Manufacturing. The company began shipping its Sapphire AM machines in 2018 and quickly scaled sales in 2019. In 2021, it began shipping its large-format Sapphire XC AM machine, which has quickly become one of its most popular products.

As Chief Technology Officer, Beckett will lead the Velo3D Research and Development and Informational Technology organisations and oversee the implementation of advanced manufacturing technologies.

www.velo3d.com

GKN Powder Metallurgy and GKN Automotive set for AAM takeover in $1.44 billion deal

American Axle & Manufacturing (AAM), headquartered in Detroit, Michigan, USA, has agreed terms to acquire Dowlais Group plc, the UK-based parent company of GKN Automotive and GKN Powder Metallurgy. The $1.44 billion deal, consisting of cash and AAM shares, was unanimously agreed by the boards of directors of both Dowlais and AAM. Upon closing of the transaction, it is expected that AAM shareholders will own approximately 51% of the combined group and Dowlais shareholders will own approximately 49%. The combined company will be headquartered in Detroit and led by David C Dauch, AAM's chairman and Chief Executive Officer.

"This announcement marks another key milestone in our continued long-term strategic growth plan," stated Dauch. "We are excited to bring together these two outstanding companies to create a leading driveline and metal-forming supplier serving the global automotive industry as it continues to evolve. The combination will create significant immediate and long-term shareholder value while helping to power a more sustainable future. Together with Dowlais, we will have the powertrain-agnostic product portfolio, global reach, commitment to innovation and financial strength to meet the needs of customers and succeed in a dynamic market environment."

GKN Powder Metallurgy and GKN Automotive, together with the rest of the GKN plc, were taken over by Melrose Industries in 2018. In 2023, Melrose announced the demerger of the GKN Powder Metallurgy, GKN Automotive and GKN Hydrogen businesses, forming the new independent holding company, Dowlais Group plc. GKN Hydrogen was acquired by Langley Holdings in August, 2024.

"Today's announcement marks a significant opportunity to build on the success of Dowlais Group. The combination of the two companies accelerates the execution of our strategy by leveraging our combined scale, resources, capabilities, and outstanding management teams," added Liam Butterworth, Dowlais' Chief Executive Officer. "Our product portfolios and technological expertise are highly complementary, positioning us to better serve our customers and exceed their expectations. This transaction also combines our respective strengths in innovation, technology, and talent, creating a solid foundation for delivering long-term value to our shareholders."

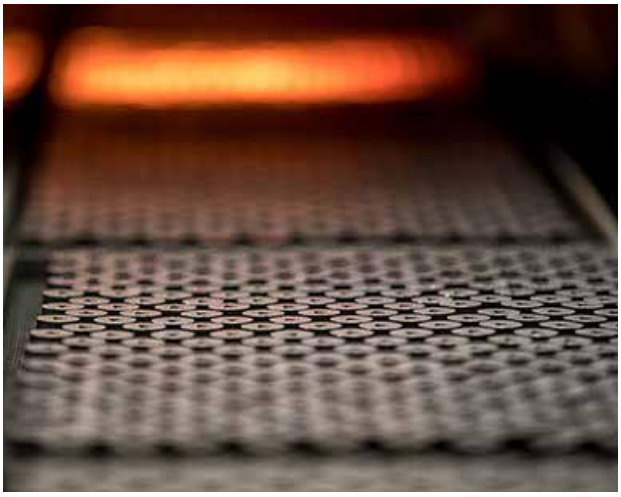
GKN Powder Metallurgy employs over 5,000 people across its twenty-seven manufacturing facilities in nine countries. The company lists 3,000 customers, ships 250,000 tons of metal powder each year and produces around ten million Powder Metallurgy parts each day. Together with GKN Automotive, Dowlais' businesses comprise over seventy manufacturing facilities in nineteen countries worldwide.

AAM is a Tier 1 automotive supplier that designs, engineers and manufactures driveline and metal forming technologies to support electric, hybrid and internal combustion vehicles. The company has over seventy-five facilities in sixteen countries. With a combined portfolio of products, the new company is expected to be well-positioned to serve a customer base spanning multiple geographies and support changing propulsion trends.

The combined company expects to achieve approximately $300 million in cost synergies during its first full year of operation. Upon completion, AAM will continue to trade on the New York Stock Exchange under the ticker symbol AXL, with Dowlais de-listed from the London Stock Exchange.

www.gknpm.com
www.gknautomotive.com
www.aam.com

GKN uses HP Metal Jet Additive Manufacturing to produce a range of AM components (Courtesy AAM)



GKN produces AM components in addition to press and sinter and Metal Injection Moulding (Courtesy GKN)

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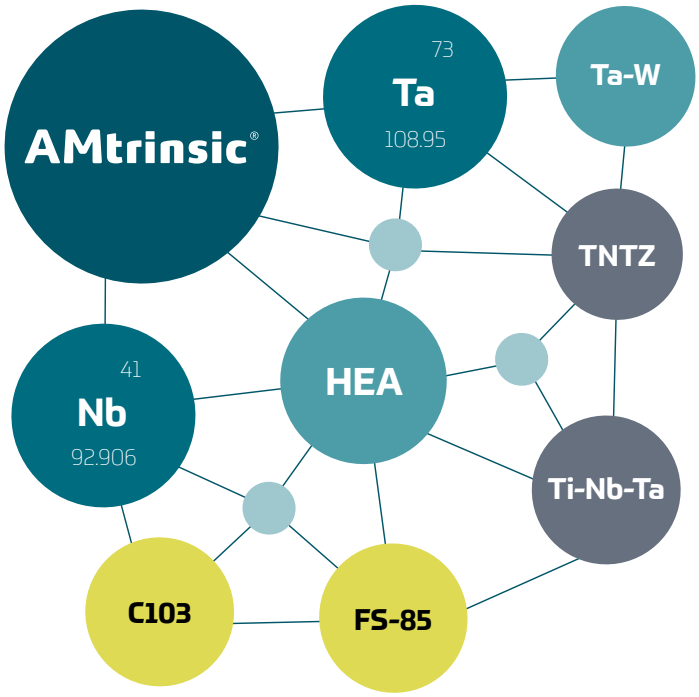

AMtrinsic® spherical tantalum and niobium powders provide outstanding combinations of material properties customized for specific applications. Aligned with 3D-printing technology, **AMtrinsic®** powders can help overcome hurdles in various high-tech industries. The high temperature stability, excellent corrosion resistance and biocompatibility of **AMtrinsic®** Ta, Nb powders and their alloys deliver a perfect fit for biomedical (Ta, TNT and TNTZ), chemical (Ta, Nb, Ta-W) and aerospace (Ta-W, C103 and FS-85) applications. In addition, **AMtrinsic®** Nb with its prominent superconducting properties is ideal for the superconducting industry.

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Phase3D expands into Japanese market via TNSC partnership

Phase3D, based in Chicago, Illinois, USA, has entered into a strategic partnership with Taiyo Nippon Sanso Corporation (TNSC). Through TNSC's established presence, Phase3D's measurement-based solutions for Additive Manufacturing will have a widespread distribution and support network throughout Japan.

"This partnership with TNSC represents a significant milestone in our mission to empower the Additive Manufacturing industry with trusted quality assurance technology," said Niall O'Dowd, founder and CEO of Phase3D. "TNSC's in-depth understanding of advanced manufacturing and commitment to technical excellence make them the perfect partner for bringing our inspection solutions to the Japanese market."

TNSC's customers will also be offered comprehensive support for Phase3D's complete line of inspection products, including Fringe Inspection and the newly launched Fringe Qualification software. The partnership will also offer rapid service and maintenance response times for Japanese customers as well as hands-on training at designated demonstration facilities.

The companies anticipate that their partnership will be particularly beneficial for industries with stringent quality requirements, such as aerospace, medical devices, and defence, where Phase3D's measurement-based approach offers the documentation needed for critical applications. Using structured light fringe projection technology, Phase3D's Fringe Inspection products generate precise heightmaps with micron-level accuracy, ensuring trusted and repeatable quality control across production.

"Phase3D's innovative approach to AM inspection aligns perfectly with our commitment to advanced manufacturing solutions," stated Hirotaka Mangyo, Innovation Division Director of TNSC. "Their metrology-based technology fills a critical need in the Japanese market for objective, measurement-based quality assurance in Additive Manufacturing."

This expansion with TNSC is noted as a key milestone in Phase3D's global growth strategy, with additional partnerships planned in Asia to extend the company's presence.

www.additivemonitoring.com

EOS marks installation of 5,000th industrial Additive Manufacturing machine

EOS GmbH, based in Krailling, Germany, a manufacturer of both polymer and metal powder bed Additive Manufacturing systems, has announced the installation of its 5,000th industrial AM machine. The milestone machine was installed at Keselowski Advanced Manufacturing (KAM), a long-time customer of EOS located in Statesville, North Carolina, USA. KAM added an EOS M 400-4 to its expanding portfolio, which now totals eighteen EOS AM machines.

KAM, which recently became part of ADDMAN's group of AM organisations, has quickly grown by applying creative technologies and innovative engineering solutions. The new addition at KAM brings the total number of metal and polymer EOS machines within the ADDMAN group to thirty-six.

"AM is now integral to many industries – defence, space, energy, tooling and medical, to name but a few. We have long relied on EOS AM technology for producing many highly engineered and complex applications and are thrilled to be a part of the EOS story," Joe Calmese, CEO of ADDMAN, shared.

"Our organisation was a startup within a startup industry. There was no such thing as Additive Manufacturing when EOS was launched with a clear vision from my father. We can proudly call ourselves AM pioneers, but it is our continued innovation and unwavering desire to ensure our customers are successful that has allowed us to reach this milestone. While 5,000 machines are impressive, we have barely left the starting blocks. The possibilities are endless, and I'm both confident and excited about the greater milestones we'll undoubtedly achieve," stated Marie Langer, CEO of EOS.

EOS was founded by Dr Hans Langer and the company's first installation was for Munich-based automotive manufacturer BMW. Dr Langer's vision was a confluence of data, analytics, machines and robotics transforming how

Joe Calmese, CEO of ADDMAN (left) and Glynn Fletcher, president of EOS North America during installation of the new metal AM machine at KAM (Courtesy EOS)

applications are manufactured: more efficiently, sustainably and in ways not possible before.

"To this day, we remain true to Hans' original vision. This focus ensures we dedicate all our energy to building the best quality products and services for organisations like ADDMAN, rather than bowing to deceptive market dynamics and misguided competitive pressures. For us, this has resulted in consistent business growth, and I'm confident we'll reach 10,000 installations much faster than the first 100," said Glynn Fletcher, president of EOS North America.

www.eos.info

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Xact Metal ships 150th metal AM machine and reports strong Q4 2024 revenue

Xact Metal, headquartered in State College, Pennsylvania, USA, has announced that it achieved its second highest order revenue in the fourth quarter of 2024, as well as shipping its 150th metal Additive Manufacturing machine.

"Q4 2024 was our second-highest order revenue quarter," said Juan Mario Gomez, CEO of Xact Metal. "Key to this success has been our application and industry focus which continues to be well received by our customers and has resulted in new and repeat orders from key industry-leading customers. In the tooling industry, for example, we experienced strong reception of our high-performing XM200G metal printer and our recently announced partnership with Uddeholm, a world-leading manufacturer of tool steel for industrial tools. Together we bring our high-performing Xact Metal XM200G metal printer plus their corrosion-resistant Corrax metal powder to help solve challenging applications in injection moulding."

"In December 2024 we also shipped our 150th metal 3D printer, which was delivered to Zero Tolerance, a growing plastic injection mould machine shop located in Clinton Township, Michigan," said Gomez. "We are excited to see what Steve Michon, the owner, and the team at Zero Tolerance will do with their XM200G metal 3D printer, as they continue to invest in the highest performance machinery and tooling to succeed in the production mould industry."

Xact Metal's 150th metal Additive Manufacturing machine was delivered to Steve Michon, the owner of Zero Tolerance (Courtesy Xact Metal)

www.xactmetal.com

Fehrmann MaterialsX bridges academia and research with AI-based MatGPT Classroom

Fehrmann MaterialsX, a division of the Fehrmann Group headquartered in Hamburg, Germany, has launched its AI-powered platform MatGPT Classroom.

Intended as a bridge between the knowledge gained in university labs and the practical needs of the industrial world, MatGPT Classroom provides access to both public data and proprietary, industry-relevant insights that aren't available in academic databases.

Henning Fehrmann, CEO and Chairman of Fehrmann MaterialsX, stated, "With MatGPT Classroom, universities can go beyond traditional research methods. We're giving them the tools to make their discoveries relevant in the real world, supporting the creation of industrial value and, ultimately, jobs. This is about empowering researchers to make a tangible difference."

Through partnerships with institutions such as University of California, Irvine; Ohio State University and the Advanced Casting Research Center (ACRC), known for their industrial-focused materials science and engineering, Fehrmann intends to facilitate the exchange of knowledge between academia and industry. Researchers and students can now collaborate globally, pushing their findings towards industrial-scale implementation.

www.fehrmann.tech
www.materialsx.ai

Nanoe launches Zetasinter 4L sintering furnace

Nanoe, based in Ballainvilliers, France, has reported the launch of its new Zetasinter 4L sintering furnace to complete its current line of Zetamix metal and ceramic filaments, machines and sintering furnaces. Nanoe partnered with Cerinnov Group to develop this new sintering furnace, aimed at filling a gap in Nanoe's current product offerings for the medium-size production of sinter-based Additive Manufacturing parts.

The new Zetasinter 4L furnace, manufactured by Cerinnov in France, features a sintering volume of 4 litres (140 mm diameter, 250 mm length). The model is four times bigger than the previous Zetasinter tubular furnace, allowing sintering of small production batches. It has full digital control, a part loading system, and a maximum operating temperature of 1,350°C.

The Zetasinter 4L is available for a price of €25,000, with first deliveries expected in Q1 2025.

www.nanoe.com

The Zetasinter 4L is four times bigger than the previous Zetasinter tubular furnace, allowing sintering of small production batches (Courtesy Nanoe)

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Fieldmade and Plastometrex partner to integrate quality testing in metal Additive Manufacturing

Fieldmade, headquartered in Lillestrøm, Norway, and Plastometrex, a developer of mechanical testing solutions based in Cambridge, UK, are partnering to bring quality assurance to the forefront of on-demand metal Additive Manufacturing.

With the aim of improving part confidence and safety, Plastometrex's PLX-Benchtop is now offered within Fieldmade's NOMAD micro factory series. For the first time, customers are presented with a portable, end-to-end metal AM solution with built-in mechanical testing capabilities.

Fieldmade's deployable NOMAD systems, built for on-site AM, now enable immediate validation of the mechanical integrity of additively manufactured metal parts for critical applications. By integrating Plastometrex's compact PLX-Benchtop machine, customers can perform quality assurance directly at the point of production, gaining confidence in part performance within minutes, even in demanding environments.

The PLX-Benchtop is powered by Plastometrex's proprietary PIP testing method (Profilometry-based Indentation Plastometry) and delivers accurate, non-destructive stress-strain curves. The machine's intuitive interface eliminates the need for specialised expertise, allowing operators to confidently perform testing with minimal training and without complicated sample preparation or equipment.

"Plastometrex's solutions represent a paradigm shift for in-field testing," said Fieldmade Head of Quality, Tobias Rønneberg. "Our customers work in remote environments where parts are urgently needed and access to expertise can be limited. The ease of use, the speed of testing and compact size of the PLX-Benchtop, makes it highly suitable for use in expeditionary manufacturing."

"By integrating Plastometrex's PLX-Benchtop into our NOMAD® systems, our end-users can rapidly assess the quality of the additively manufactured parts on-the-fly, ensuring the safety and performance of critical components," Rønneberg added.

Plastometrex CCO, Mike Coto, shared, "This partnership marks an exciting turning point for deployable production. Traditional testing methods are too slow and inflexible for effective use in deployable settings. By integrating the PLX-Benchtop into the NOMAD systems, Fieldmade and Plastometrex are jointly enabling customers to manufacture and test components at the point of need."

By integrating Plastometrex's compact PLX-Benchtop machine, customers can perform quality assurance directly at the point of production (Courtesy Plastometrex)

With the integration of Plastometrex's PLX-Benchtop, Fieldmade now offers a comprehensive production ecosystem that ensures both rapid on-site manufacturing and delivers confidence in part performance through integrated quality assurance, combining flexibility, reliability, and speed in one seamless solution.

www.fieldmade.no
www.plastometrex.com

Aerojet Rocketdyne names Ken Bedingfield its new president

L3Harris Technologies, headquartered in Melbourne, Florida, USA, announced that Ken Bedingfield has been appointed president of Aerojet Rocketdyne. Bedingfield assumes his new role on February 3, 2025, in addition to maintaining his current position as L3Harris's CFO. The previous president, Ross Niebergall, will remain with the company to support the transition before entering retirement.

It was also announced that Sam Mehta's role will be expanded to lead enterprise Strategic Collaboration Agreements while continuing to lead the Communication Systems segment. Mehta is expected to establish, grow and leverage strategic relationships with industry partners to deploy next-generation capabilities to the US and its allies.

In addition, the company's transformation initiative LHX NeXt (led by Heidi Wood) will report to L3Harris Chair and Chief Executive Officer Chris Kubasik.

"Ken and Sam are highly respected leaders, both with an established track record of success. Under Heidi's leadership, LHX NeXt will continue to focus on cost savings and expand to enterprise transformation. I'm confident these changes position the company for continued success," Kubasik said. "I would also like to thank Ross for his contributions to L3Harris and the defence industry. We wish him well in retirement."

Ken Bedingfield has been appointed president of Aerojet Rocketdyne (Courtesy L3Harris Technologies)

www.l3harris.com

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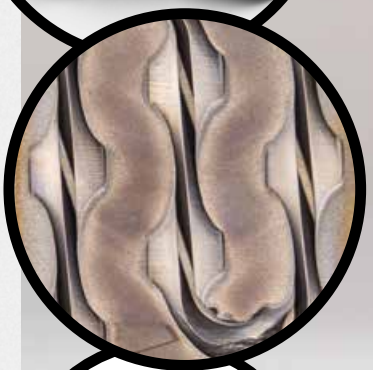

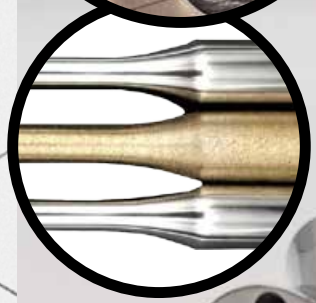

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WAAM3D co-founder Filomeno Martina steps down as CEO; Chee Weng Lee appointed Interim CEO

WAAM3D, based in Milton Keynes, UK, has announced that Filomeno Martina, co-founder and CEO, has stepped down after six years at the company. The remaining co-founders, Stewart Williams and Jialuo Ding, will continue to drive the development of the company's products and offerings, while Chee Weng Lee will assume the role of Interim CEO.

As one of the company's founding members, Martina has helped shape WAAM3D from its early academic roots at Cranfield University into the commercial entity it is today.

"After six incredible years as the CEO and member of the board of directors of WAAM3D, I have made the wholly-personal decision to step down from these roles. It was not made lightly, as my journey with WAAM3D has been a most rewarding and significant experience," stated Martina. "I am incredibly proud of what we have accomplished together. We have grown from a small academic team into a commercial organisation that has contributed significantly to our field."

With more than thirty years of operational and management experience in precision manufacturing, Chee Weng has been a Director of WAAM3D since its founding and currently serves as the Managing Director of Addept3D, a joint venture between WAAM3D and Accuron Technologies.

Accuron Technologies will continue to be a strategic investor in WAAM3D, supporting its development and scaling up the adoption of WAAM by its customers globally.

www.waam3d.com

Filomeno Martina, co-founder and CEO of WAAM3D, has stepped down after six years (Courtesy LinkedIn)

Chee Weng Lee has been a Director of WAAM3D since its founding and will take on the role of Interim CEO (Courtesy LinkedIn)

Atomik AM receives investment to commercialise innovative Binder Jetting technology

The Atomik AM team has received funding to accelerate the commercialisation of its Binder Jetting solutions (Courtesy Atomik AM)

Atomik AM, a spin-off from the University of Liverpool, UK, has received a £125,000 investment from LYVA Labs. LYVA Labs creates engineering solutions for the advanced manufacturing sector from its base at the University of Liverpool's School of Engineering.

Having developed a number of techniques and binders intended to improve the process of Binder Jetting (BJT) Additive Manufacturing, Atomik AM plans to use the investment from LYVA Labs to accelerate product commercialisation by enabling the team to convert pipeline opportunities into commercial contracts.

The funding will also support the business in developing new intellectual property (IP), filing a patent, securing eight jobs, and creating the role of Chief Operating Officer. Since its inception, Atomik AM has successfully collaborated with blue-chip companies, filed multiple patents, and established an IP pipeline.

"This investment is a testament to the groundbreaking work our team is doing to advance Additive Manufacturing processes," stated Professor Kate Black FREng, founder and CEO of Atomik AM. "It allows us to expand our capabilities, accelerate innovation, and bring sustainable, cutting-edge solutions to the industry. At Atomik AM, we believe in driving change in manufacturing to create a better future for everyone."

LYVA Labs' Head of Investments, Akshay Bhatnagar, added, "We hope this will be the first of many investments alongside the University of Liverpool, Atomik AM exemplifies the excellence found in advanced manufacturing R&D across Liverpool City Region, and we are pleased to be part of this business's exciting innovation journey."

Recently, Liverpool City Region Combined Authority invested £10.5 million in LYVA Labs in bolstering companies into high-growth businesses, as part of Liverpool Mayor Rotheram's plan to invest 5% of regional GVA into research and development (R&D) by 2030. Advanced manufacturing is said to be key to this goal, representing a significant sector.

www.lyvalabs.com

TekSiC debuts Xforge HT high-temperature induction furnace

TekSiC, based in Linköping, Sweden, has announced its new Xforge HT, a modular high-temperature induction heating furnace. The Xforge HT is designed for applied manufacturing applications such as post-processing of additively manufactured components, sintering, various diffusion treatments, material testing etc.

"The Xforge HT represents the next step in our evolution as a company," stated Joachim Tollstoy, CEO of TekSiC. "This product is a result of our dedication to innovation, designed with the flexibility to meet the specific needs of processes in high temperatures, low pressures, and introduction of process gases. We engineered it to provide the highest performance in the most demanding environments while offering a modular solution that can be customised to each customer's unique requirements."

The Xforge HT is designed for high-temperature performance, reportedly able to stably exceed 2,500°C. Its pressure and gas management system is said to enable the precise regulation of the processing environment, allowing optimal conditions for complex heat treatment applications. The machine's design is also focused on versatility, enabling the generation of high-vacuum environments while allowing the controlled introduction of multiple gases, including hydrogen. Its advanced control algorithms enable precise thermal management, making it even possible for processing refractory metals such as tungsten, niobium, and tantalum.

Throughout its development, Xforge HT underwent industrial reliability testing at customer sites over several years, demonstrating its ability to function during extreme high-temperature applications. Additionally, Xforge HT is CE-marked, certifying compliance with EU health, safety, and environmental standards.

The new Xforge HT furnace (Courtesy TekSiC)

www.teksic.com

MetShape appoints Lucas Vogel as CEO

MetShape GmbH, Pforzheim, Germany, has announced Lucas Vogel as its new CEO, succeeding Andreas Baum, who has led the company since its founding. Although Baum will step down from the CEO role, MetShape stated that he will remain closely connected to the company, continuing to support its growth and success.

Lucas Vogel will become CEO, taking over from Andreas Baum (Courtesy Metshape GmbH via LinkedIn)

Vogel, who has been an integral part of the team as Head of R&D, brings experience and a deep understanding of its innovative Lithography-based Metal Manufacturing (LMM) technology. One of his key focus areas will be further strengthening the company's position in the MedTech sector.

"I am honoured to take on the role of CEO at MetShape and am grateful for this opportunity," stated Vogel. "I want to thank Andreas for his contributions over the past six years, as well as our dedicated team and supportive shareholders for their trust. As we enter this new chapter, I look forward to driving MetShape's continued growth and innovation together."

"I am also excited to have Andreas remain closely connected to the company and collaborate with him in the R&D field as he transitions into his new role as a professor at Pforzheim University," Vogel said.

Baum added, "After six intense and highly instructive years as founder and Managing Director of MetShape GmbH, the time has come for me to open a new chapter. I look back with pride on what we have achieved as a team during this time – from the initial idea to the successful scaling of the company."

"I am all the more pleased that Lucas Vogel, who has helped shape MetShape from the early days and knows the company inside and out, is taking over as CEO. I am confident that he will continue to lead the company successfully with his expertise and passion," Baum continued. "My connection to MetShape will remain: In my new role as Professor of Production Engineering with a focus on additive processes at Pforzheim University, I will continue to accompany and support the company scientifically."

"A huge thank you to the entire team, our partners, and companions – this success would not have been possible without you! I look forward to everything that lies ahead," Baum concluded.

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ORNL achieves nuclear industry first with additively manufactured rabbit capsule for test reactor

A research team from the Department of Energy's Oak Ridge National Laboratory (ORNL), Oak Ridge, Tennessee, USA, has designed, manufactured, and successfully tested a specimen capsule for use in a High Flux Isotope Reactor (HFIR). Specimen capsules, commonly referred to as rabbit capsules, are used in nuclear fuels and materials research to hold experiments undergoing irradiation in a test reactor. The achievement is said to be a first for Additive Manufacturing.

To demonstrate that Additive Manufacturing could produce and qualify a rabbit capsule for use in a reactor, ORNL used a Laser Beam Powder Bed Fusion (PBF-LB) AM machine to build a stainless-steel capsule that was then assembled, loaded, and sealed.

The capsule was later inserted into HFIR for nearly a month, where it successfully weathered the effects of the reactor's high neutron flux environment.

"This is a significant step toward demonstrating that Additive Manufacturing can be used to develop and qualify specialised components that cannot be conventionally machined," said Richard Howard, group lead for irradiation engineering at ORNL.

"As we demonstrate the reliability of these printed components, we're looking at a future where Additive Manufacturing might become standard practice in producing other critical reactor parts," stated Manufacturing Demonstration Facility Director Ryan Dehoff.

What's next?

ORNL will conduct post-irradiation evaluation of the additively manufactured rabbit capsule this winter.

The capsule's successful testing is anticipated to help pave the way for the use of other additively manufactured components in safety-critical applications within the nuclear energy community and other highly regulated industries with stringent material composition, design, and qualification standards.

The research team that created the additively manufactured rabbit capsule plans to utilise the geometric flexibility that Additive Manufacturing enables to create more complex designs with unique features that are difficult to fabricate conventionally.

The work was supported by the US Department of Energy's Advanced Materials and Manufacturing Technologies programme, which aims to accelerate the commercialisation of new materials and manufacturing technologies through demonstration and deployment.

www.ornl.gov

A research team from the Department of Energy's Oak Ridge National Laboratory (ORNL) has designed, manufactured, and successfully tested a specimen capsule for use in its High Flux Isotope Reactor (HFIR) (Courtesy Oak Ridge National Laboratory)

Colibrium Additive plans Lichtenfels workforce reduction

According to the German newspaper *Obermain-Tagblatt*, Colibrium Additive – a GE Aerospace company based in Lichtenfels, Germany, is planning to lay off between 40% - 48% of its workforce. The source indicated that a meeting was held in December for all employees based in Lichtenfels, during which Colibrium Additive leadership explained that significant job cuts would be necessary.

Obermain-Tagblatt shared that this could result in at least 160 workers and up to 192 losing their jobs.

Colibrium Additive has neither confirmed nor denied the existence of a workforce reduction plan, but it has stated plans to streamline operations across its global business.

"On November 6, Colibrium Additive submitted proposals for changes to GE Aerospace's European Works Council," a company spokesperson told *Obermain-Tagblatt*. "Taking into account the current conditions in the additive industry, we are proposing measures to make our business more efficient so that we can best meet the needs of our employees and customers."

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JAXA selects Nikon to develop metal AM technology for space applications

The project will result in the metal Additive Manufacturing machines that can produce parts to the scale shown in these reference parts (Courtesy JAXA)

Nikon Corporation, headquartered in Tokyo, Japan, has been selected by the Japan Aerospace Exploration Agency (JAXA) to participate in a technology development programme to establish metal Additive Manufacturing technology for the production of large-scale space components. The selection is part of the open call for proposals from the Space Strategy Fund (SSF), titled 'Innovative technology for lightweight, high-performance, and lower cost space transportation systems.'

The aim is to capture a significant share of the global aerospace market by developing Japan's first Additive Manufacturing machine capable of producing components for large-scale structures and parts for space transportation systems. This includes large and precise space applications, such as the rocket engine components shown above. The project objective is to develop and demonstrate metal Additive Manufacturing technology to meet these needs.

Each organisation, selected from various Japanese companies and universities, will take the lead in its technological field of expertise. Nikon will utilise its digital manufacturing knowledge, including its metal AM and applied optics technologies.

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Addireen's green-laser Additive Manufacturing technology achieves 99.9% dense pure copper parts

A joint research team from Shanghai Jiao Tong University and Shanghai University has published a paper focusing on the use of green lasers in processing copper via Laser Beam Powder Bed Fusion (PBF-LB) Additive Manufacturing in the Journal of Materials Processing Technology.

'Enhanced electrical and mechanical properties of additively manufactured pure copper with green laser' examines the key characteristics of copper components and aims to provide a framework for laser Additive Manufacturing of highly reflective metal materials. Moreover, the study demonstrates the application capabilities of green lasers in metal Additive Manufacturing machines (the research is based on the use of an XH-M160G AM machine from Addireen).

The XH-M160G features a 500 W single-mode continuous fibre laser with an average spot diameter of 30µm; the absorption rate of copper powder is approximately 85%. In this research, the team fixed the hatch spacing and adjusted parameters such as scanning speed and laser power to observe variations in the microstructure, mechanical properties, and electrical performance of the experimental samples under different conditions.

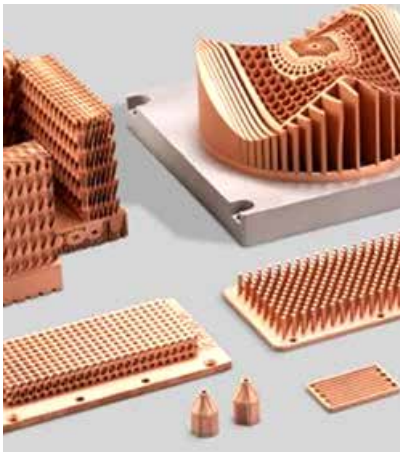
The high utilisation rate of green laser energy also significantly enhances printing efficiency while minimising the amount of laser energy reflected by the materials. This reduction in reflection effectively mitigates spattering during the melting process, ensuring stable and continuous operation of the equipment. Furthermore, the precise control over thermal input afforded by green laser enables consistent microstructures and superior part quality.

The researchers found that optimising the parameters of green lasers in a PBF-LB machine can result in copper components with over 99.9% relative density and 98% international annealed copper standard (IACS) electrical conductivity.

The combination of comprehensive experiments and finite element modelling also reveals how defect morphology impacts electrical conductivity. The authors of the paper have stated that this work contributes to the broader application of AM technologies, especially for high-reflectivity metals, and provides insights into how these defects affect conductivity and should be controlled during the AM process.

Green-laser metal Additive Manufacturing machines

Green-laser powder bed fusion technology not only enables the efficient Additive Manufacturing of pure copper and copper-based materials, but also provides novel solutions for the AM of other highly reflective and refractory metals such as gold, platinum, silver, tantalum, and tungsten.



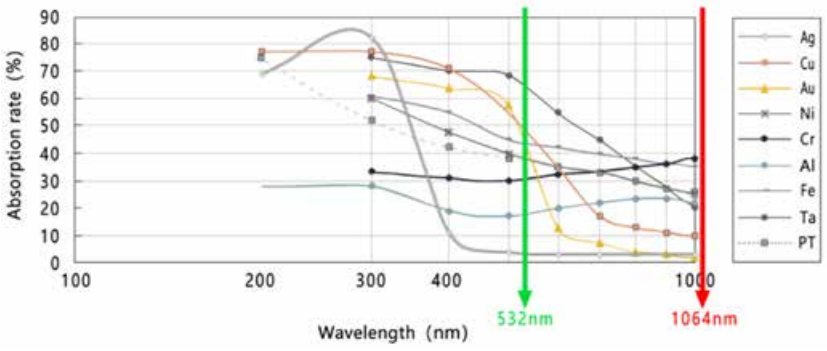
Pure copper, CuCrZr, CuCrNb, CuSn10 samples additively manufactured using Addireen's green-laser AM machines (Courtesy Addireen)

Addireen's range of green-laser powder bed fusion AM machines includes the M100G, M160G, and M350G. These machines have either 500, 700 or 1,000 W high-power single-mode continuous green fibre lasers developed in-house, and are said to offer significant advantages, such as high beam quality, stability, and a finer laser spot.

Addireen states that the pure copper components produced by these machines achieve a thermal conductivity of up to 390W/m·K. As an example, additively manufactured liquid heat sink and heat exchanger components can withstand water pressures greater than 8 MPa at a wall thickness of 0.5 mm (in comparison, the additively manufactured TPMS structure has a minimum wall thickness of 0.08 mm).

The company reports that its machines have been adopted in various industries, including aerospace, new energy vehicles, induction heating coils, and high-speed communication devices.

en.sjtu.edu.cn
www.shu.edu.cn
www.addireen.com



Absorption rate of various metal materials (%) (Courtesy Addireen)

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Ricoh develops diffusion bonding technology for joining aluminium Binder Jetting components

Ricoh Company, Ltd, headquartered in Kanagawa, Japan, has developed a process to join aluminium parts fabricated by Binder Jetting (BJT) to wrought aluminium alloy. This new technique not only eases the restriction on the size of parts fabricated by Binder Jetting, but it also has the potential to significantly reduce costs.

Metal Binder Jetting is a highly productive and low-cost Additive Manufacturing technology that can be used for prototyping and series manufacturing. However, because BJT requires sintering, it can be difficult to ensure accuracy when manufacturing very large parts, explains Ricoh.

Ricoh's newly developed diffusion bonding technology for sintered materials fabricated by the BJT method solves the above issues. The company is using its proprietary liquid-phase sintering technology, which is useful in the fabrication of high-efficiency heat exchangers and other applications.

A heat exchanger consists mainly of fins that determine cooling performance and a case that determines the component's dimensional accuracy. Ricoh's idea is to use BJT to make fins of complex shapes and join them to an aluminium case prepared using an existing method. BJT's ability to fabricate complex shapes allows for highly efficient cooling performance, while the machining accuracy of existing methods ensures the dimensional accuracy of the component.

Fig. 2 shows a sample of 6061 aluminium bonded to a gyroid-type fin. The fin is fabricated with the aluminium BJT and joined to the base using the newly developed diffusion bonding technique. Its appearance shows that the gyroid shape created by the BJT machine is joined to the 6061 block without distortion. The cross-sectional image also shows that there are few voids at the interface between the BJT sintered body and the 6061 block. By utilising this bonding technique, a component with three fins (gyroid) bonded to the case can be made, producing a heat exchanger as shown in Fig. 1.

Fig. 3 shows an example of a large component fabricated by combining this diffusion bonding technique with conventional brazing. Ten gyroids made by aluminium BJT are diffusion bonded inside a 1050 aluminium case. The case and lid are joined by conventional brazing. The external dimensions of this component are 400 x 160 x 10 mm. Such a large cooling component can be difficult to make in one piece using BJT, explains Ricoh, but is possible using the diffusion bonding technology.

In addition to 6061 and 1050 aluminium alloys, Ricoh's diffusion bonding technology has also been confirmed to be capable of joining 6063 aluminium and BJT sintered bodies.

The diffusion bonding method is based on technology that controls the amount of aluminium liquid phase accumulated in the development of the sintering process for Ricoh's aluminium BJT machine. Unlike brazing, this technique does not require flux or brazing material. Brazing is a typical technique for joining aluminium, but there are limitations to the aluminium alloy compositions that can be used for brazing. Aluminium alloys for Additive Manufacturing, including Powder Bed Fusion, have been developed to make the method work, but they are not necessarily suitable for brazing. Ricoh's technology is reported to be novel, in that both the Binder Jetting and the joining process are effective.

Takafumi Sasaki, head of the metal BJT project at Ricoh, stated, "This unique bonding technology will achieve both improved cooling efficiency and reduced component costs, and also allow for larger component sizes. This technology will bring our customers closer to utilising aluminium BJT in the manufacturing field. We plan to further validate its manufacturing feasibility in the real market through collaborations with our customers."

www.ricoh.com

Fig. 1 Example of a heat exchanger component fabricated by joining the sintered aluminium BJT part and a wrought alloy (Courtesy Ricoh)

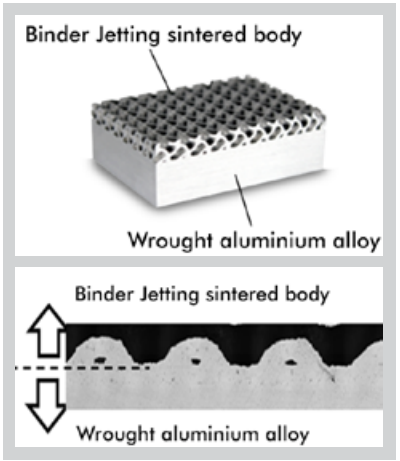

Fig. 2 Example of an aluminium BJT sintered part joined to a wrought alloy base (Courtesy Ricoh)

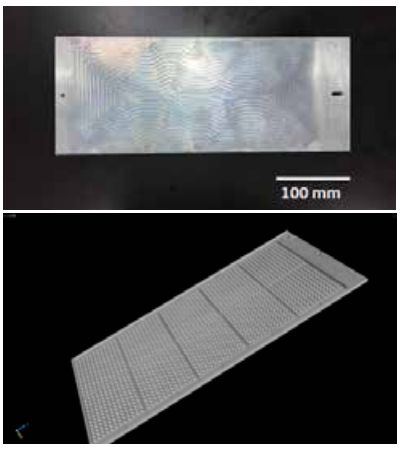

Fig. 3 Example of a large component fabricated using this diffusion bonding technique with conventional brazing. Photograph and X-ray CT images are shown (Courtesy Ricoh)

ProFocus six-laser DED titanium components with m4p's Ti-6Al-4V powder

Oscar-PLT GmbH, Klipphausen, Germany, and m4p material solutions GmbH, Magdeburg, have published the results of a joint project on the production of Ti-6Al-4V via Oscar's ProFocus Directed Energy Deposition (DED) Additive Manufacturing machine.

The ProFocus machine uses six individually controllable lasers arranged around a centrally guided metal feedstock of either powder or wire. This allows users to carefully control the energy input and distribute heat homogeneously, a characteristic which, according to Oscar, allows the use of materials that were previously unable to be processed. As the machine has a shielding gas flow, it doesn't need to be used in an enclosed space.

At the recent additivefertigung: metal in bestForm conference, Oscar-PLT's Dr-Ing Michael Schnick and m4p material solutions' Dr-Ing Burghardt Klöden presented their work in the project. Dr Schnick focused on the technology used in the ProFocus and wire processes, whilst in his presentation, Dr Klöden discussed the properties achievable when manufacturing with a titanium alloy powder (m4p Ti grade 23.09).

According to Klöden, the mechanical properties of the resultant components were in a range previously exclusive to titanium alloys processed via Laser Beam Powder Bed Fusion (PBF-LB) Additive Manufacturing. This was said to confirm the compatibility of the ProFocus DED Additive Manufacturing technology with m4p's Ti-6Al-4V powder for the successful processing of this demanding material.

Oscar's ProFocus DED Additive Manufacturing machine is said to produce results comparable to PBF-LB (Courtesy Oscar-PLT)

www.oscar-plt.de
www.metals4printing.com

EOS, AMEXCI and SAAB to develop metal AM solutions for Finnish Navy

AMEXCI, based in Tampere, Finland, and EOS GmbH, headquartered in Krailling, Germany, together with Sweden's Saab, will develop new capabilities to additively manufacture both spare parts and new products for the Finnish Navy's Squadron 2020 project.

The partners will focus on providing Finland with an Additive Manufacturing supply chain for the Finnish Defence Forces and critical industries, as well as enabling the rapid deployment of new innovative equipment. Under the project, new and enhanced competencies are expected to contribute to improving the overall security of supply in Finland.

"I'm thrilled to be involved in developing new technologies and creating novel Nordic collaboration with Saab and EOS. I believe our new competencies developed within this project will be beneficial for many companies and stakeholders, and it will strengthen Finnish supply chain resilience in challenging situations," stated Johannes Karjalainen, Managing Director, AMEXCI Oy.

Paula Kainu, Senior Metal Solutions Architect, EOS, added, "Over the years, we have developed comprehensive know-how on AM materials with an extensive material databank, which we will leverage in this project. By combining our extensive experience with the specific application requirements, we can develop an AM solutions that perfectly fits. Not only advancing this project but adding value to many companies alike."

The partners will develop new capabilities to additively manufacture both spare parts and new products for the Finnish Navy (Courtesy Puolustusvoimat/Finnish Defence Forces)

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SWISSto12 reports 40% revenue growth and workforce up 75%

SWISSto12, based in Renens, Switzerland, is celebrating impressive growth in 2024, reporting revenue up over 40% and its workforce increasing by 75% across facilities in Switzerland, Europe and the US. The company delivered significant momentum in its HummingSat small satellite programme, cemented new customer partnerships with global OEMs, increased production capacity and gained widespread international industry recognition.

"2024 has been another year of outstanding growth for SWISSto12, as we continue to push boundaries in satellite communication and scale our operations globally," stated Emile de Rijk, CEO and founder of SWISSto12. "We are reinforcing our position as a trusted and mature partner for the world's leading satellite operators, space agencies, aerospace OEMs and telecommunications companies. We are excited to build on this momentum in 2025 as we accelerate on our mission to connect and protect the world."

In September 2024, Intelsat, Viasat+Inmarsat, the European Space Agency (ESA) and SWISSto12 announced that the HummingSat programme was able to achieve what the company referred to as 'major' progress in its Preliminary Design Reviews ahead of its scheduled Intelsat 45 and Inmarsat 8 missions.

SWISSto12 also secured over $15 million contracts with aeronautical OEMs to provide equipment for improving maritime safety.

The company expanded its facilities in Renens, Switzerland, with additional production space and state-of-the-art clean room to reach a total footprint of 5,700 m^2. Production capacity was further expanded with the acquisition of four MetalFabG2 metal Additive Manufacturing machines from Additive Industries.

SWISSto12's US-based entity (St12 RF Solutions Inc) also won major contracts throughout 2024, delivering integrated RF Antenna Feed Chain products to Northrop Grumman for its GEOStar-3 product as well as continuing deliveries of antenna products to Lockheed Martin Space.

The company also announced the opening of its US HummingSat command and control centre in the state of Georgia.

During its company-wide growth in 2024, SWISSto12 expanded its global workforce by 75% (Courtesy SWISSto12)

SWISSto12 was named WEF Technology Pioneer 2024 by the World Economic Forum; 'Top 10 Hottest Satellite Companies' by ViaSatellite; 'Leading European Technology Scaleup' (LETS) by France Digitale; and was included in Le Temps Forum Top 100. The company also won the 'Innovation' category at the Prix Vaudois des Entreprises Internationales 2024.

SWISSto12 is a manufacturer of advanced satellite RF products, payloads and systems. The company's RF products benefit from Additive Manufacturing technologies and associated Radio Frequency (RF) product designs that deliver lightweight, compact, highly performing, and competitive RF functionality.

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Backflip releases AI design software on back of $30M funding round

Using Backflip, designers can produce real parts from a simple text description or by snapping a photo of a broken component (Courtesy Backflip)

3D generative AI company Backflip, headquartered in Miami, Florida, USA, has emerged from stealth and launched its design platform, supported by $30 million in funding. Started by Greg Mark and David Benhaim, the founding team behind Markforged, the funding was co-led by NEA and Andreessen Horowitz (a16z). Angel investors include CTO of Microsoft and co-founder of LinkedIn Kevin Scott, Android founder and AI futurist Rich Miner, and Ashish Vaswani, co-author of the Attention is All You Need research paper.

The company believes that using traditional 3D design software used to develop digital models is slow, which can throttle the design process. The team posited that every finished product ships without features and refinements that could have been added if the design process had been more efficient.

To address this, Backflip has released its AI-powered design platform that translates user inputs into high-resolution models suitable for Additive Manufacturing. Users can produce real parts from a simple text description or by snapping a photo of a broken component.

"Each era of humanity is defined by the tools we harness. The last fifty years has brought incredible improvement to the pace of innovation in software and electronics, but the design of physical products has lagged behind. We're building a next-generation design tool that allows a small team to move with the velocity of the biggest engineering army in the world. This is a giant leap forward in bringing design and manufacturing back to the US," Mark stated.

"AI language models capture how we think, vision models capture how we see, and Backflip is creating foundation models that capture how we build," said Benhaim. "We've invented a novel neural representation that teaches AI to think in 3D, unlocking a new category of models. That development yields 60x more efficient training, 10x faster inference and 100x the spatial resolution of existing state-of-the-art methods. Our series of 3D foundation models will form the kernel for building the real world."

"The promise of AI extends far beyond transforming knowledge - it is the catalyst for building a world once only imagined," said Lila Tretikov, NEA Partner and Head of AI Strategy. "I seek out extraordinary founders capable of driving this transformative vision across massive industries, from manufacturing and construction to transportation and robotics. The Backflip team stands at the forefront of this new industrial age at a pivotal time revitalising American manufacturing, strengthening national security, and accelerating economic prosperity."

Andrew Chen, General Partner at a16z, added, "The line between the physical and virtual world continues to blur. At the cutting edge of all computing advancements has been the push to create 3D simulations in virtual worlds that mirror the real world. That holy grail is within reach now thanks to the convergence of 3D photorealism born out of gaming and VFX with complex physics-based simulations born out of engineering. That's why we're so excited about Backflip's new technology, which will let users turn text into physical reality."

www.backflip.ai

Desktop Metal dismisses Markforged from previously filed merger complaint

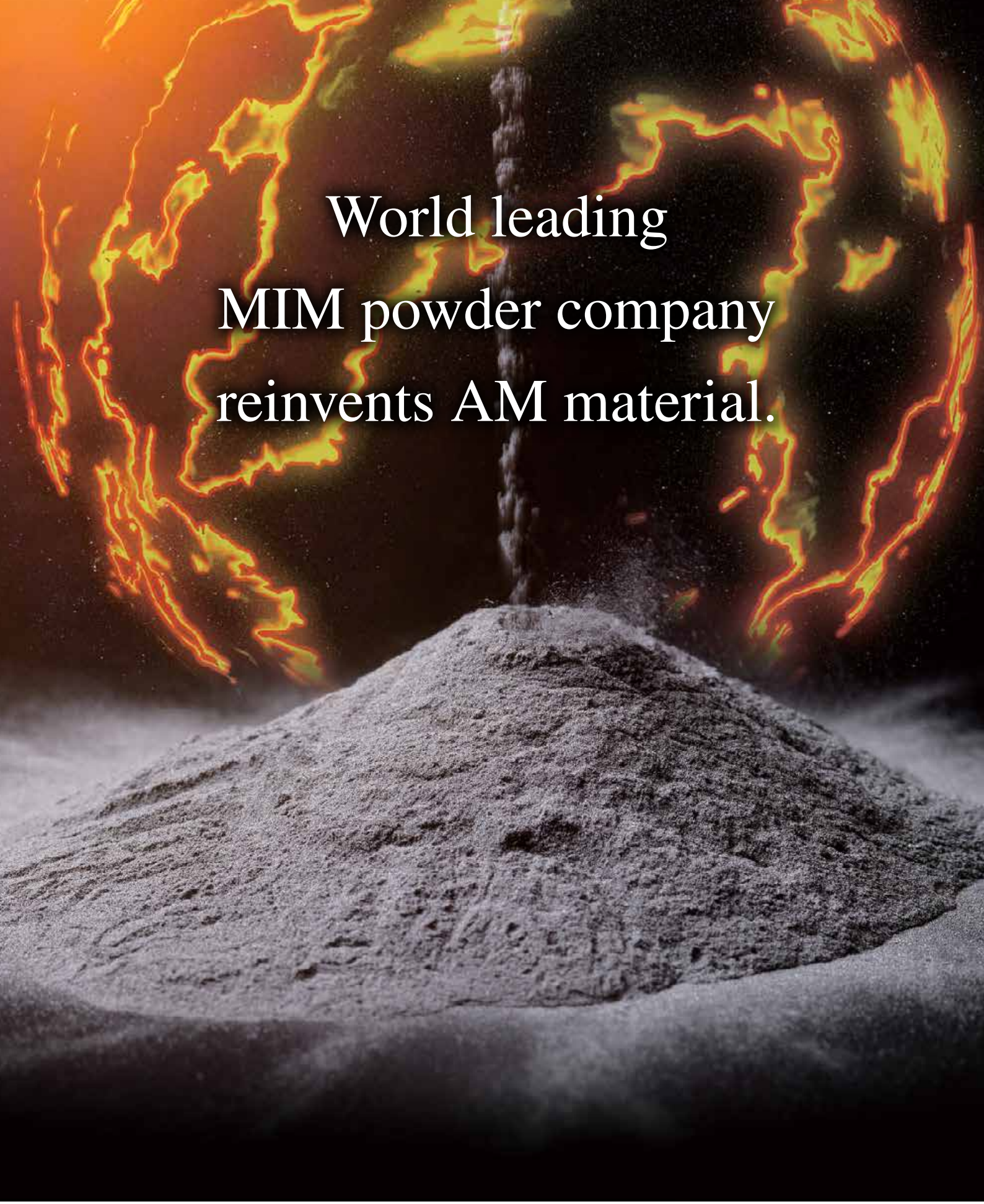
Markforged, based in Waltham, Massachusetts, USA, has announced that Desktop Metal has voluntarily dismissed Markforged without prejudice from its previously filed complaint against Nano Dimension. The dismissed complaint alleged that the proposed merger between Markforged and Nano Dimension would jeopardise the proposed merger between Nano Dimension and Desktop Metal.

On January 2, 2025, Desktop Metal filed a complaint in the Delaware Court of Chancery, in which Nano and Markforged were named as defendants. The complaint generally alleges that Nano breached the terms of its merger agreement with Desktop Metal by subsequently entering into the merger agreement with Markforged, and that closing the merger prior to the pending merger between Desktop Metal and Nano would jeopardise the parties' ability to close the Desktop Metal Merger.

It was stated that on January 22, 2025, Desktop Metal filed a notice of voluntary dismissal with the court to dismiss Markforged from the action, without prejudice.

As of January 24, 2025, Markforged also reported it has obtained approval for all regulatory filings required pursuant to its merger, except for filing with the Committee on Foreign Investment in the United States. Upon completion, Markforged will function as a wholly-owned subsidiary of Nano Dimension.

www.desktopmetal.com
www.markforged.com
www.nano-di.com



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Ortho Solutions acquires custom orthopaedic implant manufacturer Meshworks

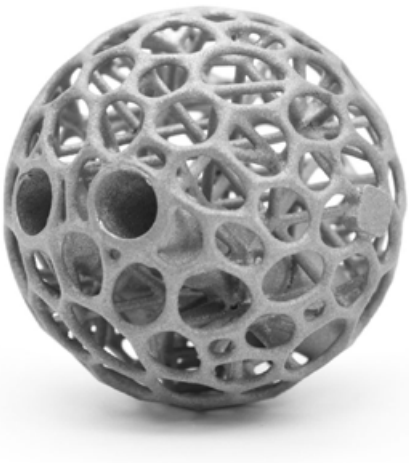
Ortho Solutions, a medical device company specialising in foot and ankle care based in Maldon, Essex, UK, has announced that a definitive binding agreement has been signed to acquire Meshworks, formerly part of the Alloyed group of companies based in Oxford, UK.

Meshworks was established to create custom orthopaedic implants that perfectly fit their intended patient. The company has scientific roots in Oxford and Imperial College London and consists of orthopaedic design engineers, Additive Manufacturing specialists, software engineers, and metallurgists. This multidisciplinary team has been guided by leading surgeons throughout all aspects of its research and development, creating proprietary structures and an exceptional implant creation process coupled with a straightforward surgeon design experience.

The company's titanium alloy implants are produced in Meshwork's ISO 13485-accredited manufacturing facility using laser beam powder bed fusion (PBF-LB) metal Additive Manufacturing technology.

"We are delighted with the opportunity to integrate Meshworks into the Ortho Solutions Group of companies. Through collaboration, Meshworks has established itself as the UK's market leader in Additive Manufacturing and 3D custom printed extremity implants. With our combined sector expertise, everyone here is super excited to see where this next chapter in our company's evolution takes us. Our dedicated team is confident of expanding our reach through this acquisition, significantly accelerating the company's global mission of advancing foot and ankle care," said Eliot Clare, CEO and co-Founder of Ortho Solutions.

www.orthosol.com
www.meshworksimplants.com



Meshworks was established to create custom orthopaedic implants (Courtesy Meshworks)

Switzerland's SIPBB installs new IMPACT 4530 metal AM machine from IRPD

United Grinding Group member IRPD, based in St Gallen, Switzerland, has debuted its IMPACT 4530 metal Laser Beam Powder Bed Fusion (PBF-LB) Additive Manufacturing machine at a celebratory hand-over event at the Switzerland Innovation Park Biel/ Bienne (SIPBB). The Innovation Park is a private non-profit organisation that primarily supports and conducts applied, industry-related research and development. As part of the Switzerland Innovation foundation network, the SIPBB aims to attract international research investment, promote Swiss innovation, support start-ups and accelerate the translation of research into marketable products.

The handover was attended by representatives from IRPD, SIPBB and the United Grinding Group, who acknowledged the importance of the acquisition.

"After six years of development, today is an important day for IRPD and the history of Additive Manufacturing in Switzerland – this fills me with pride," stated Andreas Burn, Managing Director of SIPBB and Head of the Swiss Advanced Manufacturing Centre. "By maintaining a strong emphasis on quality and productivity, utilising a fully digitalised process chain, and implementing a high level of automation, manufacturing in Switzerland is set to remain profitable in the future."

The IMPACT 4530 has a build volume of 450 x 300 x 400 mm and is available with either two or four 1,000 W synchronised fibre lasers. It is equipped with C.O.R.E., the hardware and software architecture for machine tools from the United Grinding Group. This allows it to communicate with third-party systems and access other United Grinding Group products.

IRPD explained that the IMPACT 4530 has a high level of system autonomy and can be scaled as a stand-alone machine or a fully automated manufacturing network.

Christoph Plüss, member of the Board of Directors at IRPD and CTO of the United Grinding Group, added, "Market analyses had shown that we could fill a gap with the development and construction of the first Swiss additive machine tool. This was a clear opportunity and motivation enough for the Group."

www.irpd.ch

The IMPACT 4530 has been installed at the Switzerland Innovation Park Biel/ Bienne (Courtesy IRPD)

Former Blue Origin CEO Bob Smith joins Seurat Technologies' Board

Seurat Technologies, based in Wilmington, Massachusetts, USA, has announced the appointment of Bob Smith to the Seurat Board of Directors. Smith, the former CEO of space technology company Blue Origin, will be Seurat's fourth board member and its first independent board member.

"We are excited to welcome Bob Smith to the Seurat Board," said James DeMuth, CEO and Co-Founder of Seurat. "Bob's proven expertise in scaling complex technology operations, as demonstrated by his leadership in transitioning Blue Origin from a research organisation to a multi-billion-dollar business, will be a tremendous asset as we expand our production capabilities. His experience building robust manufacturing systems, growing teams, and delivering groundbreaking innovations aligns perfectly with Seurat's mission to revolutionise metal Additive Manufacturing."

As CEO of Blue Origin, Smith successfully led the company's transformation from a research-focused organisation to a fully operational business. Before his tenure at Blue Origin, he spent 13 years at Honeywell Aerospace, where he held various leadership positions, ultimately serving as Chief Technology Officer and president of a $4B business.

"There are many 3D-printing companies. However, I'm confident that only Seurat has the technology, and the focus required to drastically reduce part costs and improve the manufacturing velocity needed to compete and beat conventional serial manufacturing methods," said Smith. "Seurat's approach is truly a 21st-century innovation that realises all the advantages of digital printing. I'm excited to be part of the team that will help scale up this business and make Seurat's advanced manufacturing capability available to a wide range of customers."

www.seurat.com

EOS and 6K Additive win $2.1M America Makes grant for sustainable Additive Manufacturing project

6K Additive, a division of 6K, based in North Andover, Massachusetts, USA, reports it has been selected, along with project lead EOS GmbH, headquartered in Krailling, Germany, for the America Makes sustainability and environmental benefits project for Additive Manufacturing. Other organisations included in this project are Texas A&M University, 3Degrees, Wichita State University and the National Institute for Aviation Research (NIAR). The proposal directly addresses the sustainable production of aerospace and defence products via Additive Manufacturing.

6K Additive's titanium powder, manufactured using its UniMelt microwave plasma reactors, uses over 73% less energy than conventional methods and produces 78% less carbon emissions (Courtesy 6K Additive)

The project call, awarded through the Office of the Under Secretary of Defense for Research and Engineering's (OSD(R&E)) Manufacturing Technology Office, totals $2.1 million in funding. EOS and 6K Additive have been awarded under 'Topic 6' which will utilise a portion of the $2.1 million funding. Topic 6's primary objectives are to develop and demonstrate sustainable AM practices and products through design, material selection and development, material handling, and/or recycling.

"When it became time to decide on a material development partner for this project, 6K Additive was quickly identified as a frontrunner," stated Jon Walker, government relations & key account manager, EOS. "Their expertise in the field of sustainable materials and proven track record supporting grant projects in the DoD community made them the clear choice for partnership."

6K Additive will support the project with its titanium powder, manufactured using next-generation UniMelt microwave plasma reactors designed and patented by 6K. As evidenced by Foresight Management's Life Cycle Assessment, 6K Additive's titanium powder uses over 73% less energy than conventional methods and produces 78% less carbon emissions.

"We are truly excited to be selected again by America Makes and equally excited to be working hand in hand with EOS and the other team members on this project," said Frank Roberts, president of 6K Additive. "EOS and 6K Additive share the same dedication and responsibility towards sustainability in Additive Manufacturing and this project provides yet another proof point that our powder is the best in the industry when it comes to overall environmental benefits."

www.eos.info
www.6kinc.com

Oechsler AG appoints Karl Ostler as CEO

The Supervisory Board of Oechsler AG, located in Ansbach, Germany, has extended Karl Ostler's contract as Spokesman of the Executive Board and appointed him as Chairman of the Executive Board (CEO), effective January 1, 2025. Karl Ostler was initially appointed as Spokesman of the Management Board on January 1 of this year in addition to his role as Chief Financial Officer (CFO). In addition to Ostler, the Management Board of Oechsler AG will continue to consist of Raik Lüder as Chief Products and Markets Officer (CPMO) and Alexander Wortberg as Chief Operating Officer (COO).

"The Supervisory Board is convinced that Karl Ostler is the right person to lead the Executive Board. He is approaching the transformation of the company with courage and dedication and is not afraid to make the changes that are urgently needed," stated Wolf Matthias Mang, Chairman of the Supervisory Board of Oechsler AG. "He is proceeding with a sense of proportion and is aware of the sacrifices that our employees are making in order to successfully restructure our company. This has earned him the trust of the entire Supervisory Board and the shareholders of Oechsler."

"The extension of his contract and his appointment as CEO are an expression of this. The Supervisory Board is grateful that the entire Management Board with Karl Ostler, Raik Lüder and Alexander Wortberg will accept the challenges posed by the markets and customers and lead our traditional company into a successful future," concluded Mang.

Oechsler AG has named Karl Ostler as Chairman of the Executive Board (Courtesy Oechsler)

www.oechsler.com

Velo3D completes strategic review to position the company for growth in 2025

Velo3D, headquartered in Fremont, California, USA, reports it has formally completed a strategic review process that commenced in December 2023. As a result, the company has implemented key corporate actions that it believes will position Velo3D for sustainable growth in 2025.

The recommendations included a debt for equity exchange resulting in Arrayed Notes Acquisition Corp (the Holder) ultimately owning 95% of the issued and outstanding common shares of Velo3D. This was followed by the resignation of six board members and the appointment of Arun Jeldi, CEO of Arrayed Additive, as the company's new board member and the company's Chief Executive Officer.

The process also resulted in the launch of the company's new go-to-market strategy to identify and maximise multiple revenue streams, as well as an increasing focus on providing a total solutions-based approach for customers, which includes both system and parts sales.

"Completing the strategic review is a significant milestone for Velo3D and I am pleased to be leading Velo3D in the new era of growth," stated Arun Jeldi, CEO of Velo3D. "Our focus remains on providing customers with our industry-leading, large-format metal 3D printing solutions and look forward to working with all of our stakeholders to make the company successful. Additionally, as these actions also show, we have taken a number of steps to accelerate our path to profitability and execute on a sustainable, long-term business model. While I am very happy with what the company has accomplished to date, I am much more excited about the future of Velo3D as we embark on our next chapter of growth."

Velo3D has completed a strategic review process set to position the company for growth in 2025 (Courtesy Velo3D)

www.velo3d.com

Goodfellow targets £30m sales through global expansion and acquisitions in 2025

Goodfellow, a specialist metals and materials supplier based in Huntingdon, UK, has shared that international expansion and accelerating the acquisition trail will be key priorities for the company in 2025.

Goodfellow, which employs 140 people across its HQ in Huntingdon and sites in Europe, Asia and the US, has set its sights on increasing group sales to more than £30 million through a combination of new materials ranges, organic growth and targeting potential companies that add new capabilities, additional products or geographic reach.

CEO Simon Kenney believes that last year's investment in an ERP system and the launch of a new website will be key to achieving these aims, not to mention tapping into significant demand from customers in the medical device, battery development, space exploration, and electrification and fusion technology industries globally.

He also outlined his firm's ability to provide 98% of materials in 48 hours as a major differential and something he wants to build on.

"2024 was all about laying the foundations for growth this year, from enhancing operational performance and the customer journey through our digital transformation project to the strategic purchase of Potomac Photonics," Kenney explained.

"The latter represents our first US manufacturing facility and gives us microfabrication capabilities that we didn't previously have and is the type of deal we want to do more of over the next twelve months," he continued. "The UK market has been challenging this year, not just for us but for other businesses in our area of expertise. International sales are where we see the big opportunity, with customers now present in more than sixty different countries."

"For example, a new distribution agreement with MicroPlanet in 2024 is projected to boost turnover in the Iberian market by 50% alone," Kenney shared.

Goodfellow, which received an investment from Battery Ventures in 2021, supplies a comprehensive range of metals, alloys, ceramics, polymers, compounds, and composites.

The company has built a reputation as a trusted supplier to firms involved in R&D, advanced engineering, space and the scientific sector, with subsidiaries across Europe, North America and China helping it extend its global reach.

From its HQ in Cambridge, the material specialist also provides a

Goodfellow CEO Simon Kenney (Courtesy Goodfellow)

range of post-processing facilities, including rolling, electroplating, sputtering, heat treatment, disk punching/turning and guillotining/sawing.

"We have seen increased demand for specialist metals and materials to support global R&D projects," Kenney added. "Our ongoing investment in stockholding allows us to meet this requirement and there has been a definite shift towards needing materials quickly for prototype work, which is where our 'no minimum' order quantity really comes into its own."

"Another important development in 2024 was increasing our 170,000-strong product range even further with the addition of three new ranges, including custom alloy powders and high entropy alloy powders, metal microfoils and rare earth metal oxides," Kenney continued. "The intention is to introduce a new collection of premium materials early into 2025."

www.goodfellow.com

Former Google CEO Eric Schmidt named new CEO of Relativity Space

Relativity Space, based in Long Beach, California, USA, has announced that Eric Schmidt will become its CEO. Schmidt is replacing Relativity Space co-founder Tim Ellis, who had been chief executive since the company's foundation; Ellis is expected to remain on the board.

Schmidt held the role of Google CEO from 2001-2011 and acted as the executive chairman of both Google and its parent company, Alphabet, from 2011-2017. Alongside these industry roles, he was also a chairman of the Pentagon's Defense Innovation Advisory Board from 2016 to 2020.

According to *Bloomberg*, Schmidt made a significant investment in Relativity Space earlier this year. It was suggested that Schmidt has been backing the company since 2024.

Relativity didn't comment on Schmidt's investment directly, but shared the following statement at the time, "We continue to align ourselves with strong capital partners who believe in our mission and are supporting our ambitious programs." Schmidt is also linked to a new investment fund called America's Frontier Fund (AFF), which "spans across three business verticals: an investment platform that backs founders building the next industrial revolution, a network of venture studios that are creating breakthrough frontier technologies, and a nonprofit foundation dedicated to re-awakening America's innovation base."

www.relativityspace.com

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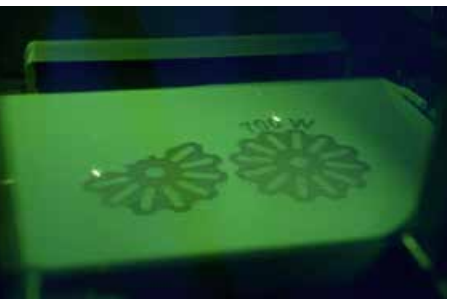

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www.trumpf.com/s/TruPrint-3000

America Makes announces $6.6 million IMPACT 2.0 project call winners

America Makes, based in Youngstown, Ohio, and the National Center for Defense Manufacturing and Machining (NCDMM) have announced the winners of the $6.6 million Improvements in Manufacturing Productivity via Additive Capabilities and Techno-Economic Analysis 2.0 (IMPACT 2.0) project call.

Funded by the US Office of the Secretary of Defense Manufacturing Technology Program (OSD ManTech), the project call consisted of two areas of focus and aimed to demonstrate lead time, productivity, and yield improvements for casting and forging manufacturing operations using Additive Manufacturing technologies.

The winners and related topic areas are as follows:

Part A (Topics 1-3)

Topic 1: Mature and Promote Methods to Add Functional Surfaces and Complex Geometric Features to Forgings

- Team Lead: RTX Technology Research Center (RTRC)
- Project Team: Collins Aerospace; University of Pittsburgh; Camarc, LLC

Topic 2 (1): Disseminate Leading Practices and Promote the Adoption of 3D-printed Sand Moulds/Cores

- Team Lead: Honeywell Aerospace
- Project Team: Lightspeed Concept, Inc; American Foundry Society

Topic 2 (2):

- Team Lead: Youngstown Business Incubator
- Project Team: University of Northern Iowa 4.0 Center; The Ohio State University Center for Design and Manufacturing Excellence; The University of Tennessee Knoxville; The Boeing Company; HA International, LLC; Humtown Additive; Defense & Energy Systems, LLC; M&P Gravity Works, LLC; 3D Systems; Mathews Additive

Topic 3: Techno-Economic Analysis Tool for Selection of Metal Part Manufacturing Processes

- Team Lead: The University of Arizona Investment Casting Institute
- Project Team: PADT; 3Degrees

Part B – Rapid Casting Demonstration Challenge

- Team Lead: Skuld, LLC | Project Team: University of Tennessee Knoxville; 3Degrees; Foundry Casting Systems; Metallurgical Solutions, Inc; American Testing
- Team Lead: DDM Systems, Inc | Project Team: Department of The Air Force Sustainment Center; 76th Commodities Maintenance Group; Oklahoma City Air Logistics Complex; Tinker Air Force Base
- Team Lead: Renaissance Services, Inc | Project Team: UNEW; Aspen Technology, LLC; HTC (castings); A-Labs; Product Development & Analysis, LLC; The Ohio State University Center for Design and Manufacturing Excellence; Value Tool & Engineering

"For nearly two decades, challenges related to capability and capacity have significantly impacted the US casting and forging industry, creating obstacles in sourcing essential components for critical military equipment and support platforms," explained John Martin, Research Director at America Makes.

"Addressing these challenges is crucial for defence and economic stability. While many Additive Manufacturing technologies can enhance casting operations and have proven effective across other sectors of the supply chain, augmenting and scaling these capabilities while testing them in real-world demand situations is essential.

"The IMPACT 2.0 project call is designed to pinpoint the strengths and limitations of these integrated manufacturing approaches," Martin continued. "This initiative will empower our members and project teams to research, develop, and execute cutting-edge solutions in the casting and forging sector, a strategic move to mitigate supply chain risks that pose a threat to both the nation's defence and economy."

www.americamakes.us

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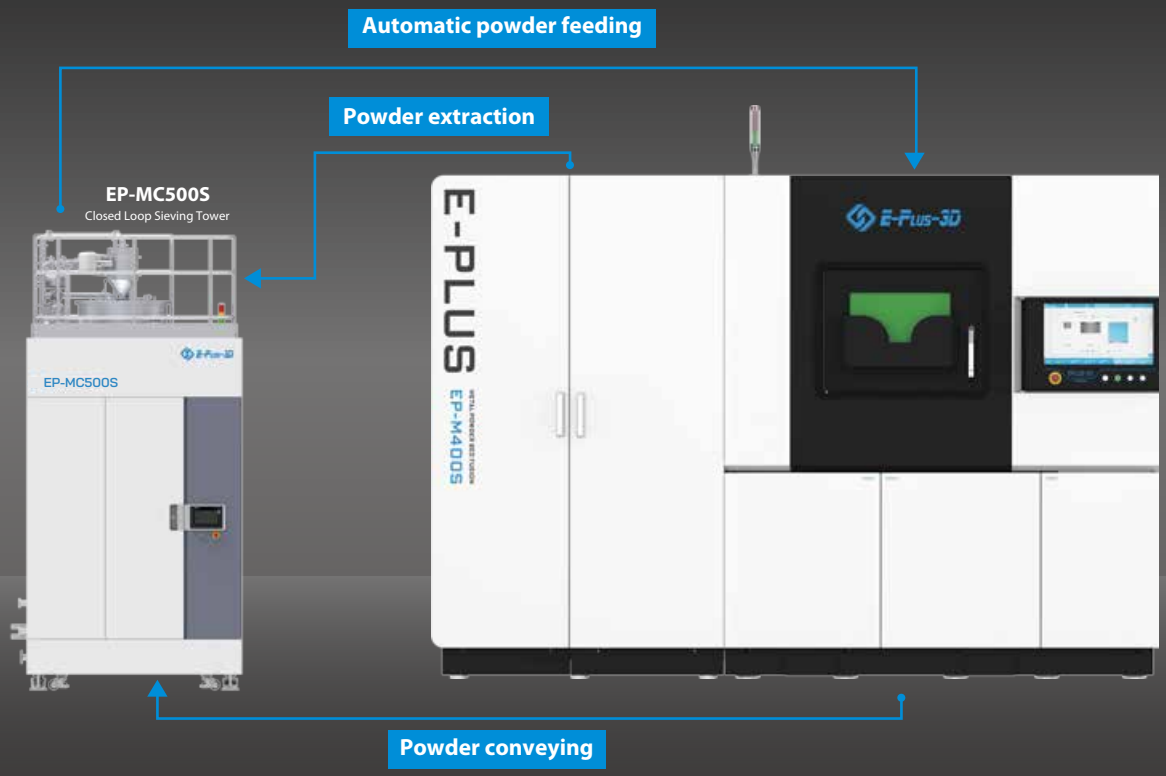

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Amaero secures $23.5 million loan to boost AM powder production in USA

Amaero International Limited, based in McDonald, Tennessee, USA, has announced that the Export-Import Bank of the United States (EXIM) bipartisan Board of Directors unanimously approved a direct loan of $23.5 million to Amaero Advanced Materials & Manufacturing Inc, a wholly-owned US operating subsidiary of Amaero. The US federal government export credit agency will provide capital equipment financing and will directly fund the loan as part of EXIM's Make More in America initiative (MMIA).

Amaero's loan is the sixth MMIA loan approved by EXIM's Board of Directors and the first to support advanced materials and Additive Manufacturing. Amaero stated that this approval sends a significant signal to capital markets and commercial customers, with the company strategically positioned at the intersection of important US policy initiatives aimed at enhancing the resilience and scalability of manufacturing and supply chain capabilities.

With the commissioning of its first advanced atomiser and the ordering of a second and third, Amaero is reportedly set to become the largest domestic US manufacturer of refractory and titanium alloy powders.

"This is a very important milestone event for Amaero. Non-dilutive, US government-funded support is an important signal to the market that validates the alignment of Amaero's strategy and capability with the United States' priority policy initiatives," stated Hank J Holland, Amaero Chairman and CEO. "Amaero has intentionally pursued a corporate strategy that addresses critical gaps in US domestic manufacturing and supply chain capabilities. Improving the resiliency and scalability of domestic manufacturing throughput is an imperative for both national security and economic prosperity. After decades of offshoring manufacturing to lower cost countries, the United States has atrophied domestic manufacturing capability, has created critical vulnerabilities in domestic supply chains and has lost approximately 7.1 million skilled, highly-paid manufacturing jobs."

As indicated in its August 2024 Investor Presentation, the company reported planned capital expense includes approximately $28.5 million for capital equipment and approximately $18 million for facility improvements. The EXIM loan will be drawn against the capital equipment purchases.

www.amaero.com

DARE's latest rocket engine additively manufactured as single unit

Delft Aerospace Rocket Engineering (DARE), a student rocketry initiative at the Delft University of Technology headquartered in Delft, the Netherlands, has revealed the next iteration of its additively manufactured Firebolt engine, the DLX-150C.

Developed to power DARE's Stratos V rocket, this regeneratively cooled engine is reported to deliver 9 kN of thrust. With a near-flight-ready design, the DLX-150C is seen as a significant step forward. Building on the previous DLX-150B, the team removed the film cooling ring and redesigned a significant part of the engine as a single unit. To build the engine, DARE relied on 3D Systems Corporation, whose Additive Manufacturing technology and large build plate size enabled the team to combine the thrust chamber, nozzle, and throat into a single piece.

dare.tudelft.nl

www.3dsystems.com

The DLX-150C built on the improvements seen in the DLX-150B. DARE removed the film cooling ring and redesigned a significant part of the engine as a single unit (Courtesy Delft Aerospace Rocket Engineering via LinkedIn)

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Mott awarded $1.9M contract for additively manufactured hypersonic systems components

Mott Corporation, headquartered in Farmington, Connecticut, USA, has announced a $1.9 million award from the US Department of Defense for the development of additively manufactured components, made from advanced porous materials, for use in hypersonic systems.

The Other Transaction (OT) Agreement award, through the Naval Surface Warfare Center Crane Division (NSWC Crane), will support the Joint Hypersonics Transition Office.

Hypersonic systems are designed to operate at speeds exceeding five times the speed of sound (above Mach 5). These high-performance systems require specialised lightweight designs that can withstand extreme conditions.

Mott uses Additive Manufacturing to produce porous metal components (Courtesy Mott Corporation)

"Mott has built a reputation for delivering disruptive solutions at record speed through collaboration with its customers," stated Sean Kane, GM of Aerospace & Defense at Mott Corporation. "While defence and space industries are pushing technology boundaries, we also must drive cost savings for long-term sustainability. Mott is proud to embrace the challenge of furthering hypersonic technology and build on our heritage as a trusted partner in the defence industrial base."

This OT Agreement follows Mott's $10 million federal grant for clean energy technology. These two significant federal agreements are said to underscore Mott's growing impact and leadership in delivering mission-critical, customisable solutions for the Department of Defense and other domestic partners.

www.mottcorp.com

Spain named as Formnext 2025 partner country

Mesago Messe Frankfurt GmbH has announced that Spain will be its partner country for Formnext 2025, scheduled to take place from November 18-21, 2025, in Frankfurt, Germany. Spain has been selected to bring an array of innovative exhibitors and the next generation of production to the event, explains Mesago Messe Frankfurt. In addition to its highly dynamic and rapidly growing Additive Manufacturing industry, its shared language is hoped to bolster representation from South American industry.

The strength of the Iberian AM sector is readily apparent at Formnext, where Spain has been one of the nations with the most exhibitors for a number of years – including around thirty in 2024.

"We're thrilled to be hosting such an incredibly exciting partner country and all its innovative AM firms," stated Sascha F Wenzler, Vice President for Formnext at Mesago Messe Frankfurt GmbH. "Spain is a perfect example of how AM helps ensure growth and new developments and gives a boost to the entire manufacturing industry, even in challenging times."

Spain's AM sector currently employs over 1,200 people and grows by double-digits every year. According to Wohlers Report 2024, 1.5% of the Additive Manufacturing machines installed around the world are located there.

"Although the market size is still small, the forecast for the incoming years is promising," said Naiara Zubizarreta, director of the Spanish Additive Manufacturing association ADDIMAT.

At the same time, the Spanish AM industry is highly diverse and features numerous internationally renowned system manufacturers such as HP Printing and Computing, Meltio, Triditive, Reinforce 3D, and Supernova, as well as many material producers, software developers, specialised service providers, and research institutes.

This year, ADDIMAT and the AM network IAM3DHUB are supporting Formnext as partners. "These highly engaged organisations play essential roles in Spain's AM industry and will once again be on hand to demonstrate the remarkable potential of their country's AM landscape along with their member companies and cooperation partners," Christoph Stüker, Vice President Formnext at Mesago Messe Frankfurt GmbH, commented.

To help support the process of technological evolution, Spain has constructed a strong manufacturing network. ADDIMAT is operating under the umbrella of AFM Cluster, an industry cluster covering seven Associations, offering tailored services for the advanced manufacturing industries.

www.formnext.com

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José Manuel Torralba appointed full member of Spanish Royal Academy of Engineering

Professor José Manuel Torralba, Director of the IMDEA Materials Institute and professor at the Carlos III University of Madrid (UC3M), has been elected as a new full member of the Royal Academy of Engineering of Spain (RAI).

A key area of Prof Torralba's research has focused on developing and characterising metal powders and advanced consolidation methods such as Metal Injection Moulding, Additive Manufacturing and electric-field-assisted sintering. His research has covered a range of materials, including low-alloy and stainless steels; super-, light- and high-entropy alloys; and metal matrix composites. He has over 500 scientific publications and has supervised thirty doctoral theses.

"Powder Metallurgy is a key discipline for the development of more sustainable and efficient technologies," Torralba stated. "I hope that this recognition will help to further highlight its importance in the development of new materials and in the technological challenges of the future."

"Being elected a full member of the Royal Academy of Engineering is a personal and professional honour. It is always gratifying to know that the work of a lifetime is recognised by such a prestigious institution," Torralba added. "It is also a recognition of the effort and dedication of all my colleagues at IMDEA Materials, UC3M and all the institutions with which I have had the opportunity to collaborate. Without them, many of the advances we have achieved would not have been possible."

Professor José Manuel Torralba (Courtesy IMDEA Materials/Professor José Manuel Torralba)

"I hope to be able to represent at the Academy the sensibilities linked to my two profiles as an engineer (Mining-Metallurgical and Armament) as well as my professional profile linked to Materials Science and Engineering," he added.

www.materials.imdea.org
www.euro-case.org

Xometry names Sanjeev Singh Sahni president

Xometry Inc, headquartered in North Bethesda, Maryland, USA, has announced the appointment of Sanjeev Singh Sahni as president, reporting to CEO Randy Altschuler. In this newly created role, Sahni will oversee all aspects of Xometry's Operations, Product, Technology and People teams worldwide.

"Sanjeev is a highly regarded executive whose background in helping B2B and B2C tech brands scale will further accelerate our growth initiatives across our global marketplace and suite of supplier services," said Randy Altschuler, CEO of Xometry. "Throughout his career, Sanjeev has demonstrated a unique ability to integrate technology, processes and people to deliver a unified experience across all customer touchpoints. He has a strong track record deploying AI, machine learning and automation to accelerate product development and drive profitable growth."

"I've been following Xometry's ascent for some time now, and I have admired the company's growth as it serves a critical area of the global economy," Sahni added. "Xometry's growing technology portfolio, which includes its global Marketplace, Supplier Services and suite of software, demonstrates the power of AI to solve the critical supply chain challenges facing customers and suppliers. I look forward to helping Xometry accelerate the introduction of new products that further deliver unmatched value to customers and partners."

At Wayfair, Sahni held numerous global roles, including Head of Customer Experience, and, most recently, as the Vice President of B2B E-Commerce, Wayfair's multi-billion dollar B2B business, and Head of B2B & B2C Sales. He was recruited to the company to establish its international supply chain capabilities and served as the Head of CastleGate Forwarding, Wayfair's digital freight forwarding arm. Prior to Wayfair, Sahni served as an Associate Partner at McKinsey & Company, where he helped lead the firm's global Transportation and Logistics practice advising Fortune 500 companies, governmental agencies and industry associations.

Sanjeev Singh Sahni has been appointed Xometry President (Courtesy Xometry)

www.xometry.com

Simtec advanced digital twin simulation framework for HIP process optimisation

Simtec Soft Sweden AB, based in Lund, Sweden, has introduced a simulation framework for Hot Isostatic Pressing (HIP) processes that uses a digital twin to provide insights into the complex thermal, gas flow, and material behaviours during HIP operations. Simtec's holistic methodology integrates advanced computational tools as well as robust mathematical and physical models.

Industries such as aerospace, automotive, energy and Additive Manufacturing demand precise material properties and defect-free components, explains Simtec. Traditional trial-and-error methods for HIP processes are costly, time-intensive, and inefficient.

Simtec's digital twin simulation framework optimises thermal management, reducing operational costs, and enhancing product quality. By incorporating Computational Fluid Dynamics (CFD), advanced algorithms, and fully coupled physical models, Simtec delivers accurate predictions of temperature gradients, gas flow, and material responses, enabling consistent, high-performance results.

In addition to thermal field simulation modules, Simtec has developed a Solid Mechanics Module that offers fully coupled stress, strain, and deformation calculations based on 3D thermal history simulations.

Simtec's simulation software models the entire HIP process using CFD methods, advanced algorithms and robust physical models to numerically solve the complete governing equations for heat transfer, gas flow, and material behaviour. Unlike simplified empirical formulas, Simtec's models capture the intricate interactions of radiation, convection, and conduction within the HIP furnace and the material itself, providing detailed insights into thermal dynamics and temperature gradients throughout the machine.

Simtec's models enable

1. Thermal profile analysis: Simulates heat distribution throughout the furnace
2. Gas flow dynamics: Captures interactions between gas flow and the sample
3. Thermal-mechanical behaviour: Predicts responses during heating, holding, and cooling

The mathematical framework looks to ensure precise predictions of thermal gradients, pressure distributions, and material behaviours at every stage of the HIP process.

Simtec software also offers

1. Multi-physics integration: Fully coupled simulations of flow, heat transfer, mass transfer, pressure, and chemical kinetics. It offers comprehensive modelling of specialised thermal processes, integrating thermodynamics, fluid dynamics, and kinetics.
2. High-Performance Computing (HPC) optimisation: Supports parallel computing and GPU acceleration using Nvidia GPUs. As well as high-performance algorithms to ensure rapid and reliable completion of complex simulations, overcoming convergence challenges often encountered with other software.
3. Efficient radiation modelling: Critical for high-temperature and high-pressure furnace processes and combustion. Simtec's proprietary EERSM (Efficient and Enhanced Radiation Simulation Method) delivers efficient, accurate, and validated radiation results across various applications, including turbulent combustion and high-pressure processes.
4. Ultra Rapid Convergence (URC) method: Speeds up computations by over 30x without compromising accuracy. Tasks that previously required a full day are now completed in just over half an hour, ensuring rapid turnaround times for demanding projects.
5. Reliability in complex scenarios: Simtec's algorithms and HPC capabilities make it ideal for intricate simulations, including high-pressure, high-temperature, and chemically reactive environments. It avoids the convergence issues seen in other commercial simulation tools, ensuring reliable results for challenging applications.

Key features of Simtec's digital twin

1. Thermal profile optimisation: Ensures uniform heat distribution across components to minimise thermal stresses and defects.
2. Energy efficiency: Optimises heating schedules, reducing energy consumption while maintaining material integrity.
3. Predictive analytics: Identifies risks like overheating or uneven cooling before they impact results.
4. Design validation: Virtually tests and refines part designs under specific thermal conditions.

Benefits for the HIP industry

With robust models and predictive capabilities, Simtec ensures HIP processes are efficient, scalable, and sustainable.

Simtec's simulations help manufacturers optimise furnace performance, reducing cycle times and energy use. As well as minimising costs through waste reduction, it can enhance product quality with uniform material properties and minimal defects. By tailoring simulations to specific materials and processes, Simtec can meet client's unique needs and deliver a transformative approach to HIP operations.

Simtec's digital twin simulations extend beyond HIP processes to address Additive Manufacturing post-processes such as debinding and sintering, as well as other thermal operations requiring precise control.

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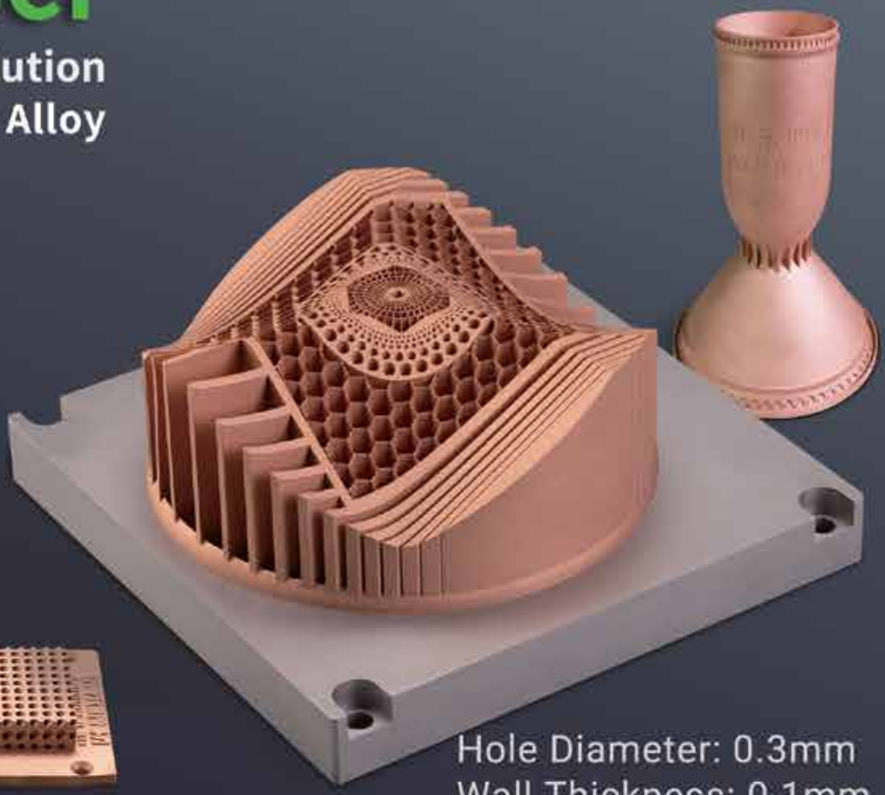

Hole Diameter: 0.3mm

Wall Thickness: 0.1mm

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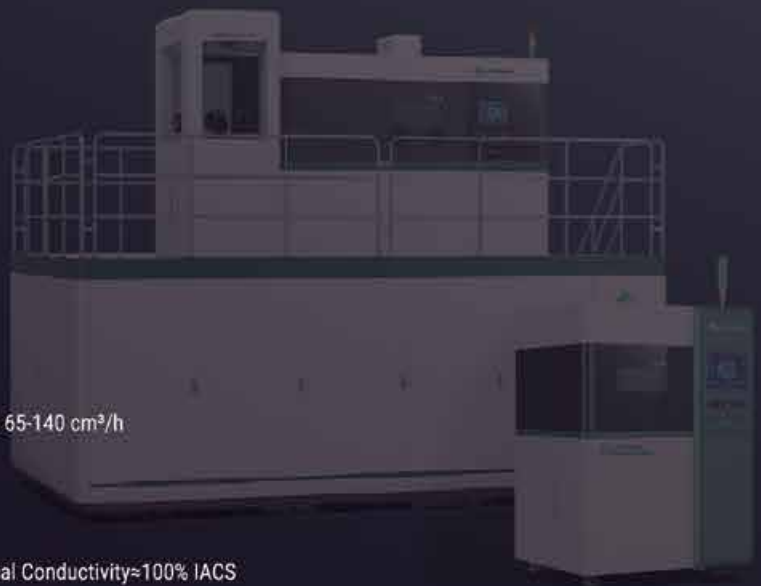

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EOS expands metal powder range for Oil & Gas and semiconductor industries

EOS GmbH, headquartered in Krailling, Germany, has announced the availability of two more metal powders for use in its Laser Beam Powder Bed Fusion (PBF-LB) Additive Manufacturing machines. The company has added EOS Nickel Alloy IN718 API, suited to applications in the Oil & Gas sector, and EOS Nickel NiCP, ideal for use in semiconductor industries.

EOS NickelAlloy IN718 API

This nickel-based material is said to offer high-impact toughness at low temperatures and good corrosion resistance for high-stress oil and gas applications; it has a tensile strength of 878 MPa and 27% elongation when combined with a specific heat treatment. Meeting the requirements for API 6ACRA standardisation, manufacturers can use IN718 API to additively manufacture components for downhole, injection and fixture, and fastener applications, among others.

A leading inflow control technology organisation provided an early test case for IN718 API, producing a flow module component meeting API standardisation and high-strength performance while being subjected to the corrosive environment of oil and gas equipment.

A demonstrator gas injector part made using NiCP on an EOS M 290 (Courtesy EOS)

"Additive Manufacturing has previously been out of reach as a solution for demanding downhole applications due to the stringent requirements of the oil and gas industry," the customer stated. "With the development of EOS NickelAlloy 718 API, we are now able to evaluate industrial 3D printing's business case for our manufacturing needs, while ensuring all facets of part performance remain unchanged."

EOS Nickel NiCP

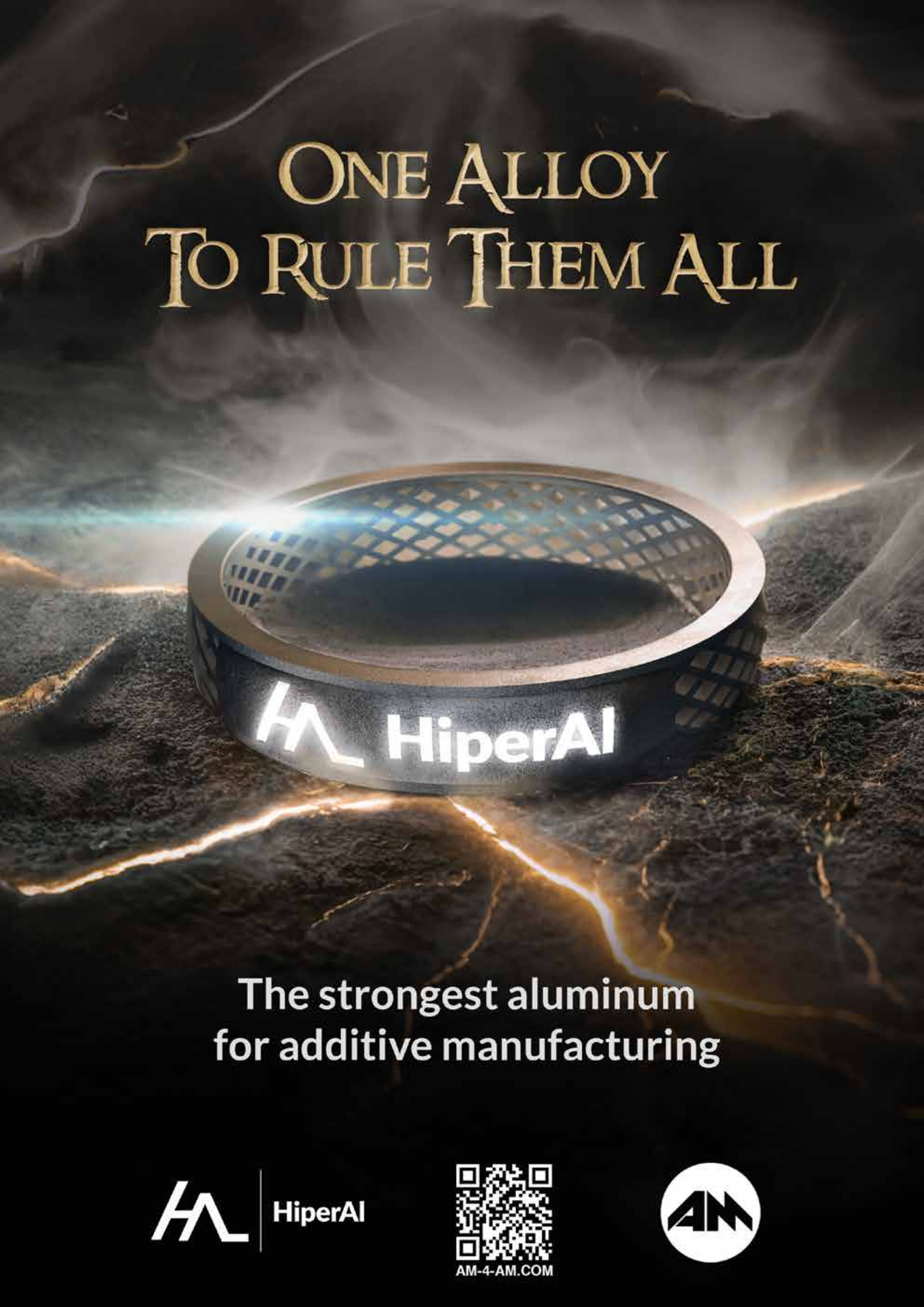
This material provides a tensile strength of 400 MPa and 49% elongation, making it well-suited for applications like gas injectors and corrosion-resistant components within semiconductor capital equipment.

Traditionally manufactured applications in the semiconductor equipment industry often include electroless nickel plating to increase corrosion resistance in chemically harsh conditions. Parts manufactured entirely from NiCP are said to require no plating, thus extending component life.

"By additively manufacturing these parts, manufacturers can maximise machine uptime and availability, which in turn increases overall throughput of the wafer fabrication process and benefits the end user's revenue," stated Sophia Heyl, EOS Product Specialist. "Eliminating the electroplating process that generates hazardous waste offers a cleaner, more sustainable manufacturing process for the future."

Dr Ankit Saharan, EOS Director of Metals Technology, added, "EOS Nickel NiCP has already been successfully deployed in production settings, demonstrating its reliability and performance. By making it more broadly available, we continue to strengthen our engagement with the semiconductor industry and our dedication to advancing their applications through innovative materials and processes. We look forward to working with our partners to push the boundaries of what's possible with NiCP in Additive Manufacturing."

www.eos.info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Nano Dimension removes Stern as CEO, appoints Julien Lederman in interim

Nano Dimension, headquartered in Waltham, Massachusetts, USA, has announced that its board of directors has appointed Julien Lederman as its interim Chief Executive Officer. The move follows the termination of Yoav Stern as CEO. The board is reported to be searching for a permanent CEO.

Lederman has served as Vice President of Corporate Development since March 2021. Previously, Lederman held roles at Amazon.com Inc, The Goldman Sachs Group Inc, Lehman Brothers Holdings Inc, and the World Economic Forum. He earned an MBA from INSEAD in France in 2013 and a BA from Colgate University in New York in 2008.

"The board is pleased and confident in our appointment of Julien Lederman as Interim Chief Executive Officer," stated Ofir Baharav, chairman of the board. The board fully supports Julien during this transition period while we conduct a broad search for a permanent Chief Executive Officer."

This follows the announcement of changes to the Nano Dimension Board of Directors in December 2024, which included the removal of Yoav Stern from his role as director. Stern served as CEO and a member of the board from January 2020.

www.nano-di.com

Nano Dimension announces further changes to its Board following six resignations

Nano Dimension, headquartered in Waltham, Massachusetts, USA, has announced further changes in the composition of its board of directors following the resignation of Dr Yoav Nissan-Cohen, Eitan Ben-Eliahu, Oded Gera, Roni Kleinfeld, Chris Moran and Georgette Mosbacher. The resignations, effective immediately, followed news that Yoav Stern and General Michael Garrett had not been re-elected to the Board at the company's annual general meeting.

Nano's Board currently consists of four members, consisting of Ofir Baharav, Robert Pons, Dr Joshua Rosensweig and Kenneth Traub. Baharav has been appointed as Chairman of the Board, Dr Rosensweig will serve as the Chairman of the Company's Audit Committee and Pons will serve as the Chairman of the Company's Compensation Committee.

The Board commented, "As a newly reconstituted Board, we are committed to strong corporate governance and executing plans to maximise long-term value for shareholders."

It is currently unknown if the Board changes will impact Nano Dimension's planned acquisitions of Markforged and Desktop Metal.

www.nano-di.com

Ipsen USA announces two leadership promotions

Ipsen USA, Cherry Valley, Illinois, USA, has announced the promotion of two team members to its management. Matt Clinite is now Sales Director and Christina Connelly, Director of Ipsen Customer Service (ICS). The company has said that these changes reflect its strategic focus on better serving customers by strengthening the ICS and Sales teams.

In his position as Ipsen USA Sales Director, Matt Clinite will report to Patrick McKenna, Ipsen USA President & CEO. Since joining Ipsen in 2014 as a Sales Associate in the Ceramics Division, Clinite is noted as having demonstrated outstanding leadership and exceeding expectations in roles of increasing responsibility.

Clinite most recently served as the Director of Ipsen Customer Service (ICS) Sales and Retrofits; in 2024, he led his team to a record-breaking performance. In his new role, Clinite will lead Ipsen's outside sales team, focusing on developing and implementing sales strategies, mentoring and guiding his team, and fostering strong relationships with clients and key stakeholders.

Ipsen USA has attributed Christina Connelly's leadership to the significant growth and improvements within the parts team, which now includes production control, parts engineers, and pricing.

Under Connelly's guidance, parts bookings are said to have grown at a double-digit percentage rate, and her initiatives (e.g. Kaizen events and customer engagement strategies) have enhanced performance and customer satisfaction. Looking forward, Connelly will lead the integration of parts purchasing and inventory planning.

www.ipsenusa.com

Christina Connelly, now Director of Ipsen Customer Service – Parts, and Matt Clinite, now Ipsen USA Sales Director (Courtesy Ipsen USA)

Amazemet expands ultrasonic atomisation with new high-energy laser melting source

Amazemet Sp Zoo, based in Warsaw, Poland, has announced the development of a new high-energy laser source. Developed under an EU-funded project, the laser is intended to enable higher levels of efficiency and purity in the ultrasonic atomisation process.

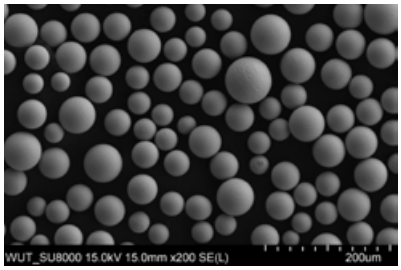
Compared to conventional TIG or plasma-based melting systems, Amazemet states that the laser-based energy source provides a highly concentrated and cleaner heat source that enables more efficient atomisation of high-performance materials. The new melting source will seamlessly integrate into the company's rePowder atomisation machine.

"Laser-beam unlocks new capabilities in ultrasonic atomisation," stated Łukasz Żrodowski, inventor and CEO at Amazemet. "The integration of a precise and highly concentrated heat source allows us to expand the range of materials that can be effectively atomised. By eliminating contamination risks associated with traditional plasma sources, we achieve cleaner, more controlled atomisation with improved powder quality. The ability to fine-tune the energy input of a 6 kW laser through advanced scanning strategies enables new level of process control for high-performance materials, like C103. We are confident that laser-based ultrasonic atomisation will redefine industry standards in powder manufacturing."

Attributes of the higher-energy laser source

The high-intensity laser enables the atomisation of a range of materials, from lightweight aluminium to materials like titanium and niobium with higher melting points.

Amazemet also states that its process eliminates the need for the consumable electrodes found in TIG and plasma torches, thus avoiding tungsten contamination and minimising undesired element evaporation.

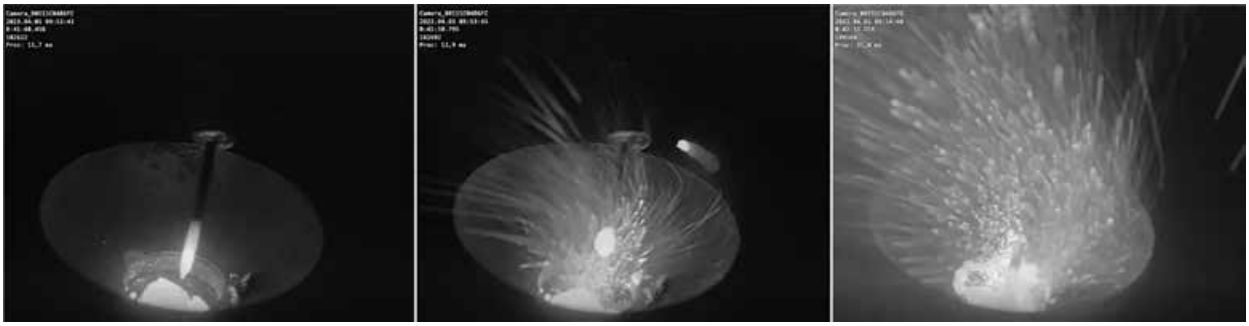


Laser-melted and ultrasonically atomised C103 powder (Courtesy Amazemet)

The laser is also said to enable precise energy input on the sonotrode surface, enabling advanced scanning strategies that can optimise material melting, enabling users to opt for Laser or Electron Beam Powder Bed Fusion (PBF-LB and PBF-EB, respectively).

The ability to integrate the laser-based melting system into Amazemet's rePOWDER machine is hoped to act as a step forward in sustainable metal powder production. The company continues to develop its material processing capability and is taking active steps to develop and protect its IP, with its atomisation platform protected by an extensive patent portfolio.

www.amazemet.com



Laser-based ultrasonic atomisation process patented by Amazemet (Courtesy Amazemet)

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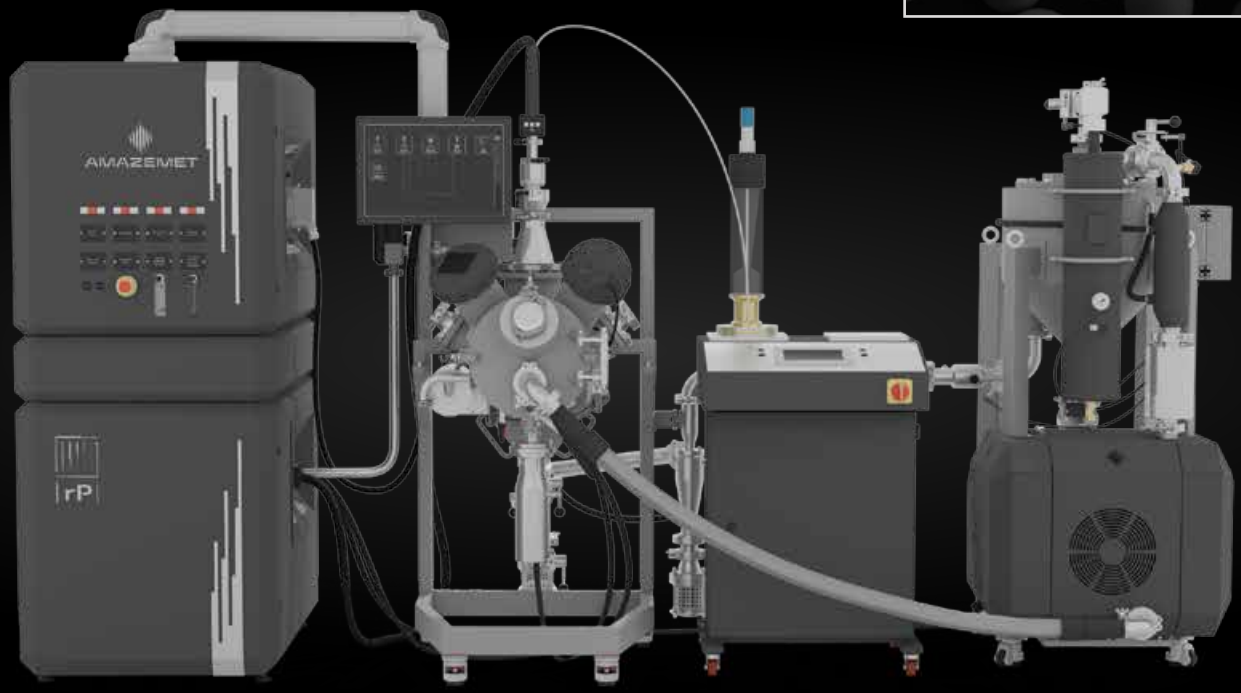

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Kostas Research Institute acquires a SPEE3D Cold Spray AM machine for education and military collaboration

SPEE3D, headquartered in Melbourne, Australia, reports it has sold a WarpSPEE3D Cold Spray Additive Manufacturing machine to Northeastern University's Kostas Research Institute in Burlington, Massachusetts, USA. The new machine is intended to teach students about the Cold Spray Additive Manufacturing process and allow the university to collaborate with the US Army Research Laboratory on materials development, quality control, and process control for large builds.

"SPEE3D is excited to partner with Northeastern University's College of Engineering and the Kostas Research Institute, where faculty can work with students on our WarpSPEE3D printer and learn about Cold Spray Additive Manufacturing technology," stated Byron Kennedy, CEO at SPEE3D. "Additionally, the Institute's close ties with the military align well with our customer base. We look forward to a successful collaboration with the US Army Research Laboratory."

SPEE3D has sold a WarpSPEE3D Additive Manufacturing machine to Northeastern University's Kostas Research Institute (Courtesy Northeastern University)

"Northeastern University's Cold Spray Research Group is excited to have added SPEE3D's Cold Spray Additive Manufacturing technology with support from the US Army Research Laboratory," added Dr Ozan Cagatay, Assistant Professor of Mechanical and Industrial Engineering at Northeastern University. "We will be leveraging their WarpSPEE3D printer for materials research and development, development of novel applications, and training future engineers, scientists, and skilled personnel. Our focus will be publishing high-quality research, addressing the needs of our stakeholders, and helping close the growing gap in the US advanced manufacturing workforce."

SPEE3D's Cold Spray Additive Manufacturing technology reportedly offers high-density metal parts at build rates up to 100 g/min, speeds which can accelerate prototyping and product development while minimising operational downtime. The WarpSPEE3D AM machine can manufacture parts up to 40 kg with a diameter of up to 1 x 0.7 m and is well-suited for a research or factory environment.

www.spee3d.com
kostas.northeastern.edu
www.northeastern.edu

Oerlikon expands Laser Center of Competence with advanced 7-axis DED

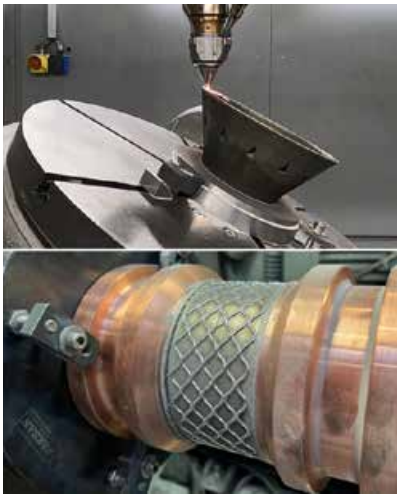
Oerlikon, based in Pfäffikon, Switzerland, has increased its engineering team and added the highly precise seven-axis 3D Laser Center Gantry from Karl H Arnold Maschinenfabrik GmbH & Co KG at the Laser Center of Competence. The 3D Laser Center Gantry is reported to allow for the construction of intricate structures, while maintaining precise temperature control throughout the entire process.

Under Dr Arkadi Zikin's leadership, the Laser Center of Competence team collaborates closely with customers throughout the entire manufacturing process, offering support from feasibility studies to industrialisation.

Although aerospace continues to be a key area of expertise for Oerlikon, the Laser Center of Competence is reportedly experiencing increased demand for complex structures in other sectors as well, including oil and gas, general industry, and advanced aeronautics. These industries are utilising laser-based Directed Energy Deposition (DED) Additive Manufacturing to tackle challenges such as manufacturing large-scale, intricate components with reliable and efficient processes.

One of the latest initiatives seen by Oerlikon is the use of Additive Manufacturing to produce rocket propulsion systems components. These components – which are over one metre tall and have wall thicknesses of less than one millimetre – are lighter, more complex, and manufactured rapidly. Features such as integrated cooling channels leverage the advanced capabilities of Additive Manufacturing, delivering high-performance solutions across various industries.

www.oerlikon.com



Oerlikon has expanded its manufacturing capabilities by increasing its engineering team and enhancing its equipment portfolio at the Laser Center of Competence (Courtesy Oerlikon via LinkedIn)

NAAREA and Phoenix Manufacture to produce AM parts for XAMR nuclear microreactor

France's NAAREA (Nuclear Abundant Affordable Resourceful Energy for All), a company developing nuclear microreactors, has partnered with Phoenix Manufacture, a specialist in the industrialisation of complex devices for the military, nuclear, aerospace and robotics sectors, to mass produce NAAREA's XAMR (eXtra Advanced Nuclear Reactor) molten salt fast microreactor.

The aim of the partnership is to structure the industrialisation of the XAMR, integrating the key phases of the project: design, prototyping, first-of-a-kind (FOAK) manufacturing and mass production. To meet these challenges, NAAREA and Phoenix Manufacture will harness technologies such as Additive Manufacturing to envisage creating a joint plant, including specially designed reprocessing facilities.

The XAMR microreactor is a low-carbon energy source that will be used to replace fossil fuels in local electricity networks, thus reducing greenhouse gas emissions. The reactors also contribute to the transition towards a more sustainable economy, thanks to their ability to provide constant, reliable energy to back up intermittent renewable energies such as wind and solar power.

The collaboration between NAAREA and Phoenix Manufacture is based on five main phases extending until 2032:

1. Preliminary phase: validation of raw materials and the manufacturability of parts designed by NAAREA for Additive Manufacturing.
2. Prototyping of the components of the XAMR® microreactor.
3. Series production: providing the necessary parts for the mass production.
4. Scaling up production capacity: study on the creation of a joint production facility for components of the XAMR microreactor, pooling of resources and mutual skill development.
5. Reprocessing: evaluation of solutions for recycling and recovering waste material resulting from production and the recycling of used components. This partnership reflects an innovative approach, with the incorporation of Additive Manufacturing as a production process. AM machines will be used to produce components for the XAMR microreactor. Phoenix Manufacture will lend its expertise to assist NAAREA with design reviews and the manufacturing of these parts throughout the project phases. This collaboration reflects NAAREA's commitment to working with French partners, contributing to technological development and promoting local French industrial capabilities.

Phoenix Manufacture has installed AM machines capable of building large components (Courtesy Phoenix Manufacture)

"We have chosen to rely on the expertise and skill of Phoenix Manufacture, a French company that will contribute to the design of an XAMR microreactor made in France. Incorporating Additive Manufacturing represents a major asset for us: it will allow us to produce parts with consistent quality controlled in situ at each step of the manufacturing process. Additive Manufacturing also makes it possible to lower production costs, reduce assembly needs and meet the highest standards in terms of safety and security, which remains our absolute priority," explained Jean-Luc Alexandre, Founder and CEO of NAAREA.

Marco Calcamuggi, CEO and co-founder of Phoenix Manufacture, added, "We are proud of this strategic partnership with NAAREA, since Additive Manufacturing is at the heart of our vision for French reindustrialisation. We firmly believe that this disruptive technology is profoundly transforming all industries, in particular the nuclear sector. In our collaboration with NAAREA, we share a common ambition: to become key agents of change. Together, we are creating positive momentum to strengthen sectors contributing to sovereignty and shape an ambitious technological future."

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Cornell researchers develop method to control metal microstructure for stronger parts

Researchers from Cornell University, Ithaca, New York, have found a way to control the changes in the microstructure of metals during Additive Manufacturing by adjusting alloy composition, said to result in stronger and more reliable metal parts. The findings, published in *Nature Communications*, provide insight into the phase changes that occur during the metal AM process and could improve materials used for Additive Manufacturing.

"A major problem is that most of the materials we print form column-like structures that can weaken the material in certain directions," stated senior author Atieh Moridi, assistant professor and an Aref and Manon Lahham Faculty Fellow in the Sibley School of Mechanical and Aerospace Engineering, in Cornell Engineering. "We discovered that by adjusting the composition of the alloys, we can essentially disrupt these column-like structures and make a more uniform material."

By adjusting the ratio of manganese to iron in their starting material, the team disrupted columnar grain growth, reduced grain size significantly, and enhanced the yield strength of the finished metal.

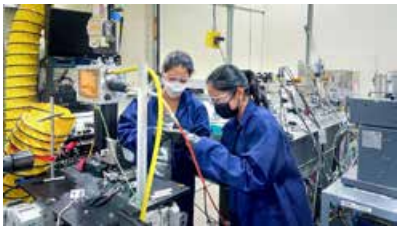
"Microstructural features, like grain size, are the building blocks that govern material performance and properties," Moridi said. "The material composition controls the phase stability, which was the key for us to control the microstructure."

The column-like grain structures form and grow in a fraction of a second during the phase change in the manufacturing process, which is why scientists had previously struggled to study this phenomenon, said the study's first author, Akane Wakai, PhD '24.

"The difficult part was trying to resolve these very short spans of time where the material goes from liquid state to solid state," Wakai shared. This is because the final product retains no trace of its earlier state.

The utilised the Cornell High Energy Synchrotron Source to overcome this issue by obtaining fraction-of-a-second data about their materials during the manufacturing process. In the best-performing sample, Moridi shared, "We found evidence of an intermediate phase that can help disrupt those column-like grains and refine the grain structure."

Understanding the material properties of the starting alloy and resulting phase changes could establish a new foundation for selecting metals in Additive Manufacturing.



Akane Wakai and Jennifer Bustillos prepare a sample at the Cornell High Energy Synchrotron Source (Courtesy Cornell Chronicle)

"The findings from this research can be used for real-life applications to create more reliable materials that enable even better performance," Wakai said. "Not too far into the future, we'll start seeing 3D printed metal parts, even in consumer products like cars or electronics."

Improving the reliability of AM metals would significantly benefit the manufacturing industry. Wakai noted that Additive Manufacturing of metal has a "freedom of design that can lead to weight reduction, shortened manufacturing time, minimised material waste, and can create features that are otherwise really difficult or impossible to fabricate through conventional methods."

Collaborators included researchers from NASA and the University of Pittsburgh. The research was funded by the US Department of Energy, National Science Foundation, and NASA.

www.cornell.edu

First US installation of Lithoz CeraFab Multi AM machine at Embry-Riddle

Lithoz GmbH, based in Vienna, Austria, has installed its first CeraFab Multi 2M30 in the United States at Embry-Riddle Aeronautical University's campus in Daytona Beach, Florida. The multi-material Additive Manufacturing machine, which can combine ceramic with another ceramic or metal, is expected to be used for the development of advanced lunar exploration systems, among other aerospace and energy sector applications.

Dr Seetha Raghavan, Professor of Aerospace Engineering at Embry-Riddle, emphasised the transformative impact this technology can offer. "The Lithoz CeraFab Multi 2M30 enables our researchers to manufacture ceramics with intricate geometric features across scales with remarkable precision. Its capability to print combinations of ceramics tailored for specific needs is pivotal in accelerating material design."

The CeraFab is said to have already played a crucial role in campus projects, including aiding the C.R.A.T.E.R team during NASA's Human Lander Challenge. Using the Lithoz machine, the team successfully developed bio-inspired ceramic patterns to mitigate dust adhesion on lunar surfaces. These precision-engineered patterns, modelled after hydrophobic surfaces like the lotus leaf, underscore the AM machine's capabilities.

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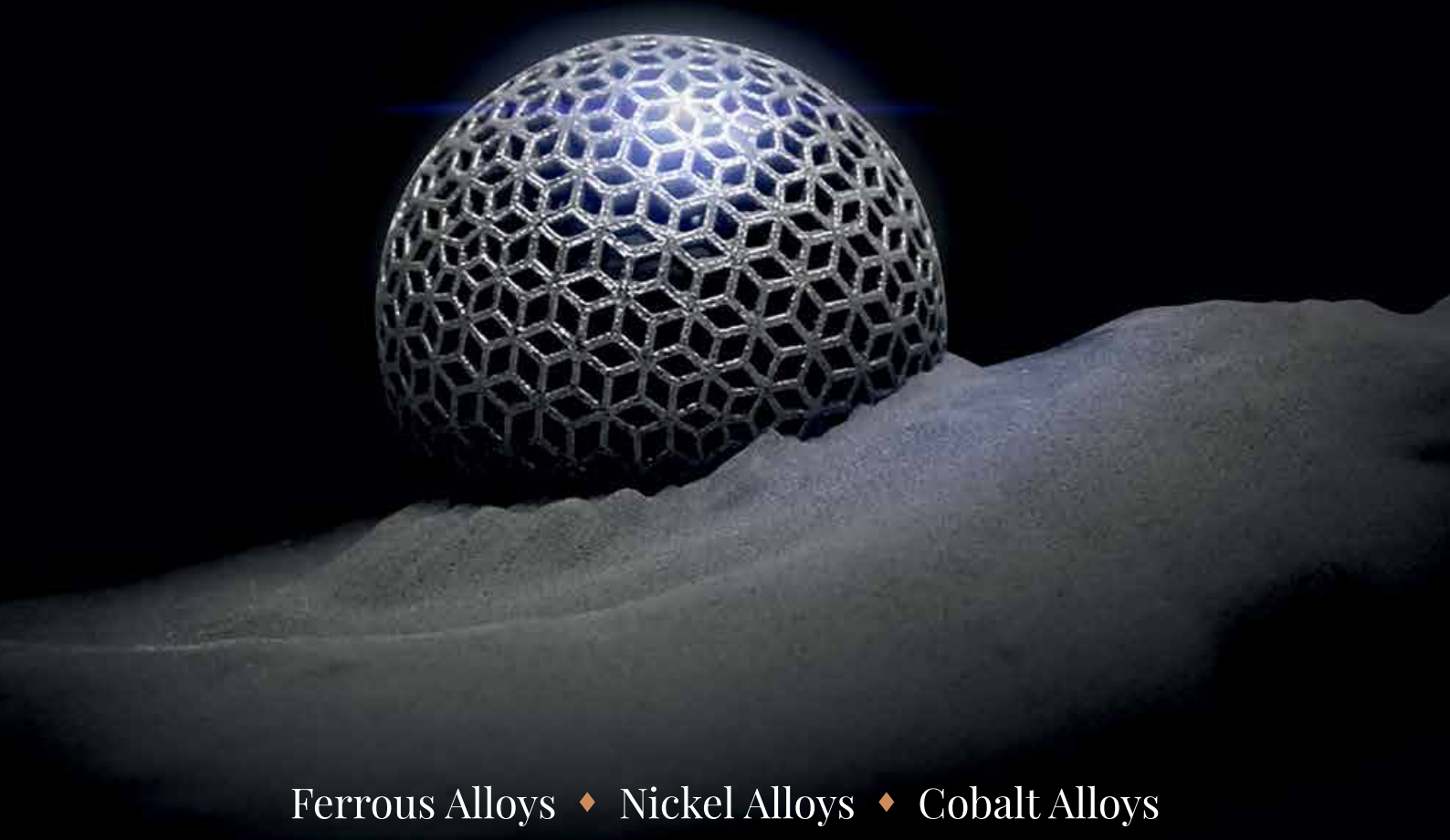

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Velo3D starts the year on a high with Arrayed Additive restructuring deal

Velo3D, headquartered in Fremont, California, USA, has undergone major financial restructuring, with Arrayed Additive gaining a 95% stake through its subsidiary Arrayed Notes Acquisition Corp. The company announced a debt for equity exchange, where approximately $22.4 million or 81.7% in principal amount of its outstanding senior secured notes held by Arrayed Notes Acquisition Corp will be cancelled in exchange for an issuance of 185,151,333 newly issued shares.

Unanimously approved by the Velo3D Board of Directors, the deal will see Arun Jeldi, CEO of Arrayed Additive, appointed as CEO of Velo3D and added to Velo3D's board of directors. Following completion, the Board will be reduced from ten to five members.

"Velo3D's industry leading technology and capabilities allow Arrayed Additive to greatly expand our services and product offering to our customers," stated Jeldi. "Velo3D's focus on defence, space/aerospace and technology end-markets is complementary to Arrayed Additive's customer base and our leading technology in lightweight precision manufacturing using magnesium and aluminium alloy further expands Velo3D's capabilities. I am thrilled to lead Velo3D into a new chapter of growth."

It was announced that Carl Bass, Ellen Smith, Gabrielle Toledano, Matthew Walters, Benyamin Buller and Darryl Porter have resigned from Velo3D's board of directors. Brad Kreger will remain with the company as its Chief Operating Officer.

"I am excited to work with Arun and the Arrayed Additive team to reposition the company for future success," added Kreger. "With the majority of our senior secured notes cancelled, we are now in a stronger financial position, enabling us to focus our efforts on the future of Velo3D and delivering unparalleled large-format metal 3D printing capabilities to our global customer base."

Velo3D's Additive Manufacturing machines, used by a number of leading space technology companies (Courtesy Velo3D)

Velo3D delivered its first Sapphire metal Additive Manufacturing machine in 2018 and has been a strategic partner to leading companies such as SpaceX, Aerojet Rocketdyne, Lockheed Martin, Avio, and General Motors.

www.velo3d.com

APP receives $3 million funding for equipment and expansion

Advanced Powder Products, Inc (APP), Philipsburg, Pennsylvania, USA, a company specialising in Metal Injection Moulding and metal Additive Manufacturing, has received almost $3 million from the Pennsylvania Industrial Development Authority (PIDA). The funding will enable APP to invest in new machinery and expand its Philipsburg facility, following a fire that damaged the site in February 2023. The company was approved through the Moshannon Valley Economic Development Partnership (MVEDP) for a fifteen-year, $2.25 million loan, as well as a seven-year Machinery and Equipment Loan Fund (MELF) loan totalling $700,928.

According to the state press release, APP will use the PIDA loan to construct a new 2,700 m^2 building. The MELF loan will allow the company to invest in new CNC machinery, moulding equipment, and robotics. The total project cost is $7.47 million and is expected to create fifteen new full-time jobs and retain 165 full-time jobs.

Local news outlet *The Progress* reported that MVEDP Executive Director Stan LaFuria has worked with APP owner Don Heaney since 2002, a year after the creation of the Moshannon Valley Regional Business Park at which Heaney and his partner bought a 1.49-acre plot. "We are very pleased to be working with the owner and staff of Advanced Powder Products on their expansion efforts," LaFuria said.

APP Controller Andy Shoop told *The Progress*, "We continue to see a huge opportunity for our Metal Injection Moulding technology even after the fire we experienced last year. This expansion project will allow us to continue to serve and grow with our customers, create new jobs in the area, and become America's best and biggest Metal Injection Moulding company."

Shown above is APP production building prior to the fire (Courtesy Advanced Powder Products)

"We sincerely appreciate the support from MVEDP and PIDA," Shoop added. "APP has created roughly 100 new jobs since the first time we worked with Stan and PIDA for financing 2019. Our goal is to continue on our growth path. We're currently looking for engineers, technicians, and other supporting roles throughout the company."

www.advancedpowderproducts.com

EDM Network launches fast-wire machine for large-scale PBF-LB build plate cutting

EDM Network Inc, based in Sugar Grove, Illinois, USA, has introduced a new single-axis horizontal submerged EDMMax 1100HW electrical discharge machining (EDM) machine. This addition to EDM Network's portfolio can cut a build plate up to 1,400 x 1,100 mm, weighing up to almost 3,000 kg.

The EDMMax 1100HW uses 0.18 mm diameter molybdenum high-tensile wire that is cycled back and forth from a capstan continuously until it is replaced with a new load of wire. One load of molybdenum wire (about 250 m) will last 60-80 hours at a cost of about $20/load, depending on cutting conditions and material type.

The machine was built to be easy to load from overhead cranes or a forklift: operators put the build plate on the worktable, align the wire to the face of the build plate, add an offset, submerge to cover the wire, then cut.

Unlike conventional brass wire EDMs, the fast-wire EDMs are not 'flush dependent', meaning they do not require high-pressure flush or submerged cutting to reduce wire breakage. Instead, an additive is put into the deionised water that allows the water to adhere to the molybdenum wire, allowing it to be drawn through the narrow kerf and remove the EDM swarf without breaking the wire.

EDM Network has announced the US patent-pending EDMMax 1100HW (Courtesy EDM Network)

This feature is said to make it well-suited for removing the Laser Beam Powder Bed Fusion (PBF-LB) parts from the build plates. These Fast Wire EDMs will reportedly cut 2-3x faster than brass wire EDMs in interrupted conditions.

The EDMMax 1100HW is available in a pure, deionised water option as well as the standard 'water additive' model.

www.edmnetwork.com

Freemelt ONE for University of Arizona's advanced aerospace and semiconductor materials research

Freemelt AB, based in Mölndal, Sweden, has received an order from the University of Arizona for a Freemelt ONE Electron Beam Powder Bed Fusion (PBF-EB) Additive Manufacturing machine. Valued at approximately $363,000, the AM machine will be used for material research and carries additional strategic significance as part of a collaboration focused on processing TZM (Titanium-Zirconium-Molybdenum) and Inconel 718.

TZM and Inconel 718 are critically important to a wide range of advanced manufacturing industries, including aerospace, defence, and semiconductors.

"This order from The University of Arizona allows Freemelt to contribute to advanced material development in the defence, aerospace, and semiconductor industries and demonstrates the unique capabilities of our [PBF-EB] technology in highly demanding sectors," stated Daniel Gidlund, CEO Freemelt.

Professor Sammy Tin, Patrick R Taylor Endowed Department Leadership Chair and head of Materials Science and Engineering at the University of Arizona, shared,

The University of Arizona has ordered a Freemelt ONE for material research (Courtesy Freemelt)

"We are incredibly excited to collaborate with Freemelt and to acquire the Freemelt ONE system. This system is the ideal complement to our existing advanced manufacturing facilities and gives us the unprecedented ability to tailor and fabricate topologically-optimised structures from novel alloys."

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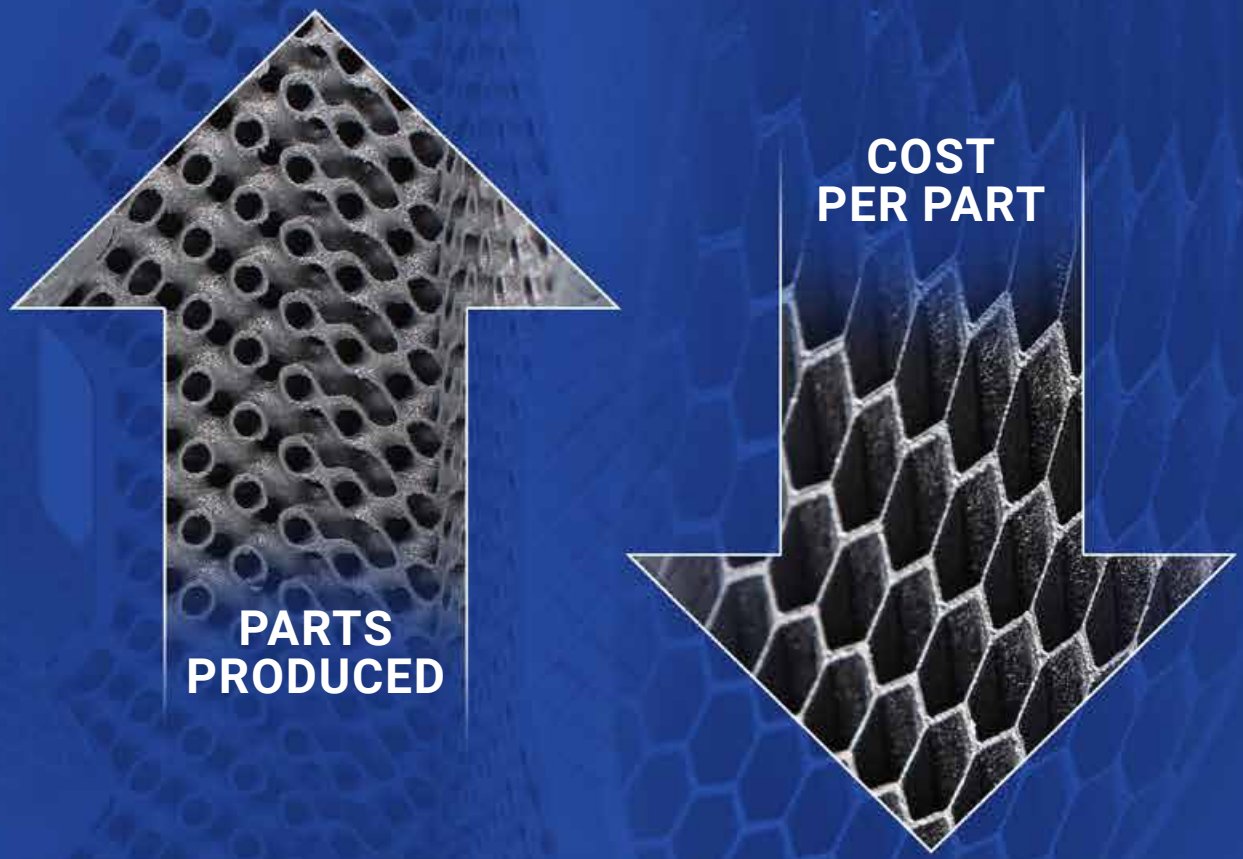

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Part design credit 3D Systems

Freemelt extends UKAEA partnership with tungsten tiles production scalability

Freemelt AB, based in Mölndal, Sweden, has received an order from the UKAEA (United Kingdom Atomic Energy Authority) to conduct production scalability tests of additively manufactured tungsten tiles for fusion energy power plants. The order is expected to be delivered during the first quarter of 2025.

This project is a continuation of previous feasibility studies performed by the two organisations. The proof-of-concept project target is to demonstrate volume production using Electron Beam Powder Bed Fusion (PBF-EB) and, in particular, Freemelt's eMelt machine .

Freemelt and UKAEA, which have been collaborating since April 2023, have carried out two feasibility studies: the first focused on process development and the second, application testing. In this project, Freemelt intends to demonstrate production scalability of tungsten tiles, a critical step in validating the potential for future volume production. As part of this study, the repeatability of the PBF-EB process will be evaluated to support component qualification programmes for potential use in next-generation fusion energy power plants.

The proof-of-concept project target is to demonstrate volume production using Electron Beam Powder Bed Fusion and, in particular, Freemelt's eMelt machine above (Courtesy Freemelt AB)

Fusion energy has great potential as energy source, and during the coming years, large experimental tokamaks (experimental fusion reactors using fusion energy) and fusion power plants will require significant volumes of advanced components.

"The fact that we now advance the collaboration to volume production tests of tungsten tiles is an important confirmation that our E-PBF technology meets the demanding requirements in fusion energy," stated Daniel Gidlund, Freemelt CEO. "Tungsten is one of the most challenging materials to process, and our technology enables the production of complex components with high quality. This is an opportunity to further strengthen our position in the energy sector."

Unlike today's nuclear power which relies on fission (nuclear splitting), fusion does not produce long-lived radioactive waste. However, for the process to succeed, extremely high temperatures and advanced materials that can withstand the harsh conditions of the fusion environment are essential.

Test fusion machines like experimental tokamaks are essential for validating fusion technology before scaling to commercial electricity production. They require millions of tungsten components. ITER, the world's largest experimental tokamak, is predicted to need between 1-1.5 million tungsten tiles, while smaller power plants under development by Tokamak Energy will require about 10% of ITER's volume.

UKAEA is the UK's national organisation responsible for fusion energy development and commercialisation, driving several advanced research projects to commercialise fusion as a safe, sustainable, and emissions-free energy source. Through collaborations with industry and academia, UKAEA aims to drive the development of new materials and manufacturing methods required for future fusion power plants.

www.freemelt.com

Additive Manufacturing UK launches 2025 industry action plan

Additive Manufacturing UK (AMUK), a trade association representing UK companies engaged in all aspects of the Additive Manufacturing value chain, has released its Annual Action Plan for 2025. Building from the inaugural 2024 action plan, the updated iteration aims to enhance the UK's place in AM research, development, adoption and application.

The plan highlights progress made in 2024, including increased membership, strategic initiatives, and enhanced services, all of which contributed to strengthening the UK's global competitiveness in AM. It addresses critical challenges in the areas of supply chain, skills, and standards, with newly defined actions to drive forward the development of the UK's AM ecosystem.

Challenges

Key challenges outlined in the 2025 plan include initiatives to grow and develop the UK supply chain, establish an industry-agreed training programme, and simplify and roadmap the standards landscape for Additive Manufacturing.

To demystify the complex standards landscape, AMUK aims to develop sector-specific standards roadmaps, provide free access to key standards, and host a dedicated event to foster understanding and best practices in the use of AM standards.

New initiatives

Among the new initiatives outlined in 2025, AMUK will work to expand its case study database, create a comprehensive adoption guide, and explore an online AM suitability assessment tool to help companies evaluate the suitability of AM technologies for their operations and enhanced collaboration with supply chain exhibitions and professional bodies to amplify the visibility of the UK's AM capabilities.

In the realm of skills development, the organisation aims to develop new curriculums, launch school outreach programmes, and host regional open days to promote Additive Manufacturing adoption.

AMUK also plans to support an AM users' group event and launch the Membership Spotlight programme to showcase members and their achievements. The plan also introduces exploratory actions, including the development of an online part printability assessment tool.

The UK's place in AM

According to the AMUK report, the UK's share of the global AM market is currently estimated at 4–5.5% and, with the right support, could grow to 7% by 2030.

Josh Dugdale, Head of Additive Manufacturing UK, stated, "At AMUK, our mission is to establish the UK as a global frontrunner in Additive Manufacturing. This year's plan demonstrates our ongoing commitment to fostering innovation, supporting our members, and addressing the challenges that matter most to the sector."
additivemanufacturinguk.org.uk

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HII installs first additively manufactured valve manifold on US Navy aircraft carrier

HII, America's largest shipbuilder and a global defence provider, has announced that its Newport News Shipbuilding (NNS) division in Virginia, USA, has successfully installed the first additively manufactured valve manifold assembly on a new construction aircraft carrier.

The valve manifold assembly, a specialised assembly that allows the distribution of a single source of fluid to multiple points on the ship, is installed in a pump room on the Gerald R Ford-class aircraft carrier Enterprise (CVN 80). The assembly, which is approximately 1.5 m long and weighs 450 kg, was produced in collaboration with DM3D Technology, a company which uses Directed Energy Deposition (DED) to additively manufacture large structures such as this manifold.

Following the successful installation on the Enterprise, it was stated that similar manifolds planned for the Doris Miller (CVN 81) will employ Additive Manufacturing rather than traditional casting methods. This will help reduce schedule risk and improve efficiency.

"What started as a proof of concept quickly turned into a tangible result that is making a meaningful difference to improve efficiencies in shipbuilding," stated Dave Bolcar, NNS Vice President of engineering and design. "The benefits of this innovation will extend well beyond Enterprise (CVN 80), as we incorporate our expertise in Additive Manufacturing into the fundamentals of shipbuilding."

This latest development and deployment of Additive Manufacturing builds on NNS' prior certification and approval as a supplier of Additive Manufacturing components on Naval Sea Systems (NAVSEA) platforms. To date, the shipyard has created more than fifty-five additively manufactured parts installed on both new construction vessels and those currently in the fleet, with plans to install over two hundred additional parts this year.

www.dm3dtech.com
www.hii.com

The additively manufactured manifold on US aircraft carrier Enterprise CVN 80 (Courtesy Ashley Cowan/HII)

Novel Si/Cu-modified Al-Mg alloy achieves crack-free, high-strength parts through PBF-LB

Researchers from Central South University, Hunan, China; Nanjing University of Aeronautics and Astronautics, Nanjing, China; and Brunel University London, United Kingdom, have published a paper titled 'A novel Si/Cu-modified Al-Mg alloy processed by laser powder bed fusion: Crack inhibition, microstructures and mechanical properties.'

The paper covers the use of cost-effective silicon and copper to modify an Al-5.5Mg alloy for Laser Beam Powder Bed Fusion (PBF-LB). This is reported to have achieved a synergetic combination of crack-free features and high strength. It was found that the hot cracking was effectively eliminated in the PBF-LB samples due to the reduction in brittleness temperature range and the formation of fine Al-Mg2Si eutectics.

The strength improvement in the PBF-LB Al-5.5Mg-2Si-Cu alloy (an ultimate tensile strength of 560 MPa, yield strength of 453 MPa and elongation of 9.1%) resulted from a hierarchical structure featured by the refined α-Al grains, sub-micron cellular structures decorated with Mg2Si, S-Al2CuMg nanoparticles and substantial dislocation networks.

The synergistic effects of crack elimination and precipitation strengthening induced via the incorporation of Si/Cu provide a guideline for fabricating crack-free Al-Mg alloys with high strength.

en.csu.edu.cn/index.htm
www.nuaa.admissions.cn
www.brunel.ac.uk

Skillbond Direct acquires second TRUMPF Additive Manufacturing machine, named UK dental sector reseller

Skillbond Direct Ltd, a dental supply company based in High Wycombe, United Kingdom, reports that, following the addition of a second TruPrint 1000 Additive Manufacturing machine from Trumpf, based in Ditzingen, Germany, it has now become an official reseller of the AM machines to the UK dental lab market.

Laser Beam Powder Bed Fusion (PBF-LB)-based machines have been operational at the company for the past ten years. However, the desire to launch a new product service, namely cobalt-chrome removable partial dentures (RPDs), prompted Skillbond to seek out a metal Additive Manufacturing machine with the necessary size capacity, build speed and surface quality. As a strong metal that is resistant to gum and mouth irritation, cobalt chrome makes for a durable material that is also lightweight, ensuring thinner and less bulky designs than acrylic counterparts.

Khanjan Langalia, Technical Manager of the manufacturing facility in High Wycombe, explained the process, "Dental technicians create a digital dental restoration using CADCAM software. We subsequently use this CAD model to produce a physical dental restoration. Skillbond offers a fast turnaround, high-quality, high-precision dental restoration manufacturing service using the latest production technologies, including metal 3D printing."

"We looked at various metal 3D printers from a number of manufacturers, but the TRUMPF TruPrint 1000 stood out for its ability to meet our checklist of requirements," Langalia continued. "We duly invested in our first TruPrint 1000 around 12 months ago."

An exposure speed up to 2 m/s and build rates of 10-50 cm^3/h ensures that the TruPrint 1000 offers short turnaround times, helping Skillbond to produce several RPDs every day.

With its two 200 W Trumpf fibre lasers and automatic substrate plate change capabilities, users of the TruPrint 1000 can maximise productivity. Two lasers simultaneously scan the entire build volume with complete overlap, generating up to 80% more parts with excellent component and surface quality through optimal gas flow and stable laser focus.

Skillbond's business model means that its manufacturing technology, such as scanners, CNC milling machines, grinding machines and Additive Manufacturing machines,

Skillbond Direct Ltd has acquired two TruPrint 1000 Additive Manufacturing machines from Trumpf (Courtesy Trumpf)

are also available for sale via its capacity as a reseller.

"We've been using this business formula for over fifty years and it's proved very successful," said Langalia. "Customers can come here and see the machines operating in real-world applications, backed by our support team of highly experienced dental technicians and engineering specialists."

"Many dental laboratory start-ups use Skillbond in their formative years. But as they grow, some labs want to bring manufacturing in-house, which is where we can also act as a partner. They can buy a new machine and consumables from us – and tap into our know-how. We're excited to become a reseller of TRUMPF TruPrint 1000 3D printers to the UK dental lab market, and we're already in discussions with potential customers," Langalia added.

www.trumpf.com
www.skillbond.com

India's largest Additive Manufacturing machine at IIT Hyderabad

Recent advancements in large-area Additive Manufacturing have been reported following a collaboration between India's DRDO Industry Academia Centre of Excellence (DIA-CoE) at IIT Hyderabad and a number of industry partners. Together, the team has developed what is reported to be one of the largest metal AM machines in the country, and demonstrated its ability to manufacture large-scale components.

The new machine has a build volume of 100 x 100 x 300 cm and utilises metal powder-based Laser Beam Directed Energy Deposition (DED-LB) technology. It features dual heads for enhanced thermal efficiency, which is said to help balance thermal distribution and speed up the manufacturing process.

A significant milestone was reached when a 1 m high component was successfully fabricated using the new machine, proving the technology's ability to produce large components. This is expected to open new avenues for innovation and efficiency in various sectors.

"This will open up new possibilities for large-scale production of metal parts, paving the way for growth and innovation in the country's Additive Manufacturing sector," stated Dr Samir V Kamat, Secretary of the Department of Defence R&D and Chairman of DRDO.

www.drdo.gov.in
www.iith.ac.in

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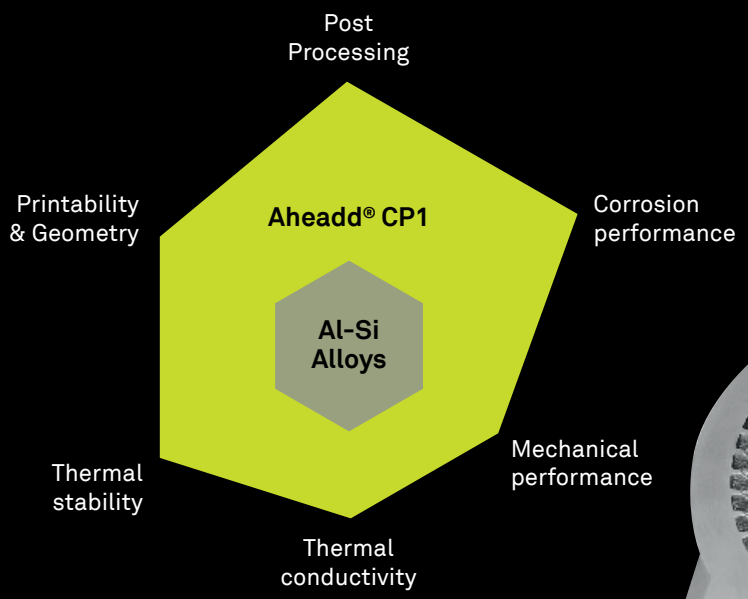

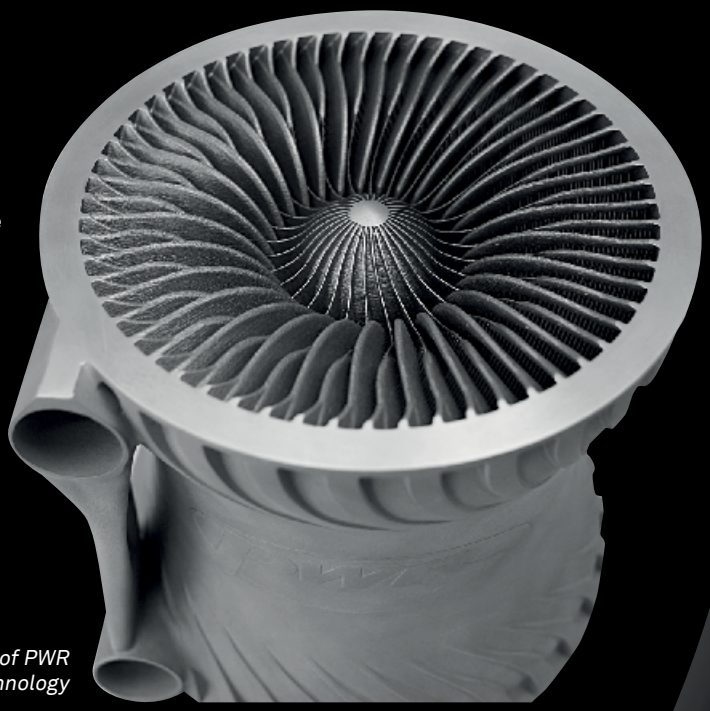

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Cold Spray as a process for the production of nickel aluminium bronze

Australian researchers from SPEE3D, headquartered in Melbourne, and Charles Darwin University, Darwin, Australia, have published a paper in PLOS One focused on the use of Cold Spray Additive Manufacturing in the production of nickel aluminium bronze (NAB) alloys over the traditional Powder Metallurgy technique.

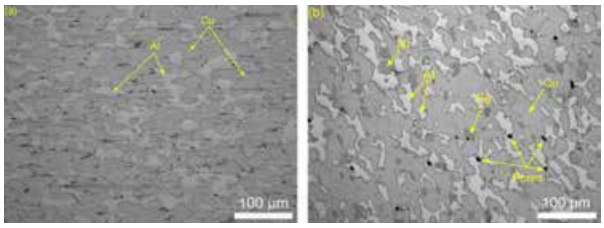
In the study, both binary aluminium bronze (AB) and NAB alloys were produced using powders, additively manufacturing components via Cold Spray and then heat treating the resultant parts. The AB alloy contained blended 9.9% aluminium alloy (Al6061) powder and copper powder, while the NAB alloy included 11% Al6061 powder, 5.8% nickel powder, 6.8% iron powder, and copper powder.

Powders were mixed under controlled conditions and deposited using a LightSPEE3D AM machine and compressed air. Post-deposition heat treatments – such as homogenisation, ageing, and/or Hot Isostatic Pressing (HIP) – were applied to enhance material properties.

According to the researchers, their results showed that Cold Spray Additive Manufacturing combined with suitable heat treatments can produce NAB alloys with desirable microstructures containing fine κ phases and mechanical properties with above 280 MPa yield strength, above 500 MPa tensile strength and 20% elongation. This dataset is comparable to numbers achieved by traditional cast methods – which results in yield strength of 240 MPa, tensile strength of 580 MPa and 15% elongation – and better results than those produced via PM.

The study also noted that replacing solution treatment at HIP process at 1035°C can further enhance the mechanical properties of NAB samples produced via Cold Spray Additive Manufacturing, making them superior to traditionally cast NAB materials. This highlights the potential of Cold Spray AM to produce high-performance materials more efficiently.

www.journals.plos.org
www.spee3d.com
www.cdu.edu.au



Microstructure of as-sprayed alloy (a) binary aluminium bronze (b) nickel aluminium bronze (Courtesy Camilleri S, Tran T, Duguid A, Krishnan K (2025) Cold spray as a Powder Metallurgy process for production of nickel aluminium bronze).

Authentise integrates with Autodesk Fusion for seamless Additive Manufacturing workflow automation

Authentise, based in Philadelphia, Pennsylvania, USA, has announced the integration of Autodesk's Fusion Application Programming Interfaces (APIs) into its production management system, Flows. This integration allows for multiple workflows to prepare designs for manufacturing, all without any interruptions or complications.

Authentise Flows' users who have access to the integration can now check the design quality, generate support structures, slice, nest, create a machine-specific build file more directly from the Flows interface, and operate directly on live Fusion Data. Other actions, such as adjusting the design or sending the part directly to the machine, can be completed from the Fusion interface, which can be directly accessed via Authentise Flows, with the design already loaded and continuously version controlled.

The integration builds on years of collaboration between Autodesk and Authentise. The newly announced capabilities mean that users can go beyond simple data exchange by selecting which specific functions they want to outsource to Fusion and accessing those directly from Authentise Flows.

"This is a milestone in the evolution of manufacturing and engineering workflows," said Andre Wegner, CEO of Authentise. "Never before have so many individual manufacturing services been accessible in one place. By seamlessly integrating these functions, we're not only enhancing efficiency and convenience, but we're also laying the groundwork for a more open, competitive ecosystem. This development is a significant boost for Additive Manufacturing and beyond. Our collaboration with Autodesk today sets the stage for a new era of innovation."

"We are proud to work with Authentise as one of the early adopters of our Fusion API capabilities," stated Alexander Oster, Director of Additive Manufacturing at Autodesk. "With this integration, a tailored and managed end-to-end Additive Manufacturing workflow is finally a reality. From quoting a design, assigning workflows and work instructions, generating supports and adjusting the design, to nesting, scheduling, and execution, Authentise users can now guide their parts from design to part in one smooth process. Our mission is to deliver a best-in-class mass-market platform solution that is adaptable to any manufacturing vertical. The controlled industries that Authentise is catering to are a great example of how third parties can build their business on top of our developer ecosystem."

www.authentise.com

Twelve KARNO clean energy generators set to be shipped to Saudi Arabia for agricultural applications

Hyliion Holdings Corp, developer of the KARNO clean energy generator, based in Austin, Texas, USA, has signed a non-binding Letter of Intent (LOI) with Al Khorayef Group, headquartered in Saudi Arabia, to deliver up to twelve 200 kW KARNO generators to Saudi Arabia for deployment in agricultural and other power generation applications.

Through this collaboration, both companies aim to explore the broader potential of KARNO generators in the regional power generation market, aligning with Saudi Arabia's Vision 2030 sustainability goals to reduce pollutants and enhance food security.

The KARNO generator relies heavily on metal Additive Manufacturing for its components, particularly for critical heat exchangers and thermodynamic systems. This manufacturing approach enhances component precision and quality, helping to increase the generator's overall efficiency.

The new generators are expected to initially operate on liquefied petroleum gas (LPG) and natural gas, with flexibility for other fuels in the future. This adaptability, combined with the KARNO generator's high efficiency, low emissions footprint, minimal maintenance, and quiet operation, makes it ideal for powering farms, irrigation systems, and agricultural machinery in remote locations where grid power is often unavailable or unreliable.

"The agricultural sector requires innovative energy solutions that not only meet its unique operational demands but also support sustainability and growth," said Mohamed bin Alkhorayef, CEO of Al Khorayef Group. "Partnering with Hyliion to bring the first KARNO generators to Saudi Arabia exemplifies our mission to transform essential resources like energy into tools for progress and prosperity."

The KARNO generator is capable of operating on over twenty different fuels, including hydrogen, natural gas, propane, ammonia and conventional fuels (Courtesy Hyliion Holdings Corp)

"Meeting the energy demands of agriculture in remote and challenging locations requires innovative and efficient solutions," said Thomas Healy, Founder and CEO of Hyliion. "We look forward to working with Al Khorayef to deliver sustainable, reliable power to support food security and economic growth with adaptable and efficient energy technologies."

www.hyliion.com
www.alkhorayef.com

APMI International names Christopher Adam and Dr Ma Qian as 2025 Fellows

APMI International has announced Christopher Adam and Dr Ma Qian as the recipients of the 2025 Fellow Award. The award recognises APMI members for their significant contribution to the organisation's goals, purpose, and mission, as well as for an elevated level of expertise in the industry's technology, practice, or business. The recipients will be elevated to Fellow status at PowderMet2025/AMPM2025, which is scheduled to take place from June 15-18, 2025, in Phoenix, Arizona, USA.

Christopher Adam, PMT, President, VALIMET, Inc
Chris Adam has led a diversified career working with graphite, iron, copper, and aluminium powders. Throughout his career, he has been committed to educating others on the importance and potential of applications that can be achieved through Powder Metallurgy. This includes outreach and mentoring of high school and college-age students.

Adam has created and presented seminars on various industries that have adopted Powder Metallurgy. These outreach programmes and workshops have played a pivotal role in sharing knowledge and experiences with diverse audiences and helping others succeed through his mentoring.

Dr Ma Qian, Distinguished Professor, Royal Melbourne Institute of Technology
Recognised for his outstanding contributions in the field of Powder Metallurgy and Additive Manufacturing of light metals and alloys, Dr Qian's work has significantly expanded the knowledge in these areas and has led to extended applications of PM and AM. He actively contributes to APMI and the broader PM and AM communities by initiating and organising key conferences in these fields. Additionally, he has served on the APMI International Liaison Committee for nearly a decade, highlighting his global engagement.

APMI International has announced Christopher Adam, PMT (left) and Dr Ma Qian (right) as the recipients of the 2025 Fellow Award (Courtesy MPIF)

www.apmiinternational.org

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Titomic partners with University of Alabama to advance Cold Spray

Titomic Limited, based in Brisbane, Australia, has announced a new partnership with The University of Alabama in Huntsville (UAH), Alabama, USA, that will bring together Titomic's Cold Spray machines with UAH's research capabilities. Through this partnership, Titomic and UAH will initially focus on a collaborative effort to gain greater insights into the material property drivers critical to enhancing material performance for aerospace, defence, energy, oil, and gas applications. These efforts will address key areas such as repair, coatings, and the development of advanced products.

As the partnership progresses, further collaboration will extend into the development and application of other materials and technologies. This includes leveraging Cold Spray technology to support advancements in automation, robotics, and augmented reality, reinforcing its position as a cutting-edge solution for modern manufacturing challenges.

Titomic CEO, Jim Simpson, stated, "We are thrilled to partner with The University of Alabama in Huntsville. Together, we will push the frontiers of Cold Spray technology and Additive Manufacturing, delivering solutions that will have a profound impact on industries from aerospace to energy."

Dr Charles L Karr, UAH President, added, "This partnership offers exciting opportunities to combine Titomic's pioneering Cold Spray technology with UAH's cutting-edge research and resources. By working together, we aim to accelerate the development of novel materials and manufacturing methods, shaping the future of the industry."

www.uah.edu
www.titomic.com

Additively manufactured kamikaze drone completes flight at over 350 mph

Cummings Aerospace, headquartered in Huntsville, Alabama, USA, reports it has recently completed a series of rigorous flight tests for its new Hellhound turbo-jet-powered, additively manufactured kamikaze drone, which can fly at speeds faster than 350 miles per hour. The drone is designed to equip the US Army's Infantry Brigade Combat Teams with the same combat power as Armoured Brigades, enabling precise, long-range strikes against tanks, armoured vehicles and fortified positions.

The Hellhound combines Additive Manufacturing and US Department of Defense-approved commercial components to reduce production costs, simplifying logistics and delivering advanced capabilities at lower costs than traditional systems. In its entirety (vehicle, launch canister and ground control system), it weighs around 11 kg, allowing single-Soldier deployment and enhancing Infantry mobility. The modular design supports warhead, Electronic Warfare, and ISR payloads; soldiers can field-swap payloads in less than 5 minutes without tools.

The flight tests provided critical data, further validating Hellhound's readiness for complex operational scenarios.

"The modern battlefield demands speed, and quadcopters and propeller-driven drones are slow. In combat, our peer adversaries will exploit every second of delay," stated Sheila Cummings, CEO of Cummings Aerospace. "Hellhound's jet-powered design ensures Infantry Brigade Combat Teams can act faster – gathering intelligence and striking critical targets deep in the contested areas before the enemy has time to react."

Hellhound is a turbo-jet-powered, additively manufactured kamikaze drone that can fly faster than 350 miles per hour. The drone is designed to equip the US Army's Infantry Brigade Combat Teams with the same combat power as Armoured Brigades (Courtesy Cummings Aerospace)

The tests took place at Pendleton UAS Range, Oregon, USA, from January 22-25, 2025. There were three flight tests covering speed and range testing, seeker integration and inert payload testing. The Hellhound flew faster than 350 mph at half throttle while exceeding distances of 20 km, using just 50% of fuel. The tests also proved Hellhound's ability to conduct Intelligence, Surveillance and Reconnaissance (ISR) missions by validating Hellhound's seeker with live video transmission during flight. It also verified the functionality of critical systems by conducting simulated strikes with an inert warhead.

The Hellhound flew, and performed reliably, in very low temperatures, high winds and snow. The tests validated the airframe and key subsystems at Technology Readiness Level 7 (TRL-7), proving reliable performance in operationally realistic conditions, meaning that all primary objectives were achieved.

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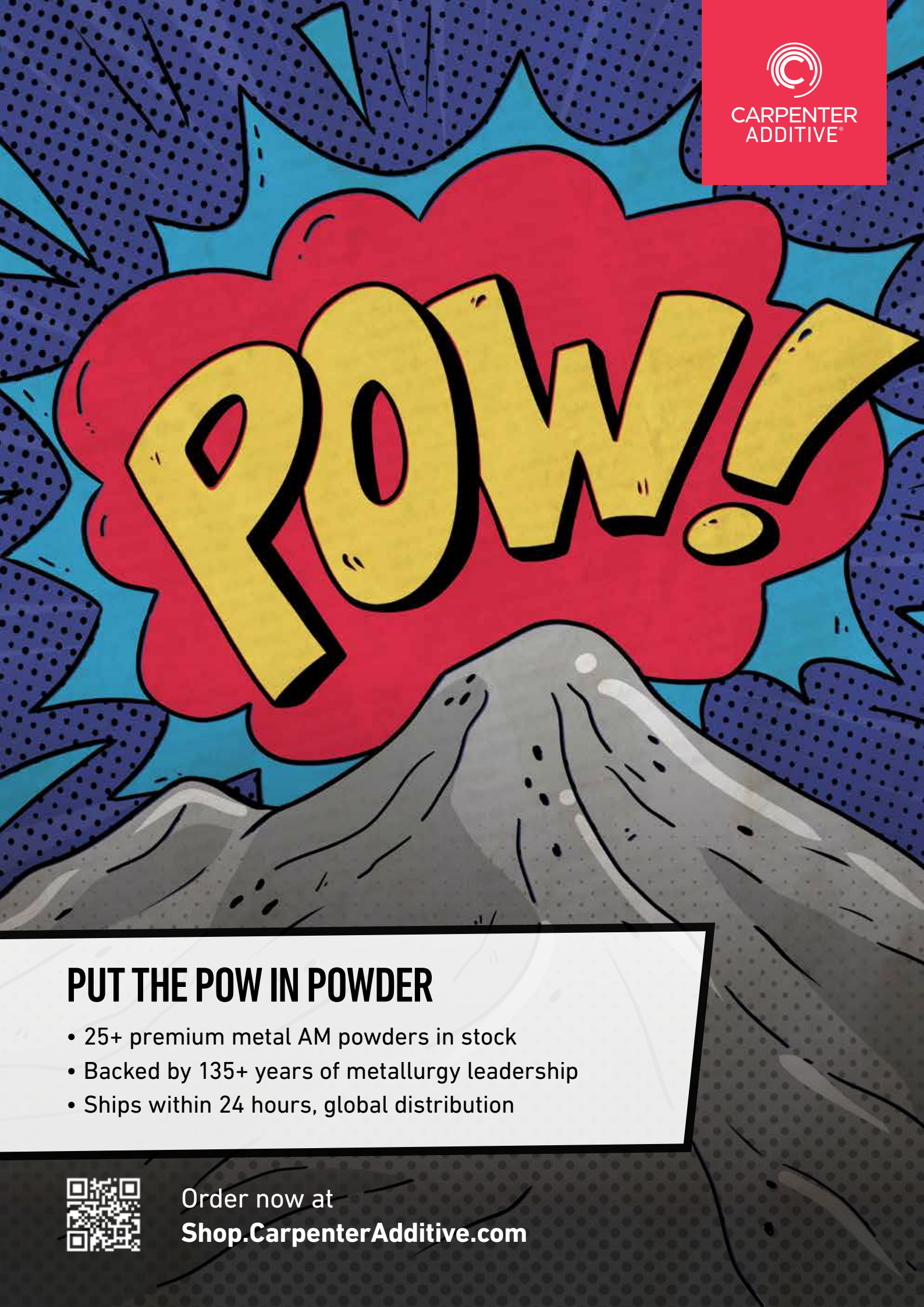
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Back to the future: A decade of Additive Manufacturing innovation and growth at Materials Solutions

Ten years ago, in the first-ever issue of *Metal AM* magazine, Materials Solutions was featured as one of the industry's rising stars. A decade on, with ongoing questions about the wider industry's progress, we returned to see what the company's journey reveals. Much has changed, including its acquisition by Siemens Energy (formerly Siemens AG), which fuelled significant growth. Yet the company remains firmly focused on its core expertise: processing nickel-base superalloys for high-temperature applications. Martin McMahon reports on its journey to large-scale series production, including a milestone agreement with Rolls-Royce Civil Aerospace and a major investment in Nikon SLM Solutions' NXG XII 600 machines.

Ten years ago, Materials Solutions was featured in the very first issue of this magazine, having established itself as a market leader in the rapidly emerging metal Additive Manufacturing industry. That first article covered the rise and success of what was then a small UK-based AM service provider focused on producing high-performance parts for the aerospace and motorsport sectors using Laser Beam Powder Bed Fusion (PBF-LB) technology.

Founded in 2006, the company quickly established itself as an industry pioneer, installing the first operational EOS M270 machine in the UK. From its humble beginnings on the University of Birmingham campus, the company moved to its first commercial site in Worcester in 2010, by which point it had already expanded to three PBF-LB machines.

By the time *Metal AM* magazine first profiled Materials Solutions in 2015, the company stood out as having one of the largest independent metal AM capabilities in the world. It operated eight machines from the then-industry leader, EOS, with three more on order the same year. What was particularly remarkable at this stage of the company's development was that very few businesses had invested so extensively in PBF-LB technology; it was still widely regarded by most industries, including aerospace, as merely a prototyping technology.

Considering that metal AM was still in a somewhat speculative phase, this was a bold move – one that, in hindsight, proved to be a fortunate decision. During this period, the company developed a razor-sharp

Fig. 1 The Materials Solutions factory in Worcester, UK (Courtesy Materials Solutions Ltd)

Fig. 2 The management team at Materials Solutions: Dean Harris – Head of Operations; Martin Williams – Head of Technical Services & NPI; Trevor Illston – Chief Manufacturing Engineer; Andy Brooker – Head of Sales; Scarlett Baker – General Manager; Colin Crabb – Head of Finance; and Andy Jones – Head of AM Engineering (Courtesy Materials Solutions Ltd)

"Where many others struggled or failed, the company leveraged its expertise in metallurgy to succeed with alloys such as Inconel 625, Inconel 718, C263 and Hastelloy X, while also developing solutions for difficult-to-weld alloys like 738, Inconel 939 and CM247LC."

strategy of focusing exclusively on a specific type of work and specialising in a single group of alloys. This approach has remained a constant for Materials Solutions ever since, with a dedicated focus on manufacturing high-temperature components in nickel-based superalloys for turbine technologies and similar applications.

Where many others struggled or failed, the company leveraged its expertise in metallurgy to succeed with alloys such as Inconel 625, Inconel 718, C263 and Hastelloy X, while also developing solutions for difficult-to-weld alloys like 738, Inconel 939 and CM247LC. The current leadership is absolutely certain that the key to Materials Solutions' success today lies in this early decision to focus on these alloys.

Fast-forward to the present, and the company has undergone a significant transformation driven by continuous technological advancements, a strategic investment, and an unwavering commitment to quality and innovation.

This article focuses on the key milestones and developments over the past decade, highlighting how Materials Solutions evolved from its prototyping roots into a world-leading production company that is part of a group within – quite literally – an industrial powerhouse.

Acquisition by Siemens Energy

Materials Solutions' first significant milestone came in 2016, when it received an initial investment from the industry giant Siemens AG, which was, at that time, a single integrated group of businesses. By 2017, an initial 14% stake grew into a complete acquisition, with the company becoming part of the Siemens Gas and Power division –

now Siemens Energy following the spin-off in 2020.

To external observers, the swift transition from initial investment to full ownership might have seemed abrupt, especially given the limited understanding of the performance of metal AM parts at the time. Additionally, the aerospace sector, a high-profile market, remained undecided on metal AM's potential. This move also surprised many who had expected Materials Solutions to deepen its involvement with aerospace rather than potentially shift focus.

What the wider world did not fully understand at the time, however, was that Siemens Gas and Power was already well-versed in metal AM. The decision to select Materials Solutions was, in fact, a highly strategic one. Siemens' journey into using metal AM began with its development of an industrial AM capability at Finspång in Sweden, where AM was used to overhaul used burner heads. Realising that it was easier to acquire external capability than to expand its existing sites, Siemens ultimately turned to Materials Solutions. As AM began to have a significant and positive impact on its manufacturing capabilities, the company recognised the importance of securing its supply chain in a world where concerns about the stability of global supplies were growing.

The acquisition of Materials Solutions was, therefore, driven by supply chain security as much as by the promise of the technology to improve component and product performance of Siemens Energy's core offerings, such as industrial gas turbines. On the other side of the coin, the acquisition marked a significant turning point for Materials Solutions: it provided the financial backing and strategic support necessary to scale its operations. What began with an initial investment of £30 million – demonstrating Siemens' commitment to the growth and development of Materials Solutions – has since been followed by continuous reinvestment. This has fuelled an average year-on-year growth of 25% since 2018.

Fig. 3 High temperature PBF-LB gas turbine components produced by Materials Solutions for Siemens Energy (Courtesy Materials Solutions Ltd)

The acquisition placed Materials Solutions in an enviable position, comparable only to Morris Technologies in the US, acquired by GE in 2012. However, while the acquisition of Morris Technologies was driven purely by internal requirements, Materials Solutions was able to maintain its role as a standalone AM service provider. This ownership model has allowed the company to remain cost-competitive and responsive to market demands while continuing its trajectory of innovation and growth.

This adaptability was particularly evident during the COVID-19 pandemic. The period presented unforeseen challenges across many industries, and Materials Solutions was no exception. Despite the obstacles, the company did not halt production. Instead, it became a vital asset to its parent company,

"What began with an initial investment of £30 million – demonstrating Siemens' commitment to the growth and development of Materials Solutions – has since been followed by continuous reinvestment. This has fuelled an average year-on-year growth of 25%..."

Fig. 4 A fleet of EOS M400-4 PBF-LB machines at Materials Solutions. Powder is supplied from the floor above (Courtesy Materials Solutions Ltd)

"While the volume of performance- and supply-chain-critical components for Siemens Energy has increased, Materials Solutions remains committed to dedicating a significant share of its capacity to external customers in adjacent industries."

emerging from the pandemic with a revised balance of 60% internal work for Siemens Energy and 40% external work. The company's ability to meet the supply needs of Siemens Energy during this time was proof of how successfully the parent company had transitioned from conventional production methods to AM.

Following the pandemic, Siemens Energy expanded the number of parts produced via metal AM, further underscoring the strategic importance of Materials Solutions within the Siemens Energy ecosystem. While the volume of performance- and supply-chain-critical components for Siemens Energy has increased, Materials Solutions remains committed to dedicating a significant share of its capacity to external customers in adjacent industries.

Relocation and upgrade to EOS M400-4 machines

One of the most significant developments over the past decade has been the expansion of Materials Solutions' facilities and capabilities. In 2018, the company relocated to a purpose-built facility, moving its entire metal AM fleet from the city to a new industrial park to accommodate its growing operations. It was around this time that I made my first visit to Materials Solutions, just before the pandemic. At this juncture, the company was clearing out some of the old and making way for the new – swapping out its remaining EOS M270 machines for M290s.

However, ever the pioneers – and having already carried out some development with the M400 single-laser machines, focusing on performance, repeatability, and cost-effectiveness – it recognised that single-laser machines, particularly those with a limited build area, would be a barrier to further progress. Hence, although the move included both of its existing M400-1 machines, the company ultimately

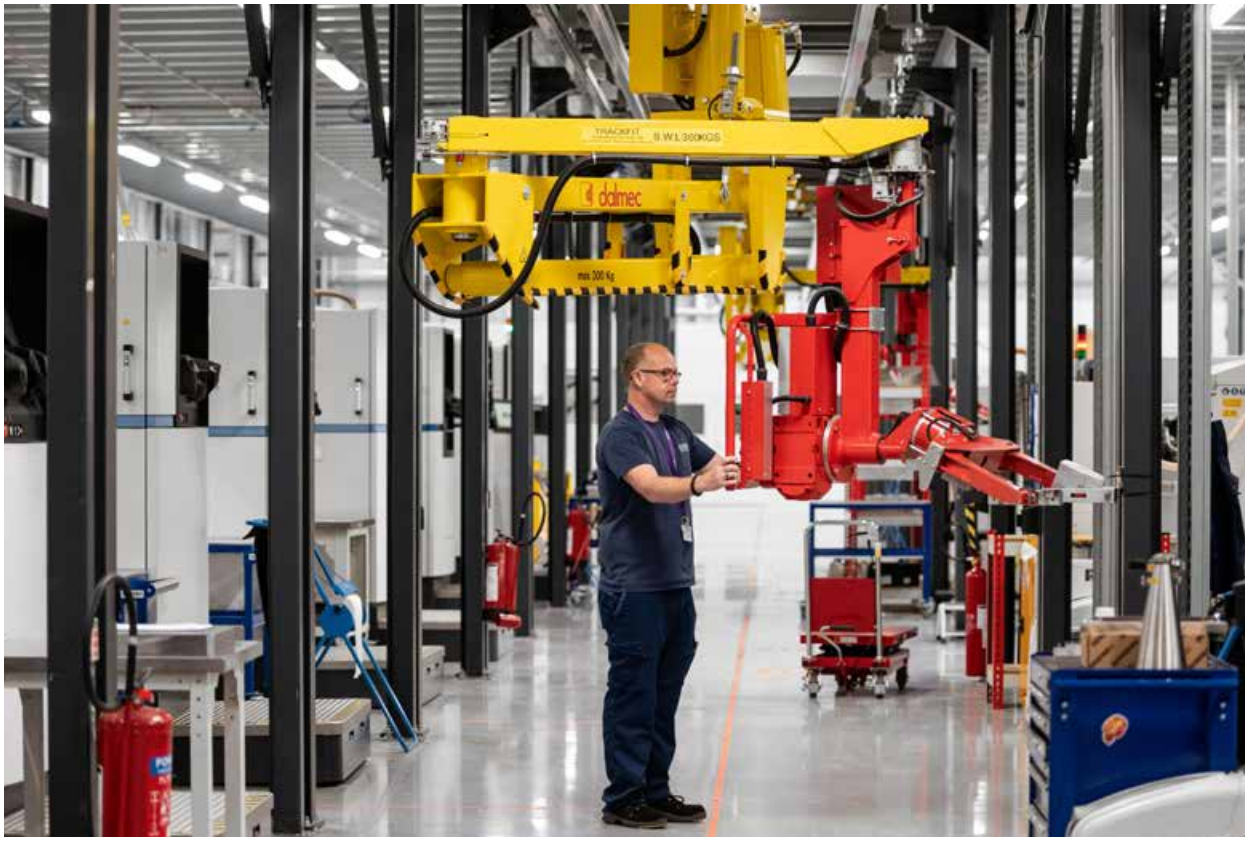

Fig. 5 This 'mech-lifter' is designed to speed up build turnarounds, supporting the drive for increased productivity measured by 'laser-on' time (Courtesy Materials Solutions Ltd)

concluded that as well as having the ability to build single, larger parts, it needed the flexibility to manufacture multiple parts simultaneously – something that could only be achieved with multi-laser machines and selected the M400-4 as it's mid-size production machine of choice.

In the subsequent years, the company began replacing more of its single-laser machines with larger four-laser machines, now all meticulously aligned along one side of the factory. However, it is also worth noting that at the time of the move to the new site, Materials Solutions had already acquired a different type of PBF-LB machine, signalling its shift away from relying solely on one vendor – this machine was already up and running during the official opening. By the time of my first visit, the well-established Renishaw machine had been dedicated to exploring the potential of using alternative materials. I recall that amid a factory full of white EOS machines, this one certainly stood out – but it was all part of the company's strategy to stay ahead of the game.

"With a line of thirteen M400s on one side, a further group of seven M290s, two RenAM500Qs, and a Nikon SLM Solutions SLM 500 machine, it absolutely cannot be mistaken for a prototyping job shop."

A fully integrated production environment

Walking through the doors of Materials Solutions in 2025 was a whole new experience. Although Materials Solutions had previously made an internal split between building and post-processing, the newer layout completely isolates these activities. With a line of thirteen M400s on one side, a further group of seven M290s, two RenAM500Qs, and a Nikon SLM Solutions SLM 500 machine, it absolutely cannot be mistaken for a prototyping job shop.

Today's facility is a fully integrated production environment – all under one roof. It is one of the best I've seen to date. Rows of

Fig. 6 High performance vanes for Siemens Energy gas turbines. Depowdering the fine cooling channels requires the utmost care and every part is inspected (Courtesy Materials Solutions Ltd)

"The NXG machine will initially produce a very specific power generation part, set to be the first of its kind produced by PBF-LB. Perhaps Metal AM will be allowed to reveal more later in the year, but, for now, we can only confirm it is extraordinarily large and replaces five separately built AM parts..."

clean, fully operational machines – each with its own dedicated powder supply – create a vibrant, high-efficiency atmosphere. The constant hum and whirring of the machines fill the air with all the activity anyone would expect to see in a modern factory.

However, there was also a touch of sci-fi. Those familiar with the film Aliens will understand what I mean by a 'mech-lifter.' While not quite an exoskeleton, the bright yellow gantry-mounted forked lifting device is a striking presence in front of the AM machines. Acquired to simplify the loading and unloading of these large PBF-LB machines, it's also reminiscent of the robots used in the automotive sector to move partially-assembled vehicles around a factory.

Scaling upwards with Nikon SLM Solutions NXG XII 600 machines

The most anticipated development is scheduled for May 2025, when Materials Solutions will receive the latest twelve-laser NXG XII 600 machine from Nikon SLM Solutions. The company also plans to install a second NXG XII 600 machine later in the year. During our visit, we were shown a large open section of the factory, where the space for the first machine was neatly marked out with tape, a clear visual clue to the scale of what will soon be delivered.

Of course, the production of very large parts isn't a novelty exclusive to AM. Anyone who has seen the inside of a large industrial foundry can attest that casting very large and heavy parts is certainly possible. That said, while there are still numerous questions regarding the performance of these gargantuan machines, the decision to

invest in such a machine has not been made lightly.

As with others who have mastered PBF-LB, the team at Materials Solutions understands that the most significant factors influencing build, aside from powder quality, are optimising the laser exposure parameters and control of the system key process variables such as laser power, laser focus, process chamber gas flow and multi-laser alignment. As a result, the investment in the NXG XII 600 comes after an extended development period in close collaboration with Nikon SLM Solutions. Gas flow and extraction from the build chamber have kept many up at night due to their impact on build quality, and these concerns are only amplified when you introduce four, eight, or twelve lasers. Months of testing and evaluation were conducted at Nikon SLM Solutions before the decision to acquire the machine was finalised.

This testing will continue following installation and verification but, once operational in the second half of 2025, the machine will enhance production capabilities in a way never previously considered possible, enabling the production of larger and more complex parts. Trevor Illston, one of the company's co-founders and its Chief Manufacturing Engineer, expressed confidence that his team will be able to deliver on this without compromising on the company's well-established standards for quality and repeatability.

The NXG machine will initially produce a very specific power generation part, set to be the first of its kind produced by PBF-LB. Perhaps *Metal AM* will be allowed to reveal more later in the year, but, for now, we can only confirm it is extraordinarily large and replaces five separately built AM parts – which had already replaced a complicated, multi-stage production and fabrication process. Thanks to AM, Siemens Energy has been able to make substantial improvements. One of the test components, in particular, is eye-poppingly huge by today's standards in metal AM. Illston commented,

Fig. 7 The assembly of vanes produced by Materials Solutions (Courtesy Materials Solutions Ltd)

"When the machine is fully operational, it will lead to significant reductions in cost and lead time for this very large part whilst significantly improving fuel efficiency and the emissions of Siemens Energy's most advanced gas turbine."

A robust portfolio of more than a hundred qualified parts for the energy sector

Achieving true production capability is the goal for nearly all AM service providers, with few aiming to be merely another 'job shop'. However, many struggle to fully understand what it truly means to be production-ready and what it takes to get there. Materials Solutions is one company that has demonstrated a clear understanding of this challenge and has made significant strides in production over the past ten years.

What began with producing striking showpieces for the aerospace sector and a few parts for motorsport teams has now evolved into a robust portfolio of over a hundred qualified production parts mostly for the energy sector and mainly produced from nickel-based alloys. In the past year alone, the company states it has produced more than 20,000 parts. Nothing could underscore its leadership in the manufacturing world more and highlight the full transition from a prototyping company to a high-throughput production organisation. To some, that number may not seem so high, but in precision engineering, power generation represents a pinnacle. It certainly is comparable to many foundry businesses of high value and complex components.

Moreover, the majority of parts Materials Solutions produces are not the size of the commonly seen widgets and novelties that many use to promote metal Additive Manufacturing, such as keyrings and bottle openers. Instead, many are the size of wine bottles – large wine bottles, too

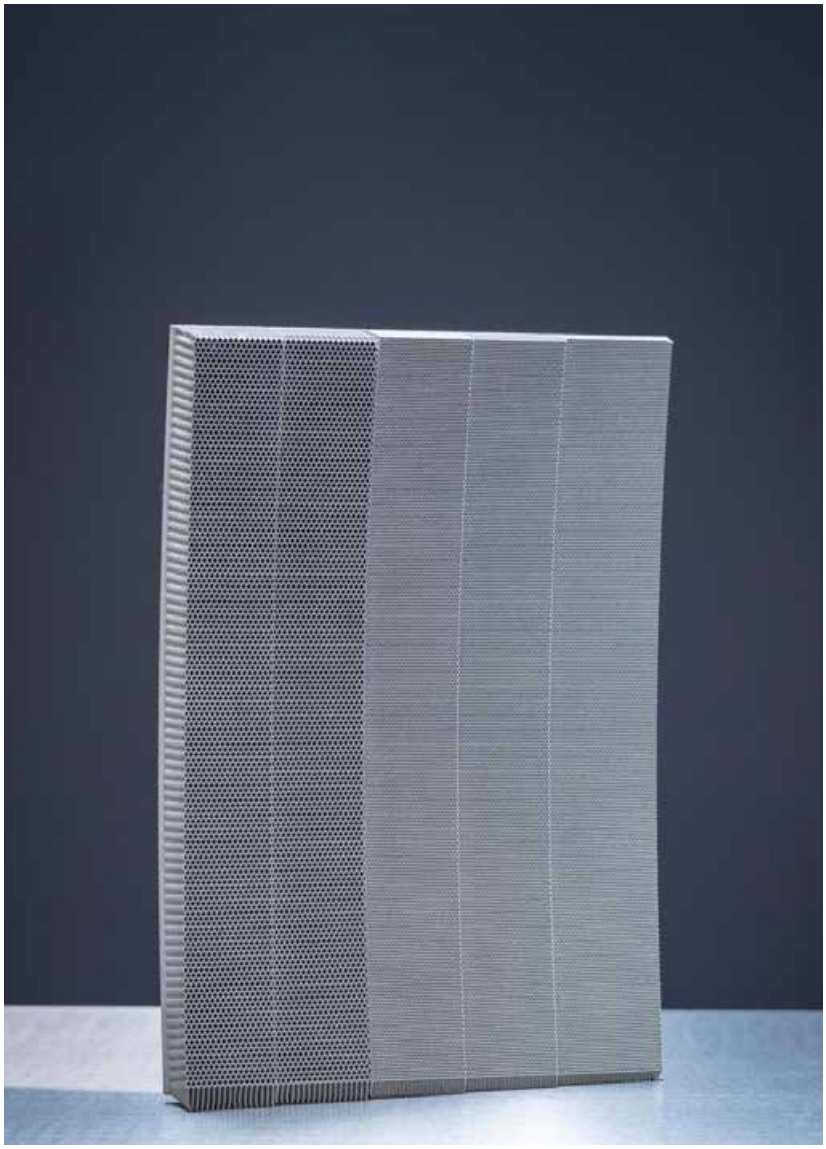

Fig. 8 A honeycomb seal for gas turbines (Courtesy Siemens Energy)

"The production of flight components for commercial aviation was described as a 'North Star' when Materials Solutions was first established, and the success that has been achieved together with Rolls-Royce builds on past collaborations that resulted in non-flight and rig components."

– or could be enclosed by a typical-sized shoebox. Many are much larger still. However, the company has also recognised that smaller build areas are still necessary. The Renishaw RenAM 500Q machine was considered the best fit for this purpose, utilising the multi-laser setup for maximum throughput.

Standards: a different path

As one would imagine, for any business operating within the power generation segment of the energy sector, quality control is a cornerstone of the company's operations. Yet, while many continue to delay decisions about adopting or using metal AM due to the lack of internationally recognised standards, Materials Solutions and Siemens Energy have developed their own specifications to qualify and control the production of AM components. To accelerate the adoption of AM, Siemens Energy invested in developing material processes and specifications, culminating in an AM materials database to provide the design input data required for critical gas turbine components.

Managing powder supply

In AM, production isn't just about how many parts it is possible to make; it is about how the process is implemented. In this respect, taking logical steps is something that all companies in the manufacturing sector wishing to grow should do, and Materials Solutions has done just that. Placing sieving units and powder delivery systems on the raised floor above some AM machines is something I've been hoping to see for years.

The powder is typically refreshed by blending with virgin powder, which is supplied to the company under a very tightly controlled supply specification. This approach is a very sensible way to ensure maximum utilisation of feedstock materials, while also minimising waste. To further refine this process, rigorous

Fig. 9 Materials Solutions has signed a collaboration agreement with Rolls-Royce to develop and supply serial production Additive Manufacturing applications for its Civil Aerospace business (Courtesy Siemens Energy)

internal analysis and verification are conducted to ensure compliance with these strict specifications. Additionally, the company has its own way of tracing and grading all of the powder in use.

Rolls-Royce agreement marks another major milestone

A few weeks before our visit, Materials Solutions signed a collaboration agreement with Rolls-Royce to develop and supply serial production Additive Manufacturing applications for its Civil Aerospace business. The production of flight components for commercial aviation was described as a 'North Star' when Materials Solutions was first established, and the success that has been achieved together with Rolls-Royce builds on past collaborations that resulted in non-flight and rig components.

Quan Lac, Vice President of Siemens Energy Additive Manufacturing, stated at the time of the announcement, "With over a decade-long history of working with Rolls-Royce on AM technology and part development we are proud to be selected now by Rolls-Royce to further complement its journey in AM production. It has been a long-standing ambition of our co-founder Trevor Illston since the very early days of Materials Solutions to supply production AM parts for flight, so it's with a great deal of pride that today we can say we are supporting critical power solutions for both land (Siemens Energy) and air." This marks a major milestone on Materials Solutions' journey to expand its PBF-LB serial production expertise beyond Siemens Energy stationary gas turbine components.

During our visit, Andy Brooker, Head of UK Sales for Materials Solutions, explained that the company has to be very precise when it comes to working with external customers. With the ethos of Materials Solutions built around serial production, it falls into a niche within AM. Brooker stated, "Our success has stemmed from a clear vision from the beginning and an alignment with the type of projects that go through the factory. This is an important factor when it comes to working with external clients as their ambitions need to align with our core focus. We are built around a high level of engineering, quality control and repeatability." It's possible to see from the examples shown here that the company has earned its right to be in this position.

Quality control

For most of the industry, once full-scale production has been achieved, it is possible to work within a process that only requires product sampling for ongoing quality controls. The

Fig. 10 Tens of thousands of PBF-LB parts produced by Materials Solutions are in service in the most demanding of applications (Courtesy Materials Solutions)

quality process runs from beginning to end and applies industry standard SPC processes to determine the right level of inspection. Each part is studied to determine the best build strategy, and the company goes to great lengths to qualify each machine for production. No matter how precise an AM machine OEM's products are, no two machines – even of the same model – are identical. As a result, each AM machine is individually calibrated for optimum performance to ensure parts meet exact material properties.

Every batch of powder is tested to its own very tight specifications, and every build is tested for dimensional tolerance, defects, and material quality. This process is fully documented and repeated across all of Siemens Energy's AM facilities. Illston's confidence in the company's processes was evident when he stated, "We have reached the point where any one of our qualified production parts can be manufactured at any Siemens Energy AM site and achieve the same materials properties." This is precisely the kind of assurance that anyone in the AM field would want to hear and rely on. As a result, the company now has a vast quantity of data points to demonstrate the stability of its metal AM production process.

Despite all these data, however, I found it extraordinary that the company still performs such thorough inspections. When asked if the company was close to shifting to sampling instead, Illston replied, "We are working towards it, component by component, and have reduced the first inspection plans, but we still have some way to go on the full product spectrum."

"In the case of Materials Solutions, one critical factor in its success has been its focus on retaining staff. This emphasis on continuity was part of the rationale behind the initial decision to relocate from Birmingham to Worcester and expand into the current facility."

However, there were visible signs that the company must be getting relatively close to that point. Investment in the facilities also includes every aspect of quality assurance. It covers virtually every step of the end-to-end process chain and is neatly displayed on a large display panel monitoring the entire facility. Only heat treatment is carried out externally before parts are returned on the build plates for finishing and complete inspection. For parts with many internal channels and features, complete powder removal is essential, and multiple steps are taken to ensure every single part is clean, clear, and conforms to requirements.

Self-certifying parts is a great way to control costs, and Materials Solutions realised this right from the start. As a result, the company now has everything from seamless integration with Siemens NX for design data to GOM and CMM dimensional measurements, chemical analysis and surface inspection – all within the same facility. Recently, the company has even invested in a large CT scanner.

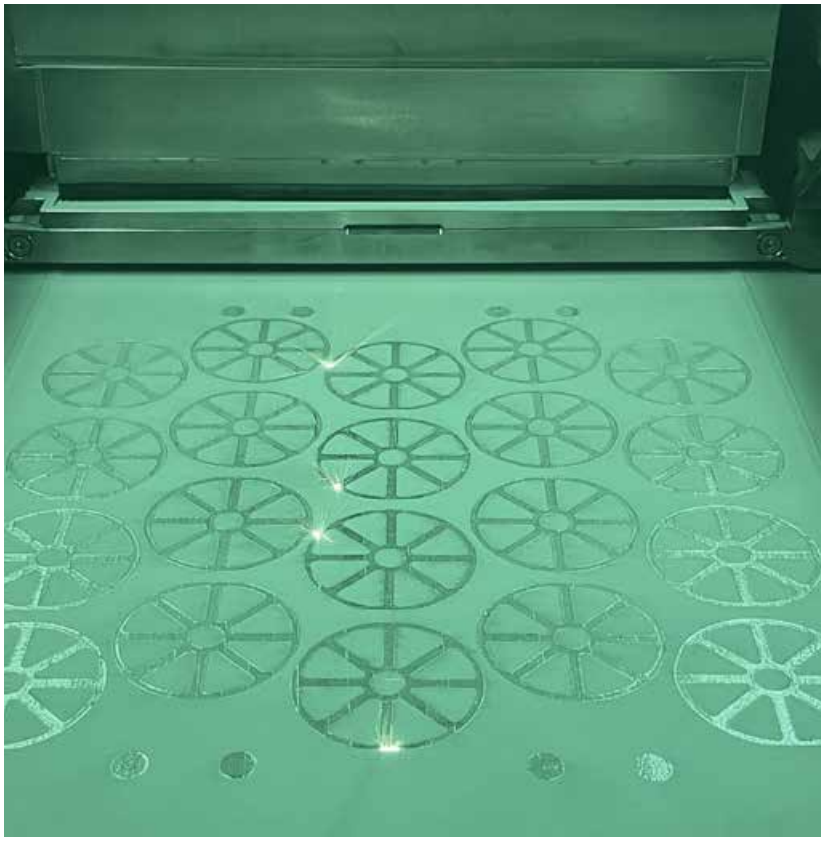

Fig. 11 A build underway on an EOS M400-4 at Materials Solutions (Courtesy Materials Solutions)

Talent development and retention

I am always encouraged when I hear about employees who have been with a company for their entire career or who have at least reached a significant milestone. However, within the metal AM world, revisiting a company can sometimes be a new experience every time; the industry sees a lot of career movement, especially when 'jumping ship' can be the only way to rise up the career ladder.

In the case of Materials Solutions, one critical factor in its success has been its focus on retaining staff. This emphasis on continuity was part of the rationale behind the initial decision to relocate from Birmingham to Worcester and expand into the current facility. Co-founder Carl Brancher remained with the company until his retirement, providing long-term leadership. Illston is still with the company, contributing to its growth and development. Scarlett Baker, General Manager, shared that she had started as employee number ten in 2016, a testament to her long-standing commitment to the company's journey.

All too often in the world of advanced manufacturing, there's a perception that digital manufacturing in particular leads to fewer employment opportunities. However, Materials Solutions strongly counters this belief. The company's focus on detail and quality requires a lot of human activity, and as the business has grown, so has its workforce, which now totals around ninety-five employees. Many of these employees are 'homegrown', with the company taking on apprentices and student work placements, some of which have led to full-time job offers.

This commitment to building a skilled and dedicated workforce has fostered such goodwill that some employees have even sought positions for family members to join the company. This somewhat old-fashioned approach harkens back to the days when parents would bring their children into the trade or workshop. It also underscores that, despite the rise of digital manufacturing, traditional workshop roles are still vital in the metal AM sector.

Environmental impact and sustainability

While a large share of Materials Solutions' products already help reduce the CO_2 emissions of Siemens Energy's gas turbine fleet through higher efficiency and power output, they will now also help revolutionise the energy sector by addressing the challenges of achieving 100% hydrogen combustion in industrial gas turbines. The ability to produce monolithic designs with complex internal purging and cooling features is crucial for managing the high reactivity and rapid diffusion of hydrogen.

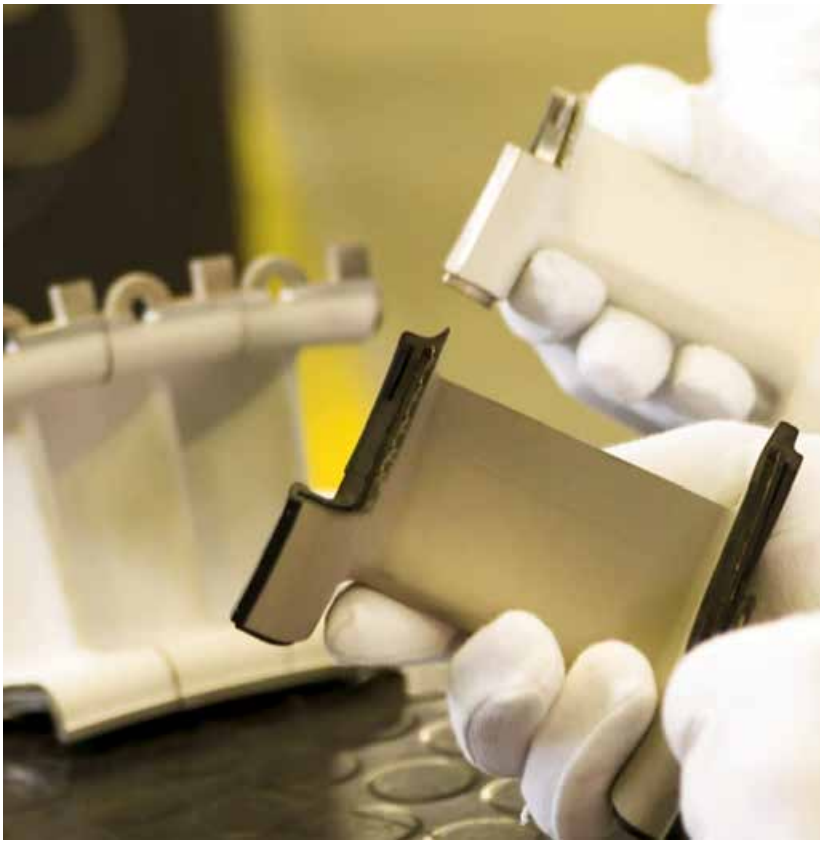

Fig. 12 Gas turbine vanes produced by Materials Solutions (Courtesy Materials Solutions)

Materials Solutions has recently delivered the first set of hydrogen burners to the HYFLEXPOWER project in France, where – for the first time globally – a Siemens Energy gas turbine is being run on 100% green hydrogen.

Beyond the positive impact of its products in improving efficiency, Materials Solutions is also making strides to continuously enhance the sustainability of its production processes. Based on Siemens Energy's research and in collaboration with its powder supply base, the company will recycle waste powder and solid support structures into virgin powder.

Outlook

Ten years after *Metal AM* magazine's first article, Materials Solutions has evolved from a pioneering prototyping company to a leading industrial producer of critical high-performance components for industrial applications, all while staying relentlessly focused on productivity, repeatability, and material properties.

In an environment where so many decided to wait and see, Materials Solutions remained committed to fully qualifying materials and the PBF-LB process. Now, it is reaping the rewards of its perseverance and forward-thinking approach.

As Materials Solutions looks to the future, it is poised for continued growth, driven by ongoing investments in cutting-edge technologies such as the new large-format PBF-LB machines. Its continued focus on high-temperature applications, notably to support Siemens Energy's carbon reduction initiatives, positions Materials Solutions as a vital player in the energy sector.

Additionally, with a business-case-driven investment model, the company is benefitting from opportunities nurtured over decades in the aerospace sector, where the advanced AM solutions it has developed are unlocking new applications and improving end-application performance. It sees future growth being driven by decarbonisation and has recognised that AM is an enabling technology for achieving reductions in carbon emissions.

Those seeking proof of whether Additive Manufacturing can enhance performance and significantly improve supply chain resilience, need look no further than Materials Solutions. With its strong track record and forward-looking strategy, the company is well-equipped to lead the AM industry into the next decade and beyond.

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Win or lose: A CEO's reflections on Artificial Intelligence and Additive Manufacturing

Artificial Intelligence is reshaping industries, and Additive Manufacturing is no exception. For CEOs, the challenge isn't just understanding AI's potential but strategically integrating it to drive efficiency, innovation, and competitive advantage. In this article, Henning Fehrmann, chairman and CEO of FEHRMANN Tech Group, considers AI's real-world impact on AM. Drawing from personal experience, he offers insights on how AM industry leaders can leverage AI to strengthen their businesses, adapt to market shifts, and stay competitive.

Artificial Intelligence is reshaping industries, and Additive Manufacturing is no exception. AI is changing how businesses operate, innovate, and compete. This shift raises important questions within the AM industry: How will AI impact existing business models, and how should companies adapt to increasingly dynamic environments?

As chairman and CEO of FEHRMANN Tech Group, I have spent seventeen years working at the crossroads of materials science, AI and industrial innovation. With a focus on applying AI-driven insights into practical solutions in materials development and manufacturing, I have been invited to share my perspective on the growing role of AI in Additive Manufacturing. I specifically discuss AI's opportunities, challenges, and implications for the AM industry, highlighting what I believe top-level decision-makers should be aware of. Further, I consider how senior executives within the industry may need to embrace AI as it becomes increasingly integrated into AM.

Innovation is in AM's DNA

Countries investing in R&D and scientific development face a common challenge: how to turn their investment in science into tangible benefits for society, such as jobs, safety, comfort, and GDP growth. Additive Manufacturing has been a prime example of successful science-to-business transfer. Despite its disruptive nature, which has challenged conventional manufacturing, AM players have successfully brought

Fig. 1 Henning Fehrmann is chairman and CEO of FEHRMANN Tech Group (Courtesy FEHRMANN GmbH)

the technology to industry readiness, overcoming numerous hurdles along the way.

AM was envisioned to revolutionise sectors such as automotive, aerospace, healthcare, and consumer goods. Its ability to create complex geometries and customised parts opened new horizons for design and production. The technology promised significant advantages: reduced material waste, shorter production times, and the potential for localised manufacturing. However, while many new developments hold such potential, we are all too aware of the limits and constraints that still exist.

To me, the reason for AM's success lay in the industry's DNA: visionary entrepreneurs and great engineers who believed in its potential and worked tirelessly to bring it to reality. Think back to the vibrant energy at past conferences, exhibitions, and industry gatherings, when AM was predicted to be a 'game changer' for almost everything that had to be produced.

The state of the AM industry today

We all know what followed. Overhype led to a lack of focus on business cases, resulting in unmet expectations and cancelled investments. AM has, so far, failed to establish itself as a significant production technology in industries such as aerospace, automotive, and complex part production for oil and gas. Even the brief resurgence during COVID-19, when resilient supply chains and decentralised production became strategic priorities, did not drive the established players to make meaningful improvements to integrate AM into production floors.

Naturally, the focus shifted to added value, tolerances, and quality standards – key factors for progress. Developments such as multi-laser machines, new materials, and industry-specific quality standards were necessary steps forward. However, it became clear to decision-makers in target industries that AM had lost its reputation as a driver of innovation. Worse still, many players – particularly in the Western world – became preoccupied with protecting their niche and celebrating incremental advancements rather than pursuing truly transformative progress. Meanwhile, conventional technologies, often dismissed as 'old and boring,' proved their capabilities with innovations such as gigacasting.

Today, established AM players face multiple challenges. Costs, size limitations, and materials still restrict wider adoption. At the same time, Chinese companies have built one of the most competitive and comprehensive AM markets, flooding the industry with lower-cost alternatives. As if that weren't enough, the rise of generative AI is reshaping the landscape entirely. Now is the time to reignite the spirit that took AM from a scientific experiment to an industrial application: the drive for disruptive innovation.

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The AI age

AI is undeniably influencing nearly every aspect of business and industry. It strongly affects all of our business models – the way we work, produce, develop and lead organisations. Just over two years ago, in November 2022, the release of ChatGPT marked what can be seen as the fifth industrial revolution: the so-called AI revolution. From a societal perspective, this was the beginning of the AI age – or should we call it the CCC (curiosity, creativity, and communication) age? This event signalled the dawn of an era in which AI will continue to challenge human dominance across all sectors of work and life.

In the early 2010s, a visionary debate between Google's Sergey Brin and Elon Musk revolved around whether advanced AI should surpass human intelligence (Brin) or whether humans should be safeguarded as the dominant species (Musk). This debate – ultimately influencing the founding of OpenAI – has now reached a pivotal moment in history. As AI continues to expand into new areas, it is not a question of if artificial intelligence will overtake human intelligence, but when.

The motto 'If you can't win, cooperate' seems to offer a guiding principle for coexisting with Artificial Intelligence. As the dominant species on Earth, it is our responsibility to establish a framework for life that upholds our values and laws, providing a solid foundation for peaceful coexistence.

AI for business

Since AI affects everything, it evidently affects business and AM, too. We are witnessing a disruption unlike any other, one that is more fundamental than past innovations

such as electricity or the internet. This challenge requires CEOs and top-level decision-makers to adapt fully to this shift.

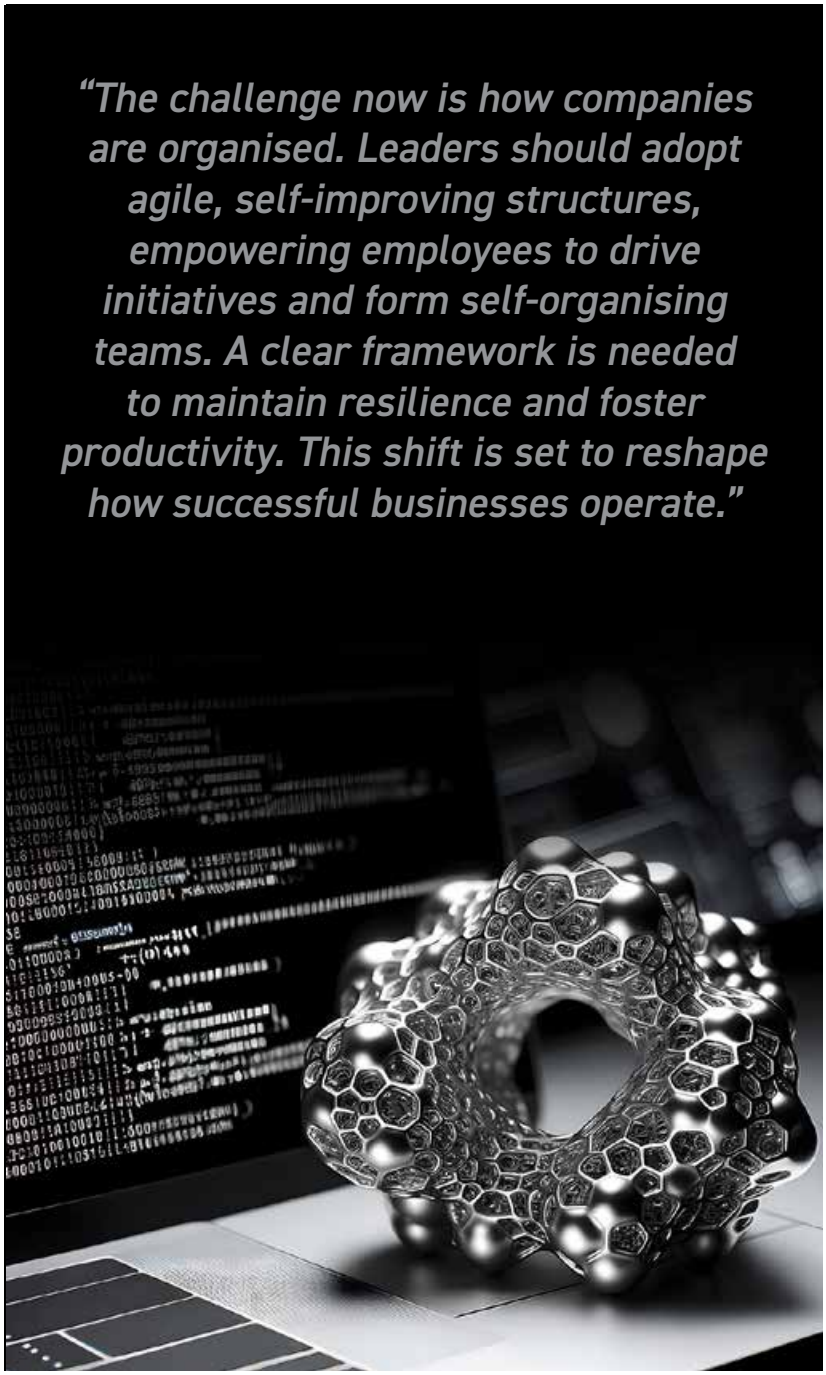
The first act of generative AI was about understanding the technology, advancing it, and experimenting with its capabilities. This phase lasted for about a year and led to the start of commoditising large language models (LLMs). Whether it's ChatGPT, Claude, Gemini, Llama, Mistral, or DeepSeek, there's now a range of sophisticated LLMs to choose from.

At the same time, the necessary infrastructure was being built. Investments in AI reached unprecedented levels globally, with companies like OpenAI (Microsoft), Gemini (Google), and Anthropic (AWS) leading the way. LLMs were deployed on the cloud to meet key organisational needs such as reliability, stability, and data security. These services have made generative AI viable for professional use.

This laid the groundwork for what Andreessen Horovitz and Sequoia Capital defined as Act 2 of genAI – focusing on solving real-world problems. This phase began in 2024, with companies tackling complex tasks across fragmented value chains.

As generative AI became enterprise-ready, many companies began with productivity improvements. Internal chatbots, like Enterprise GPTs, were implemented and filled with expert knowledge and company-specific data to expedite workflows and provide staff with quick answers to queries. The widespread acceptance of AI within organisations led to rapid adoption. Even where companies are hesitant to fully integrate generative AI, employees often use public LLMs like ChatGPT on their own, driving further adoption.

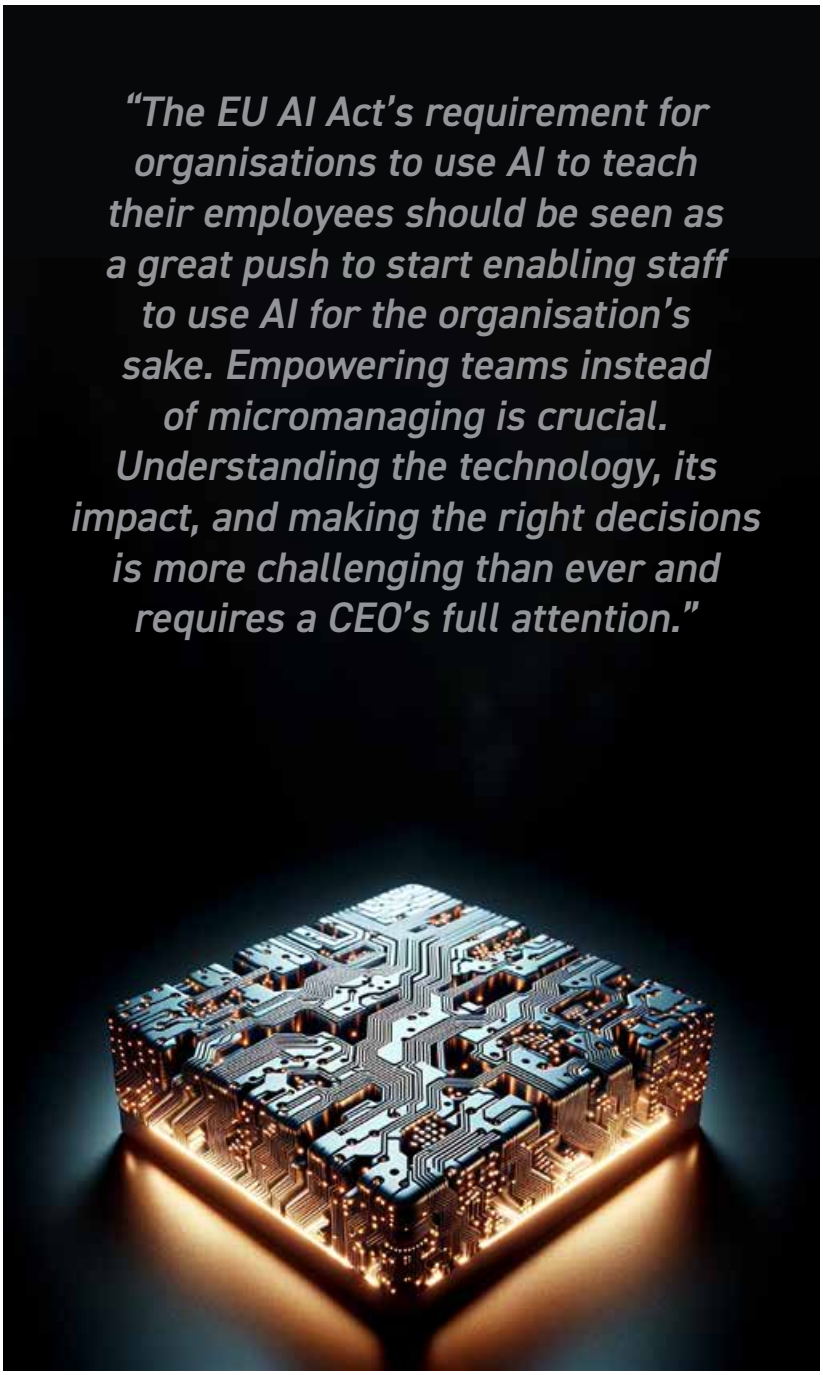
Productivity gains have been a key driver for many generative AI applications. By making knowledge more accessible and providing tools to improve efficiency, AI has streamlined operations across businesses. Early adopters were often marketing and communications departments, which rely on text-based tasks.



As new tools continue to emerge, leveraging generative AI to boost productivity is becoming essential.

The challenge now is how companies are organised. Leaders should adopt agile, self-improving structures, empowering employees to drive initiatives and form self-organising teams. A clear framework is needed to maintain resilience and foster productivity. This shift is set to reshape how successful businesses operate.

For context, when ChatGPT was released, I came across an article claiming that only three people were needed to create the next 'unicorn' company. While simplified, it highlights how AI enables small teams to drive rapid innovation and achieve success with fewer resources than was conventionally required.



AI for AM

Let's take a step back. As already discussed, we are living in an era where AI is transforming everything, and the AM industry is no exception. For decades, innovation and change have been central to AM, and there is an exciting opportunity to thrive if it can tap into the current wave of AI-driven transformation.

However, many of the players in our industry have lost this edge. Due to unmet expectations, AM companies have been optimised regarding financial KPIs to secure investments, reducing efforts toward the next big thing. Worse still, companies that had been known for driving innovation have shifted their focus to manifest their position, even stopping internal innovation from new players and scientific developments.

As a major shareholder of several companies and a CEO, I understand that a second-mover strategy avoids risks and investments that may not pay off. However, I fear this approach may not be sustainable in the long term. Without embracing AI's rapid pace of innovation, companies risk falling behind.

While the framework we need isn't fully established, I believe AI should be integrated into business performance. Beyond productivity gains, it educates organisations on using AI tools and agile development. This leads to company-wide understanding and acceptance of AI, benefitting those who adopt groundbreaking technologies early.

The EU AI Act's requirement for organisations to use AI to teach their employees should be seen as a great push to start enabling staff to use AI for the organisation's sake. Empowering teams instead of micromanaging is crucial. Understanding the technology, its impact, and making the right decisions is more challenging than ever and requires a CEO's full attention.

Accelerating innovation

Let's take another step back – solving real-world problems. What we could see in the past months was a shift from focusing on productivity gains through AI to tackling more complex tasks like product enhancement and development using AI. It needn't be an entirely new product, but enhancing the existing portfolio with features and functions that add significant value to the customers. To illustrate briefly, here are a few examples of how AI has solved real-world problems in AM:

Quality assurance of new machines before delivery

New industrial AM machines typically undergo comprehensive quality assurance, including standardised or custom testing. The larger and more expensive the machines, the more complex the testing phase, which often takes several weeks and ties up significant capital and internal resources. Using a software tool based on a generative AI-powered

algorithm and machine learning, this testing time has been reduced to mere days by feeding it with curated and experimental datasets.

In-operando quality control of printed parts

Quality control of additively manufactured parts has improved significantly in recent years, and with AI, its power increases. Deviations can now be quickly identified during the build process, stopping the entire build, guiding QA staff on what to test specifically, or even remedied automatically. This has unlocked previously unforeseen savings. By having more evidence on quality measures, final quality assurance now focuses only on areas where expert knowledge or evidence is lacking.

Ultrafast development of advanced materials

Traditionally, product development involved optimising geometries with standard materials, taking years for material development. AI has revolutionised this process, showing that optimal materials can be developed in hours and validated in days. For instance, a new printable material with unmatched levels of electrical conductivity was developed and validated in just two weeks. This was achieved through advanced machine learning, simulating materials from nano- to macrostructure, incorporating FEM for Powder Bed Fusion based on expert-curated data and rapid experimental validation.

A recent MIT study has shed light on AI's growing impact on materials development, revealing that AI-assisted scientists discovered 44% more materials than their non-AI-assisted counterparts. This advantage translated into a 39% increase in patent filings and a notable 17% boost in product innovation [1].

Ramping up series production fast

AI's impact is evident in its ability to optimise machine parameter settings, saving time and reducing the need for test builds, which previously blocked machines and delayed production. AI has empowered machine software, bringing significant value by enhancing efficiency and reducing delays.

There are three key requirements for all of these examples: reliability, domain knowledge, and security. Reliability has always been a significant challenge in building AI-powered tools for business. You simply can't afford to hand over tools to customers or staff that you can't trust. This is why tools like ChatGPT, which draw from the entire internet, are unsuitable for business. Even if the error rate is just 5%, that's still too much. As the saying goes, garbage in, garbage out. Input must be curated, and transparency and quality controls must be in place. And let's face it: you can't use one LLM for everything.

Expert domain knowledge will continue to be crucial for AI in business. While AI will undoubtedly take over more and more tasks, humans will still be needed. So much knowledge has yet to be published, and AI is only useful if you can trust the outcomes. If you can't assess the quality of AI's work, it's pointless.

Then there's security, especially data security. This is non-negotiable for any company. Cloud infrastructures have often been met with scepticism, particularly by organisations that rely on their expertise and know-how. It allows non-experts to take on tasks once reserved for specialists, which can pose a real threat if not managed properly. One bad decision and a company that has spent decades building expertise could lose everything. There's no choice but to embrace AI where possible, but the crucial questions are what tools to use, where to run them, and what data to feed into them.

There's no free lunch. Take DeepSeek – everyone knew its knowledge would eventually be accessible to Chinese authorities. The same applies to US-based LLM providers. Protecting your data has to be a priority. Day-to-day information can be handled differently from critical business knowledge, but organisations need to safeguard their core data. It's not surprising that many companies are now building hybrid infrastructures, even if the cloud is still an option. High prices are a concern, but the bigger issue is securing data.

But these decisions aren't without consequences. You'll need to invest in your own infrastructure, especially

"There's no free lunch. Take DeepSeek – everyone knew its knowledge would eventually be accessible to Chinese authorities. The same applies to US-based LLM providers. Protecting your data has to be a priority. Day-to-day information can be handled differently from critical business knowledge, but organisations need to safeguard their core data."

Henning Fehrmann, chairman and CEO of FEHRMANN Tech Group and its subsidiary, FEHRMANN MaterialsX, is recognised for his expertise in materials science, AI, AM, and augmented reality.

Founded in 1895 in Hamburg, FEHRMANN Tech Group is a family-led company that has evolved into a high-tech business group. The group develops advanced materials and AI-powered tools for materials innovation, integrating digital information into practical applications. Notable innovations include high-sea-safe windows for Onassis' yacht Christina, the MatGPT® AI platform for rapid materials development, and advanced aluminium solutions for the automotive industry.

FEHRMANN MaterialsX is one of the world's most active aluminium alloy developers, with a decade of experience in AM materials, including the AlMgty® family of aluminium alloys. These alloys, designed as a next-generation alternative to AlSi10Mg, are optimised for PBF-LB and offer corrosion resistance as well as higher strength and ductility. They are also capable of being processed by casting and extrusion.

Henning serves as chairman of the Innovation Advisory Committee at DESY (Deutsches Elektronen-Synchrotron, Germany's Electron Synchrotron), spokesman for 3D-Druck Nord, and an advisory board member of the Center for High-Performance Materials and the Federal Institute for Materials Research and Testing. Additionally, he played a role in founding the Artificial Intelligence Center in Hamburg. His contributions have earned him recognition, including Hamburg Person of the Year in Business (2022) and Family Entrepreneur of the Year in the Hamburg Metropolitan Region (2011). Additionally, he is the CEO of YNICORN, an AI fintech start-up that uses automated data analysis to assess business model maturity.

"It's tough to keep up with and even harder to predict. However, not adapting is simply not an option. The cost of staying behind has already been evident in the decline of some great car manufacturers. The old strategy of being a follower no longer works – investing to catch up later is unaffordable. The good news is that your competitors have no choice but to adapt, too."

since internal development is no longer enough. With new tools emerging every week, the key is forming strategic partnerships with AI providers offering the best-in-class tools that are responsible and trustworthy. These tools must be infrastructure-agnostic, and you'll likely need to increase your budget to ensure redundancies.

AI in the (near) future

I don't want to focus too much on the improvements and disruptive developments that you are probably already familiar with. Nobody knows when we will reach Artificial Super-intelligence – the direction is still irreversible. However, highlighting a few developments may be helpful:

- AI will be used and implemented everywhere. Agents will solve rows of tasks, automating entire processes, including quality checks. Custom LLMs or similar techniques will be used regarding the type of tasks added by specialised tools from experts providing best-in-class solutions for verticals such as metal or plastics Additive Manufacturing combined with industry-specific applications.
- Local LLMs may win against the cloud-based competitors due to the aforementioned reasons.
- New technologies of generative AI beyond current techniques, such as knowledge graph-based or neurosymbolic AI, will enhance or even disrupt the existing tools.
- Finally, I hope that 'responsible AI' will become a pleonasm, at least for business.

Concluding thoughts

Since the release of ChatGPT in November 2022, the speed of innovation and disruption in AI has been staggering. It's tough to keep up with and even harder to predict. However, not adapting is simply not an option. The cost of staying behind has already been evident in the decline of some great car manufacturers. The old strategy of being a follower no longer works – investing to catch up later is unaffordable. The good news is that your competitors have no choice but to adapt, too.

On the flip side, AI presents an opportunity to outperform your competitors and venture into new areas. Our industry, once highly innovative, still boasts committed and enthusiastic employees. This innovation DNA is key to adopting AI successfully and winning in the AM space. But what does this mean for a CEO? A lot.

1 A CEO must pay full attention to Artificial Intelligence and understand the leading AI technologies, including its opportunities and limitations. Competence is king, especially in a VUCA (Volatility, Uncertainty, Complexity, and Ambiguity) world with accelerated change. Follow experts, on platforms such as LinkedIn, and keep updating yourself.

2 Establish a long-term vision for your company – what we call a BHAG (Big Hairy Audacious Goal). It should be forward-thinking and incorporate AI's future capabilities.

3 Foster a first-mover culture of curiosity, agility, and fast adoption – vital for the company's survival. Define how failure is tackled (not punished).

4 Create an AI framework that secures your domain expertise and unique selling propositions (USPs). Ensure complete control over your intellectual property and expertise.

5 Empower your staff to automate processes wherever possible. Productivity gains should come from those who understand the work best, with an emphasis on lifting requirements and improving efficiency.

6 Focus on R&D and product development with ambitious goals for speed and AI implementation. Stop internal development that lies outside your core competencies and instead prioritise the evaluation of external AI tools and solutions. Developing in-house is no longer viable, as new tools emerge almost daily.

7 Build a culture of collaboration and invest in strong and sustainable partnerships with trusted partners that provide best-in-class AI solutions and commit to responsible AI.

The current times seem challenging, but they offer unique chances and opportunities. And the risks are not as high as you would imagine. As domain knowledge, experience, and reputation remain crucial to business success, the chances are good that incumbents will strengthen their positions and open new fields of business.

As AI continues to influence Additive Manufacturing, companies will need to adapt to these changes to stay competitive. Integrating AI should be viewed as a practical step for improving operations and addressing current challenges rather than a distant aspiration. By approaching the technology thoughtfully, businesses can maintain relevance in the evolving Additive Manufacturing industry.

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AMS 2025 New York: A reality check for the Additive Manufacturing industry

AMS 2025, organised by 3Dprint.com and Additive Manufacturing Research, delivered a stark wake-up call for the Additive Manufacturing industry. Once hailed as a disruptive force, AM is struggling to meet high expectations, with large-scale industrial adoption progressing more slowly than anticipated. The event revealed a disconnect between bold financial projections and market realities, leading to a crisis of confidence among investors and stakeholders. Tali Rosman reports on an industry at a crossroads, facing hard truths and recalibrating for the future.

The opening sessions at AMS 2025 set a stark tone, providing a long-overdue reality check for the AM industry. Yoav Zeif, CEO of Stratasys, addressed the industry's struggle to meet the ambitious financial projections initially promised to investors. Despite being touted as a transformative technology, large-scale industrial adoption of AM has progressed slower than anticipated – a trend that has not gone unnoticed by financial markets.

One of the most striking insights Zeif shared was precisely how vast the gap between expectations and reality is. SPAC-funded AM companies had projected nearly $2 billion in revenue for 2024. However, actual estimates now fall below $400 million – an 80% shortfall (Fig. 1). Even more alarming, the market capitalisation of these companies has plummeted from $16.42 billion to just $141 million – a staggering 99% decline. The numbers highlight a sobering truth: too many AM companies have overpromised and under-delivered, fuelling a crisis of confidence among investors and industry stakeholders.

Following Zeif's presentation, Scott Dunham, Additive Manufacturing Research (AMR), presented updated market forecasts, revealing further recalibrations in AM's expected growth trajectory and lowering the industry's CAGR (Fig. 2). This reflects a broader sentiment at AMS 2025, where it was clear that while AM still holds promise, it has not yet delivered the rapid disruption many had anticipated.

While all of this is true in the West, competition from Chinese AM companies is accelerating. Backed by aggressive government support

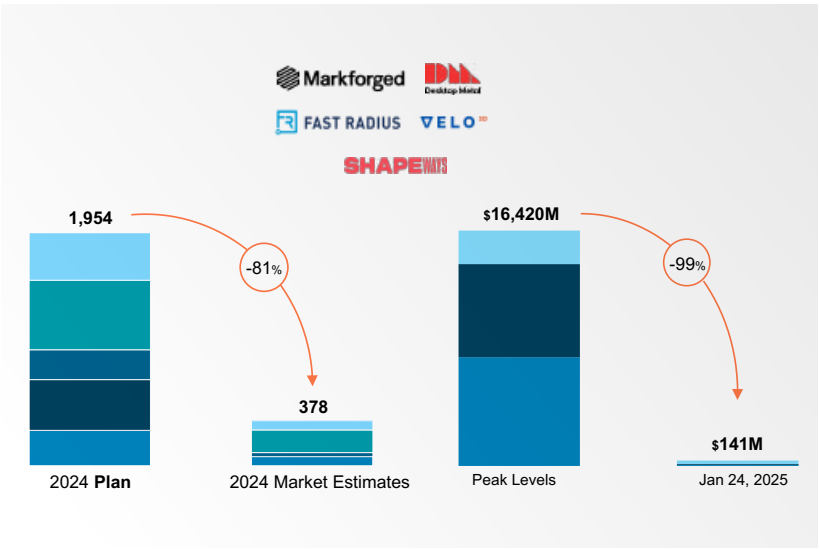

Fig. 1 Unmet promises. Left: the cumulative revenue of five SPAC-funded AM companies was projected to reach $2B by 2024, but actual revenue fell below $400M. Right: valuations have plummeted (Courtesy Yoav Zeif/Stratasys)

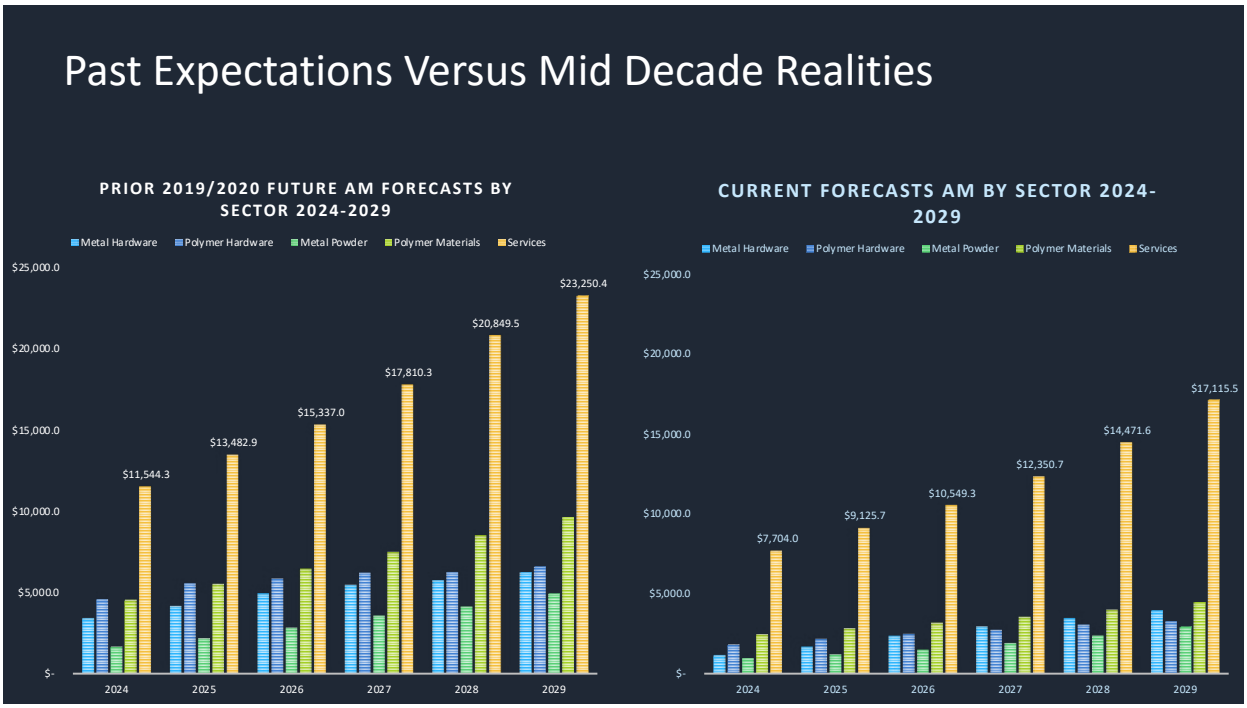

Fig. 2 Revised AM industry forecasts as presented by Scott Dunham, Additive Manufacturing Research, at AMS 2025 (Courtesy AMR/3Dprint.com)

> *"...AM is not here to replace traditional manufacturing but to complement it. Brigitte de Vet-Veithen from Materialise captured this sentiment perfectly, urging AM firms to stop trying to win the Oscars for best performance and instead aim for best supporting role."*

and cost-competitive manufacturing, several Chinese firms have made significant strides – not only in the low-end market but also in high-end technologies such as Laser Beam Powder Bed Fusion (PBF-LB). This influx of lower-cost machines, bolstered by government subsidies and cost-competitive manufacturing, is making it harder for Western AM companies to compete.

The message to AM companies was clear: the industry needs to transition from disrupting to optimising manufacturing. BMW, the US Navy, and other major users echoed the same message: AM is not here to replace traditional manufacturing but to complement it. Brigitte de Vet-Veithen from Materialise captured this sentiment perfectly, urging AM firms to stop trying to win the Oscars for best performance and instead aim for best supporting role.

With these realities setting in, the industry stands at a pivotal juncture. If AM companies want to regain investor trust and drive broader industrial adoption, they will need to focus on proving reliability, improving cost-efficiency, and seamlessly integrating into established manufacturing workflows.

National security and AM's strategic role

A central theme at AMS 2025 was AM's role in national security, defence, and supply chain resilience. Matthew Sermon from the US Navy highlighted that while AM is making progress in defence applications, there is still a long way to go. The Navy has expanded its use of AM for submarine components, reporting that over 150 AM-produced parts are now in service, compared to fewer than ten just a year ago.

While AM is already playing a role in producing spare parts and reducing lead times, the DoD acknowledged that adoption at scale is still not occurring, citing bureaucratic hurdles, qualification challenges, and the slow-moving nature of defence procurement.

With that, Adele Ratcliff from the Department of Defense Office of Innovation Capability and Modernization highlighted that reshoring manufacturing is only a part of securing the supply chain. While there is a growing push to produce more parts using AM in the US, the materials supply chain remains a weak link. Many of the raw materials needed for AM – and for metal powders, in particular – are sourced internationally, with China controlling 90% of rare earth metals. Without a stronger domestic supply chain, AM's potential to enhance national security will remain limited.

For AM to truly support national security, it is not enough to have Additive Manufacturing capability in key locations. Instead, the entire ecosystem, from material supply to post-processing, needs to be accounted for. Government initiatives in the US and Europe are working towards this goal, but there is still a gap between policy ambitions and industrial execution.

While AM's role in defence is growing, it is worth noting the scale at which the commercial sector is adopting AM. For comparison, Deutsche Bahn has deployed 150,000 additively manufactured parts across 700 identified use cases, BMW mentioned 500,000+ series parts produced, and Airbus cited over 10,000 metal AM parts in use. While these figures are unrelated to national security and are not 'apples to apples' with the part numbers referred to by Sermon, they provide a helpful benchmark, demonstrating that while defence adoption is increasing, it still has a long way to go before it reaches this level of industrial-scale implementation.

Several promising initiatives were highlighted in this context. One is the upcoming launch of the Future Alloy Study & Testing (FAST) Center, a public-private partnership between Scot Forge and the Department of Defense. Designed to accelerate the development and qualification of advanced metal alloys for defence applications, the FAST Center will be capable of conducting thousands of

Fig. 3 Materialise's Brigitte de Vet-Veithen: AM firms should stop trying to win the Oscars for best performance but instead aim for best supporting role (Courtesy AMS 2025)

Fig. 4 Matthew Sermon from the US Navy highlighted that while AM is making progress in defence applications, there is still significant progress to be made (Courtesy AMS 2025)

"For AM to truly support national security, it is not enough to have Additive Manufacturing capability in key locations. Instead, the entire ecosystem, from material supply to post-processing, needs to be accounted for."

Fig. 5 Delegates at AMS 2025 (Courtesy AMS 2025)

tests within weeks, significantly reducing traditional timelines.

Another notable initiative is the Stifel North Atlantic AM-Forward Fund, recently launched to provide growth capital to small and mid-sized US manufacturers in the aerospace and defence sectors, with a focus on AM. Operating under the SBA-DoD SBIC Critical Technologies (SBICCT) initiative, the fund leverages private capital alongside SBA support to advance critical national security technologies. It offers structured debt financing with equity-linked instruments and received its SBIC licence in October 2024. Key investors include Lockheed Martin and GE Aerospace.

"The 'pure printer play' is struggling financially, and panellists stressed that application-driven business models are more sustainable. Companies focusing on solutions – delivering high-margin, AM-enabled products – capture more value than those relying solely on machine sales."

How AM machine OEMs can win: focus on value capture and integration

At AMS, industry leaders emphasised that AM machine OEMs in AM are most successful when they focus on value capture through applications rather than hardware sales. Panellists, investors, and industry leaders emphasised the importance of aligning revenue models with customer outcomes, integrating seamlessly into production workflows, and shifting from merely selling technology to delivering end-to-end solutions.

The 'pure printer play' is struggling financially, and panellists stressed that application-driven business models are more sustainable. Companies focusing on solutions – delivering high-margin, AM-enabled products – capture more value than those relying solely on machine sales. A prime example is LightForce Orthodontics, which uses AM to produce custom braces and is, in fact, a dental company, not an AM company. Other examples include Seurat and Fabric8Labs – both AM technology companies – who emphasised their application-first strategies, focusing on delivering high-value parts rather than selling printers.

Carbon offered a different 'twist.' The company's CEO shared that the company's salespeople are measured on customer usage and not on 'box sales,' directly connecting their compensation to customer success.

The conference also revisited a familiar but underutilised concept: Total Cost of Ownership (TCO). Several speakers stressed that evaluating AM through TCO rather than cost-per-part could expand the market's potential tenfold. The value of AM lies beyond unit costs; it includes benefits such as faster time-to-market, improved performance, simpler logistics (e.g. due to part consolidation) and supply chain security. However, while TCO adoption is a goal, it remains aspirational rather than standard practice, with one panellist noting that "TCO

Fig. 6 The CEO Roundtable at AMS 2025: Left to right: Troy Jensen (Cantor Fitzgerald), Maxim Lobovsky (Formlabs), Brigitte de Vet-Veithen (Materialise) Philip DeSimone (Carbon), Yoav Zeif (Stratasys), and Jeffrey Graves, 3D Systems (Courtesy AMS 2025)

thinking is still more discussed than implemented."

Despite AM's advantages, BMW reminded attendees that material costs remain a significant barrier to AM's broader adoption in production environments, noting that without substantial reductions in material costs, AM will necessarily remain limited to prototyping and high-end applications. Further, BMW stressed that AM OEMs should stop thinking that they deserve special treatment.' To be in production, AM OEMs must step up – not just in materials prices but also in machine reliability and uptime, in integrating into existing software tools, and in automation. In short, integrate instead of isolate.

"BMW reminded attendees that material costs remain a significant barrier to AM's broader adoption in production environments, noting that without substantial reductions in material costs, AM will necessarily remain limited to prototyping and high-end applications."

This sentiment was also expressed in the 'The Industrialization of Additive for Aerospace' panel, where, in the context of PBF-LB, it was discussed that part consistency is unfortunately 'not always the norm.' It was noted that this is not an issue with machining, for example, yet it is commonplace with AM, and indeed this is a significant barrier to broader adoption. Briefly put, AM needs to be held to the same standards as other manufacturing technologies.

This means business model innovation is as crucial as technological innovation. Companies that build models aligning their success with customer outcomes – through application-first strategies, a focus on customer success, and integrated production workflows – will lead the next chapter of AM.

A final crucial point is the need for financial discipline. In recent years, many AM companies, supported by cheap capital, have overspent themselves into financial instability. Shapeways provides a stark example of this. The company went public in 2021 through a SPAC merger, resulting in a highly inflated valuation. However, it filed for bankruptcy in 2024, losing hundreds of millions of dollars, only to be bought out of bankruptcy shortly after. Marleen

Fig. 7 AM investors were well represented on the AMS 2025 programme (Courtesy AMS 2025)

> *"...investors now demand more structured, value-driven business models. A key message was the need to position AM companies as product-focused businesses rather than just technology providers."*

Vogelaar, CEO of 'Shapeways 2.0,' reflected on the excessive corporate spending and high 'Wall Street' salaries that characterised 'Shapeways 1.0,' noting that the new Shapeways is significantly more financially disciplined and profitable.

Investor sentiment: AM startups must pivot

AMS featured speakers from several investment firms, including AM Ventures, Bessemer Venture Partners, Eclipse, Exposition Ventures, AE Industrial, and North Atlantic Capital. On a positive note, the high attendance from investors in spite of the disappointing performance of past AM investments signifies there is still faith among investors in the potential of AM. However, investors now demand more structured, value-driven business models. A key message was the need to position AM companies as product-focused businesses rather than just technology providers. Several AM companies have echoed this investor investment, from Stratasys' Lego blocks example – customers want the 'assembled Lego blocks' (i.e. the product, and not the individual blocks to put together themselves) – to the previously mentioned examples of Seurat and Fabric8 Labs.

Scalability and long sales cycles remain key challenges, making AM hardware startups less attractive to traditional venture capitalists accustomed to rapid software-style growth. Investors agreed that funding will increasingly favour companies that integrate AM into larger industrial ecosystems rather than pure-play AM machine manufacturers.

On the private equity side, the focus seems to be more on manufacturing capacity, i.e. contract manufacturing rather than Additive Manufacturing technologies. However, owners of contract manufacturing firms should be aware that the days of exiting with lofty valuations, like Stratasys' acquisition of SolidConcepts in 2014, are behind us. Private equity investors are financial backers, not strategic acquirers; they are now prioritising lower multipliers with a focus on profitability. In the 'Private Equity Perspective' panel, Eugene Kim from AE Ventures focused on the need for "confidence in free-cash-flows." At the same time, Mark Morrissette from North Atlantic Capital (previously mentioned) spoke about its focus on EBITDA-positive companies (targeting $1-10 million EBITDA companies).

Workforce development and skill shortages

One of the more pressing concerns discussed at AMS 2025 was the skills gap in AM. While AM positions itself as a solution to the manufacturing labour shortage (a true pain point), AM brings its own workforce development challenges. While adoption is growing, companies are struggling to find engineers, technicians, and designers with AM-specific expertise. From AM companies such as Materialise to users such as Mayo Clinic, the lack of qualified professionals was mentioned as a key factor slowing down adoption in many sectors.

Automation is emerging as a solution, especially in post-processing, where much of the labour burden lies. Advancements in automated depowdering, support removal, and

finishing techniques will help scale AM adoption while reducing the dependency on skilled labour.

As AM grows, addressing workforce development will be just as critical as improving technology to ensure sustainable, long-term industry growth.

Sustainability in AM: expanding the conversation

Sustainability was widely discussed at AMS 2025. Specifically, Deutsche Bahn and BMW provided compelling case studies on how AM reduces material waste, lowers energy consumption, and enables decentralised manufacturing – all of which contribute to reducing emissions in supply chains.

Despite its potential, AM is not yet a primary sustainability driver in most industries, with cost and performance remaining the dominant considerations. For AM to be recognised as a sustainability leader, companies must clearly link AM adoption to measurable carbon reductions and supply chain resilience metrics.

AI's role in AM: evolution, not revolution?

AI was another hot topic at AMS 2025 – with an emphasis on *another*. While software conferences are dominated by AI, the AM industry – by and large – perceives AI as an enabler rather than a disruptor. Panellists stressed that AI alone will not transform AM, but when paired with established workflows, it can streamline design, improve process efficiency, and reduce costs.

Among machine manufacturers, HP stood out for its focus on AI. It showcased AI-driven advancements that reduce design time from hours to minutes, cutting costs and improving part quality. HP highlighted AI's role in sintering simulation and process development, demonstrating how machine learning models trained on past builds predict and resolve thermal anomalies before printing.

"The key to success now lies in solving tangible problems, improving customer outcomes, and fully embedding AM into industrial ecosystems. As the industry matures, the focus must shift from flashy promises to delivering results."

Several speakers warned against overhyping AI. Rather than positioning AI as a market differentiator, panellists advised AM companies to showcase how AI drives measurable cost savings, efficiency, and production reliability. The message: AI is a powerful enabler, not a silver bullet. Its real value lies in its ability to accelerate design, reduce waste, and optimise production workflows – but success depends on execution, not promises.

The road ahead for AM

The AMS 2025 conference made it clear that AM is transitioning from promise to proof. Across industries – defence, healthcare, automotive, and aerospace in particular – AM is no longer about disruption but about integration and impact.

While the industry continues to grapple with financial shortfalls and investor scepticism, there is still room for optimism. Narratives are shifting from technology-led to value-led. However, narratives alone will not suffice; investors are increasingly demanding more clearly defined paths to profitability, while customers expect more tangible outcomes and a better ROI.

Opportunities are clear, but execution is complex. Moving from a general-purpose machine sales model to a business model that aligns with customer value and customer success is hard, but several companies are starting to crack the code for this – and investors, in spite of high scepticism following the disappointment of the recent returns, are still willing to listen (and write cheques).

National security is a motivator but not a game-changer in itself. The American and European dependency on offshore manufacturing has been developing for decades, and it will not return overnight. Further, AM still has its challenges to overcome, from performance and reliability through standardisation to workforce development.

The key to success now lies in solving tangible problems, improving customer outcomes, and fully embedding AM into industrial ecosystems. As the industry matures, the focus must shift from flashy promises to delivering results. The future of AM will belong to those who integrate and execute, not those who rely on hype: integrate, don't isolate.

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Optimising powder removal in PBF-LB Additive Manufacturing: A Digital Twin approach

As Additive Manufacturing pushes the boundaries of design, post-processing remains a major challenge – in particular powder removal in Laser Beam Powder Bed Fusion (PBF-LB). But what if the digital twin of a part could not only optimise its design, but also predict and streamline powder removal? Here, Joseph Kowen explores how Solukon's SPR-Pathfinder software achieves this, using advanced simulation to map powder flow and automate depowdering, ensuring that even the most intricate designs remain manufacturable.

Advocates of Additive Manufacturing have long claimed that 'complexity is free' when it comes to AM design. The economic argument embedded in this statement is that AM allows for the production of complex products without significant increases in cost or effort. In conventional manufacturing, adding complexity, such as intricate designs or customisation, usually increases costs significantly. Since Additive Manufacturing builds parts layer by layer from the bottom up, as the promise goes, even the most unconventional engineering concepts can be brought to life with a simple click in Computer-Aided Design (CAD) and 'printed' with little further thought.

A simple concept can be tarnished by reality. And so it is with Additive Manufacturing. It is widely acknowledged that the downstream processing of AM parts is a headache, and even AM's most enthusiastic proponents generally underestimate the costs. Famously, the post-processing of AM parts has been called the industry's 'dirty little secret.' Given that post-processing can account for anywhere between 30% and 70% of the total cost of a part, depending upon the design and the AM technology used, post-processing could easily also be referred to as AM's *expensive* little secret. The percentage of the total cost attributed to post-processing is generally higher for metal AM than for polymer applications.

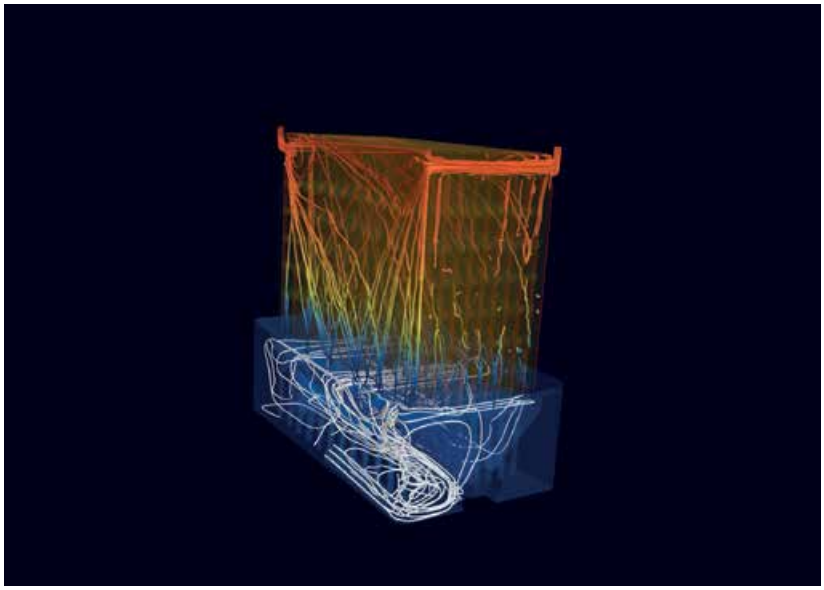

Fig. 1 With AM, even the most complex components can be created, but can they be depowdered? Developed by Siemens in collaboration with Evonik, INERATEC, and the Karlsruhe Institute of Technology, the intricate internal channels inside a shoebox-sized chemical processing device illustrate well the challenge faced (Courtesy Siemens)

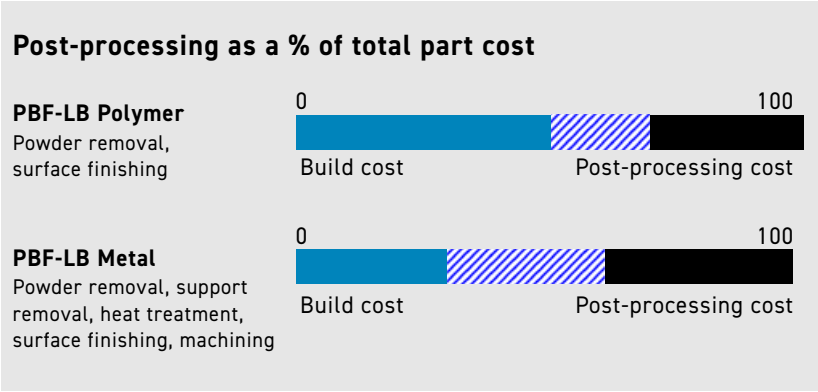

Fig. 2 Estimated post-processing costs compared to build costs

> *"Automated solutions involving vibration, knocking and rotation, if used indiscriminately, can potentially cause damage to parts, and different powders could behave in various ways."*

The pain of powder removal

This topic has been widely covered, including in this publication, highlighting the necessity of adopting an active powder management strategy for AM, particularly for Powder Bed Fusion. The reasons for action and methodology in powder management are extensive. Reactive materials pose a risk of explosion. Small particles of all powders in the work environment, including airborne particles, are an occupational and health risk for workers in the facility. Powder wastage and high labour costs for handling and removing residues are indirect cost factors that can render many AM applications economically unviable. Failure to remove powder deposits can complicate downstream processes, such as support removal and heat treatment. It can cause a part to be defective or to fail regulatory approval. Lower yield due to unwanted powder residues is very costly. Finally, reusing powder improves the sustainability of the process.

AM machine manufacturers have generally not fully addressed powder-related challenges, leaving third-party suppliers to step in with powder removal solutions of varying sophistication.

Given that the preoccupation with powder removal and management has driven many AM users to adopt some of the solutions available in the market, one would expect that the cumulative industry knowledge and experience on the topic would have gradually mitigated many of the typical powder issues. However, as with many innovative technologies, there is a learning curve. Automated solutions involving vibration, knocking and rotation, if used indiscriminately, can potentially cause damage to parts, and different powders could behave in various ways.

In short, inexperienced use of unsophisticated depowdering methods may not provide solutions to all powder issues. Even the most experienced powder removal solution providers are still learning and continuously improving based on feedback and success stories reported by an expanded user base. The more users continue to adopt these solutions, the greater their appreciation of the challenges will be, and the sooner they will be able to offer a better understanding of the factors that lead to better results.

Beyond the learning curve dynamic just described, there is another less intuitive reason why powder removal is, in some cases, becoming more complicated. The reason lies in the growth of a body of knowledge called Design for Additive Manufacturing (DfAM). Among the leading DfAM advantages, we routinely hear the arguments pertaining to increasing part complexity, lightweight design, and part consolidation. As DfAM gains traction among product developers, designs are increasingly pushed to their limits. With a deeper understanding of AM's benefits, engineers are increasingly exploring design boundaries, enabling the creation of parts that are beyond the reach of traditional manufacturing.

As DfAM becomes more established, designs are pushed further, making powder removal increasingly complex. While a virtual design can embrace (almost) anything a fervent imagination can dream up, and that virtual design can almost always be additively manufactured, the question then quickly becomes: can the part be post-processed and used as its designers intended? AM designs, it seems, have limits.

In short, the more we deploy the principles of DfAM, the greater the challenge of removing all powder residues. As designs become more complex, it's essential to accept these limitations, learn from them, and work within them to make the most of what AM can truly offer.

Design for post-processing

Designing with post-processing in mind can reduce AM costs, particularly for powder removal (Fig. 3). In metal AM, this means that successful product designers need to give thought in advance to several key process limitations. The limitations are a function of the technology being used to manufacture the part,

and considerations will be different for metal Binder Jetting than for PBF-LB. Even electron beam PBF will have other considerations than those relevant to PBF-LB due to the different methods of support and powder removal in each process. The takeaway is clear: the more a designer understands the intricacies of the AM process, the better the processing strategy, and the lower the part cost.

Predicting powder behaviour and removal

What if there was a tool that allowed AM operators to simulate and automatically pre-calculate the removal of powder from inside a part made by PBF-LB? In other words, how could the digital twin of a part be used not just for production but also for post-processing? Solukon Maschinenbau GmbH, a pioneer in powder removal technology for Additive Manufacturing, has commercialised an easy-to-use software tool for doing just that. The solution, called SPR-Pathfinder, was first developed in 2018 under the name SiDAM in collaboration with Siemens, which wrote the algorithm that lies at its heart. The driving force behind its development was Christoph Kiener, Principal Key Expert – Functional Product Design & Realization at Siemens. Solukon provided the platform and means for realising the output from the algorithm. SPR-Solukon's customers and partners tested Pathfinder for several years. Siemens owns the patent rights to the depowdering process, but Solukon finally acquired the source code and has held an exclusive license to the software since 2021. Since then, Solukon has further optimised the software and equipped it with new features.

Solukon's solution

Solukon's early development of industrial solutions for the depowdering of metal AM parts led to the introduction of the SFM-AT800 in 2015 (Fig. 4),

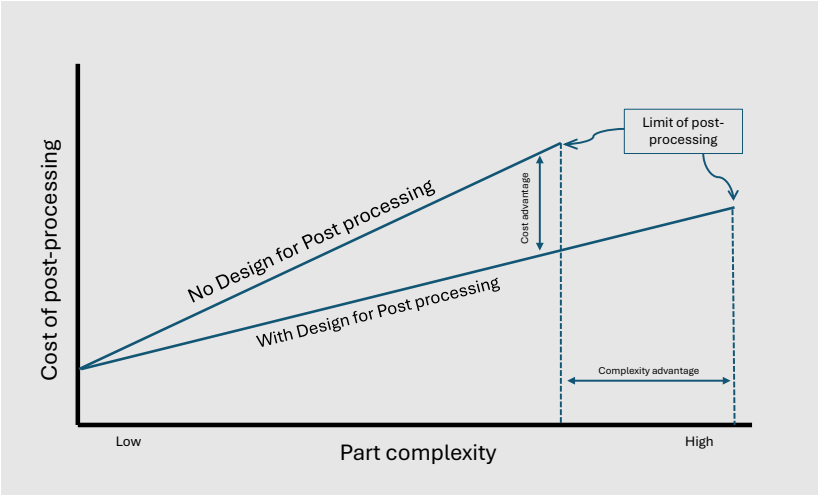

Fig. 3 Designing for post-processing - advantages

Fig. 4 A Solukon SFM-AT800-S machine (Courtesy Solukon)

"What if there was a tool that allowed AM operators to simulate and automatically pre-calculate the removal of powder from inside a part made by PBF-LB? In other words, how could the digital twin of a part be used not just for production but also for post-processing?"

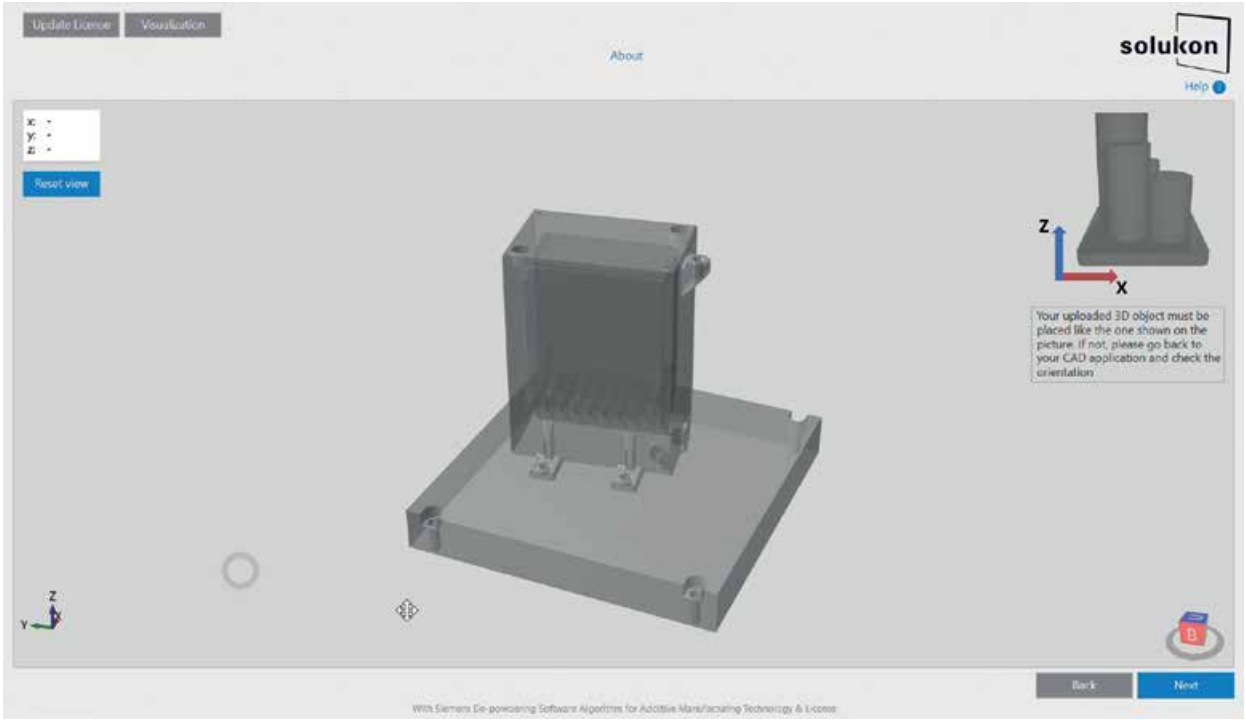

Fig. 5 The Pathfinder interface, showing the loading of the CAD file relating to the chemical processor shown in figures 1, 6, and 8-11) (Courtesy Solukon)

the AM industry's first automated machine for powder removal. This was a machine developed in response to market demand, with industrial companies turning to Solukon to address the issue of removing powder residues from metal AM build plates.

At the time, the main issue was how to remove the particles from inside complicated support structures. The solution was to automate the depowdering process by placing the build plate and parts into an enclosed environment, frequently inert, and mechanically manipulating it to release hard-to-clean and hard-to-reach residues. The particles were initially agitated or fluidised through pneumatically-driven mechanical vibration, assisted by gravity and the rotation of the build plate through different positions to maximise the powder flow. The company later added high-frequency knocking, which worked in parallel with vibration and was designed to loosen clumps of powder stuck inside the deepest recesses of the build through controlled hammer action.

> *"The concept of SPR-Pathfinder is to simulate or pre-calculate the extraction of each particle of powder from inside the AM parts. The interior of the part could be a channel designed for a functional purpose, such as cooling channels in tooling or complex inner surfaces of a heat exchanger."*

More recently, it has added ultrasonic excitation to its repertoire, which excites the powder particles and readies them for transportation out of the part. This is assisted by gravity through the continuous rotation of the build plate.

How SPR-Pathfinder works

The concept of SPR-Pathfinder is to simulate or pre-calculate the extraction of each particle of powder from inside the additively manufactured parts. The interior of the part could be a channel designed for a functional purpose, such as cooling channels in tooling or complex inner surfaces of a heat exchanger. It could also be an interior space created at the point where a support structure joins the part to the build plate. The steps to operate the software are straightforward:

Loading the CAD file

The CAD file of the entire build, including the base plate, is loaded into the Pathfinder software in STL format (Fig. 5). The build can consist of a single part, multiple copies of

the same part, or a collection of different parts.

Selecting parameters
Parameters such as the powder used in the build process are selected. Pathfinder is compatible with Solukon depowdering systems, including SFM-AT350, SFM-AT350E, SFM-AT800-S, SFM-AT1000-S, and the recently introduced SFM-AT1500-S. These parameters allow the algorithm to automatically generate a tailored path and cleaning protocol for operating the machine.

Running the software
Pathfinder runs to create a machine path and cleaning protocol, optimising powder removal from internal part cavities (Fig. 6). It operates locally on a non-networked computer requiring a minimum of 32 GB of RAM, though more powerful systems will process the simulation faster. The time to run the algorithm varies from a few minutes to several hours, depending on part complexity and the power of the processor.

Identifying powder removal issues
Pathfinder can identify areas where powder removal is not possible due to intricate internal geometries. For instance, a complex heat exchanger may have an opening that is too small for powder to exit. The software highlights these bottlenecks, enabling users to predict cleaning difficulties before a build begins.

Generating the cleaning protocol
After the simulation, the software generates a cleaning protocol that is loaded into the Solukon machine for use in the depowdering cycle. If successful, the protocol ensures all powder is removed in the shortest time possible.

This highlights the need for deeper insights into powder behaviour at a granular level to optimise depowdering. Grain-by-grain simulation ensures even the most complex parts can be cleaned effectively.

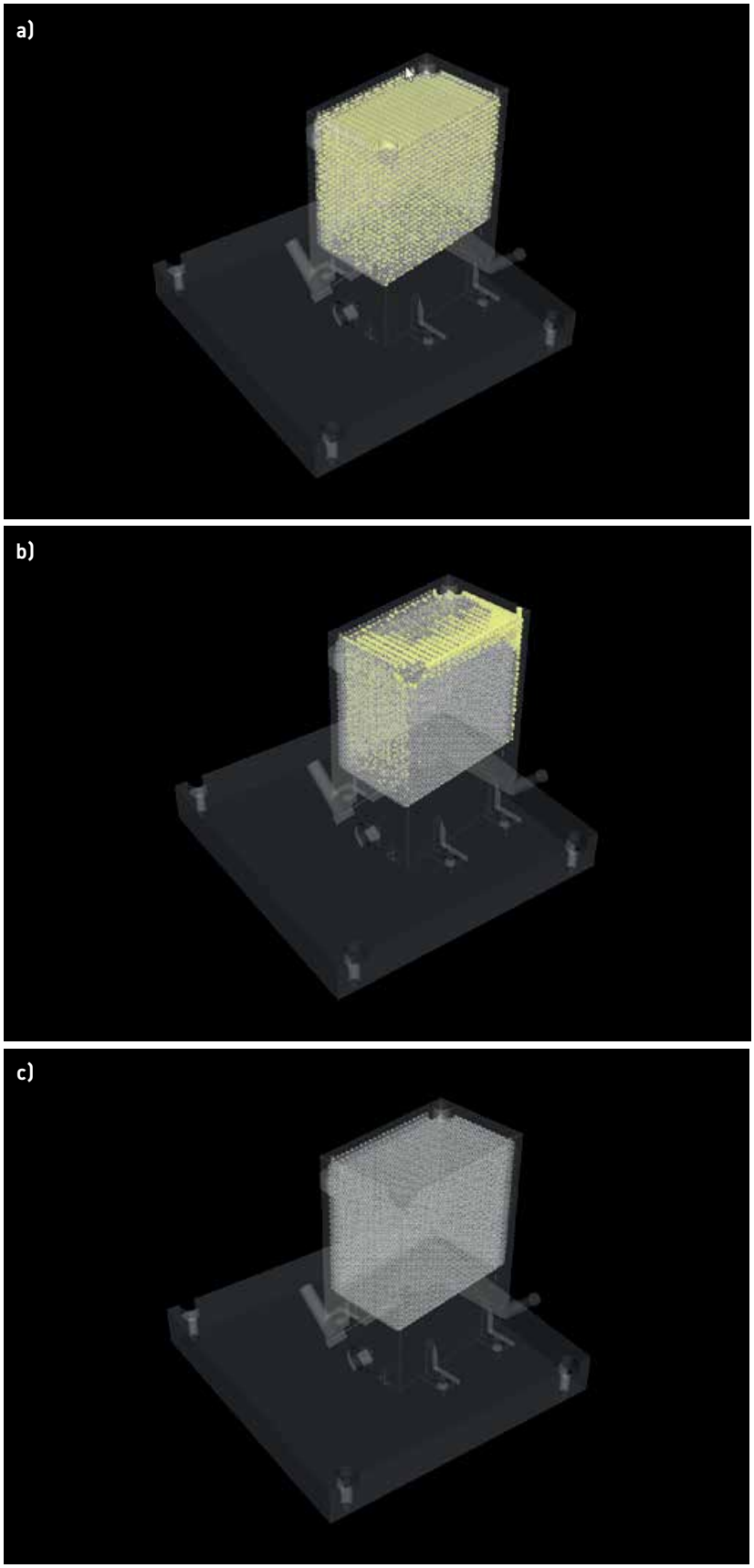

Fig. 6 The algorithm in action on the AM chemical processor: the yellow elements in each of the pictures represent grains of powder: a) start of simulation, b) simulation midpoint – most powder removed, c) end of simulation – no powder remaining (Courtesy Solukon)

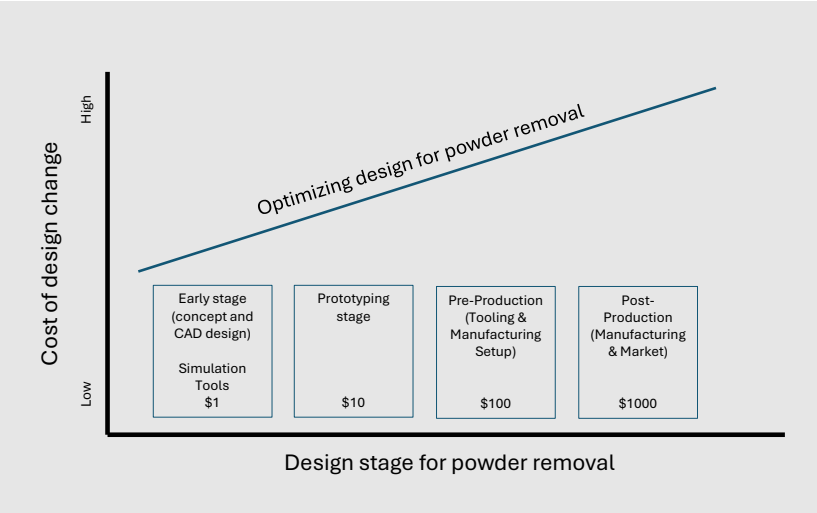

Fig. 7 The rising cost of design interaction (Courtesy Solukon)

Calculation grain-by-grain

The algorithm uses the simulation of the fluidised powder in conjunction with gravity to calculate an exit route, akin to the principle of an emergency evacuation route for a building or a stadium where one must avoid overcrowding and blocking at the exits. This means that it can identify where the powder can flow and creates pathways for the remaining powder to escape from the inner areas of the part.

The algorithm works by assigning a value to each grain of powder that cannot directly reach an opening. It then identifies the powder grain that is furthest from an opening and calculates the optimal path for the Solukon machine to follow in order to guide this grain towards an exit. The powder removal machine uses vibration, with the build plate rotating in 90-degree increments across three dimensions to facilitate movement. However, depending on the part, not all grains of powder can be evacuated due to the constraints of internal channels or other geometrical obstacles within the part.

Smart powder removal

Manually programmed sequences can work for simple components. For more complex parts, a single movement to remove what appears to be a powder choke point inside the part could result in powder getting stuck elsewhere. Manual programming by an operator is unable to see the entirety of the problem from beginning to end. Without full control or visibility, it becomes nearly impossible to ensure that all powder is removed effectively. The software is able to see further and operate quicker than the human brain, in much the same way that software was able to become more proficient at chess than the most talented grandmaster. The movement sequence proposed by the algorithm does not seem comprehensible at first because the software is able to pre-calculate the behaviour of a full chain of future movement sequences using the simulation and the algorithm. The algorithm has long-distance cause-and-effect vision, which the human brain is unable to compete with.

The most profound power of smart simulation of the powder removal process is in the ability to save time in the product development process. Time is money. Even before a product is fully engineered, an inventive engineer with a strong understanding of the PBF-LB process can now use this tool to assess the manufacturability of a part at an early stage, pushing design limits with greater confidence. The cost of design iterations varies depending on the complexity of the product, the industry, and the stage in the development cycle (Fig. 7). Generally, the later an iteration occurs, the more expensive it becomes as factors such as prototyping, testing, tooling, and production adjustments add to the costs.

A simulation of powder removal in the AM process is a new digital tool, now available alongside existing simulation tools used at the early design stage, such as finite element analysis and computational fluid dynamics. The ability to make changes based upon a digital analysis at the early design stage is a powerful cost avoidance strategy. This can boost AM feasibility and reduce time-to-part production while also maximising the functionality of design that makes AM so appealing.

Complex designs

Complicated designs are increasingly making their presence felt in the AM media. Many in the industry are familiar with examples of extravagant designs that push the boundaries of what can be achieved. Conflux Technology, an Australian company specialising in complex heat exchangers, is a prime example. One of its signature parts, which has intricate internal channels for optimal heat exchange, was featured on the cover of *Metal AM* magazine's Spring 2019 issue. The case for AM-produced heat exchangers lies in their ability to offer superior performance due to the increased surface area provided by their complex designs. Leap71, based in Dubai, is another innovative design company whose advanced creations frequently adorn the pages of industry publications. A notable example is its aerospike engine, which includes numerous complex channels. AM is justified by its ability to create these channels, which are either challenging or impossible to achieve using traditional methods. A category in its own right, though perhaps less dramatic than the examples mentioned above, is of course tooling with internal cooling channels.

Fig. 8 A cutaway version of the AM chemical reactor revealing the internal geometry (Courtesy Siemens)

Case study: chemical reactor in a box

Chemical plants today are large, complex operations with multiple pipes and connections. A collaborative project titled 3D-PROCESS (an acronym for Disruptive Digital Design – Printed Reactors for the Optimization of Chemical processes through Energy Savings and Sustainability) involved several German organisations and was supported by funding from the German government. The project aimed to develop alternative processes for the sustainable and energy-efficient manufacture of chemicals. A team of researchers from Siemens, Evonik, INERATEC and the Karlsruhe Institute of Technology developed a shoebox-sized, additively manufactured chemical reactor integrated into a scalable unit made as a single piece (Figs. 8, 9). The highly complex design can mix chemicals and conduct heat, avoiding energy-hungry chillers. The unit can be scaled up, starting from a model that processes one litre all the way

Fig. 9 CAD image of the exterior of the chemical reactor (Courtesy Siemens)

Fig. 10 The chemical reactor being depowdered inside a Solukon machine after simulation and planning using Pathfinder software (Courtesy Solukon)

to a machine capable of handling 500 litres. The innovation was recognised at Formnext 2024 with a design award.

The complex internal structure of this corrosion-resistant alloy part presented a substantial challenge to manufacture. Without AM, it is doubtful that the part could have been made at all. Given the complexity, product designers were faced with a challenge: how to maximise the complex design without affecting the ability to remove the unfused powder from deep inside the part. The designers ran the part through the Pathfinder algorithm (Fig. 6), which proposed a machine path for the successful cleaning of the part, which was then depowdered inside a Solukon machine after the build (Fig. 10).

Case study: thrust combustion chamber

Sòphia High Tech is an industrial research and development organisation based in Somma Vesuviana, Italy. It specialises in AM for the aerospace industry. Sòphia developed and built a lightweight one-piece regeneratively-cooled thrust chamber assembly (TCA) for liquid rocket engines. The conventional process for manufacturing TCAs involves separately constructing the injector, main combustion chamber, and nozzle, which are then assembled and welded together.

Sòphia's engineers were able to streamline this process by producing a single-piece TCA using advanced Additive Manufacturing technologies (Fig. 11). The design produced an innovative part with a complex interior structure. The interior channels with rectangular sections were 1 mm in height 2-5 mm in length, with the total channel length being 500 mm. Complete depowdering of the inside of the structure is necessary for success.

Sòphia is an experienced developer of complex parts and has extensively used automated depowdering systems. The challenge in this case was how to programme the automated system to release the most stubborn powders from the complicated interior design. For this, they ran the Pathfinder algorithm, which automatically produced the cleaning cycle programme. It generated a protocol with 216 separate steps, which ran on a Solukon AT350 in a 40 minute cycle. The cycle was run twice as a precaution to ensure complete depowdering. The part was produced in Inconel 718 on a TRUMPF TruPrint 3000 with a build plate of Ø 300 x 270 mm.

What have we learned?

Metal AM parts are becoming more complex. If they are too intricate and produced using PBF-LB, it may be geometrically impossible to remove the powder from inside the structure.

Building a complex part in a single piece has advantages in design, function and manufacturability. However, failure to remove all of the powder can impact the part's function or regulatory approval. Identifying this issue early reduces mitigation costs, typically requiring only minor design tweaks. Modelling the powder removal process based on the digital

Fig. 11 Picture of a Sòphia TCA in Solukon depowdering machine (Courtesy Solukon)

twin is, therefore, the cheapest way to understand whether a part design is viable from the perspective of powder removal.

The inability or difficulty of removing powder would usually require redesign and, in some cases, necessitate building the part in separate pieces to facilitate powder removal. This would involve a manufacturing process to join multiple parts by welding or brazing, meaning higher labour costs, extended production time, and potential issues at the joins.

Even if automated depowdering through mechanical agitation or rotation could, in principle, be deployed to solve the issue, programming the device is time-consuming and would result in a less efficient powder removal cycle.

It is gratifying to know that deploying digital analytical tools to solve physical problems through the use of powerful yet relatively cheap computing power is a reality in the AM industry. We have become accustomed to using design, diagnostic and simulation tools such as CAD, CAE, FEA, and CFD that can give us a high-level understanding of the physical behaviour of a real product even before the first layer has been printed. To this illustrious parade of engineering acronyms, we can now add another advanced digital solution, this one to solve a problem endemic to Additive Manufacturing. Perhaps we could call it Powder Mobility Analysis (PMA) or Depowdering Feasibility Analysis (DFA). Regardless of how we define them, smart tools – such as those embedded in the Pathfinder algorithm – serve both to diagnose problems and to execute remediation. They are yet another example of how advanced manufacturing continues to integrate the digital and the physical. We live in interesting manufacturing times.

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ValCUN's MMD: A robust, wire-based aluminium AM technology for defence and industrial applications

ValCUN's Molten Metal Deposition (MMD) technology is a wire-based Additive Manufacturing solution designed to improve deployability and cost efficiency in aluminium part production. While applicable across various industrial sectors, it is also being explored for defence applications due to its potential for in-field manufacturing. With its inherent robustness, and the elimination of powder handling, MMD offers a deployable, user-friendly solution for producing critical parts in remote or demanding environments, as well as for seamless integration into industrial production settings.

ValCUN, headquartered in Ghent, Belgium, believes that reducing cost and process complexity is key to driving the wider adoption of the Additive Manufacturing of aluminium. As aluminium is one of the most widely used materials in manufacturing, ValCUN has focused on developing an AM technology that is both efficient and cost-effective, enabling it to compete directly with conventional aluminium processing technologies.

The company's solution is its patented Molten Metal Deposition (MMD) technology, which is deployed through its Minerva AM machine. What sets MMD apart is its method of directly depositing molten metal. Inspired by Fused Filament Fabrication (FFF), which is commonly used for polymer-based AM, MMD adapts this approach to metal by replacing the polymer filament with metal wire feedstock. The wire is melted in a heating chamber and deposited through a nozzle, building parts layer by layer. Additionally, using wire feedstock addresses challenges related to handling, safety, and material costs while maintaining AM's geometric flexibility and simplifying post-processing.

ValCUN's focus on aluminium is driven by the metal's wide popularity – it is the second-most used metal in the world and makes up around 25% of the global spare parts market. Traditionally, metal AM adoption has been dominated by materials such as stainless steel

Fig. 1 Flanges welded onto housings manufactured using ValCUN's MMD technology (Courtesy ValCUN)

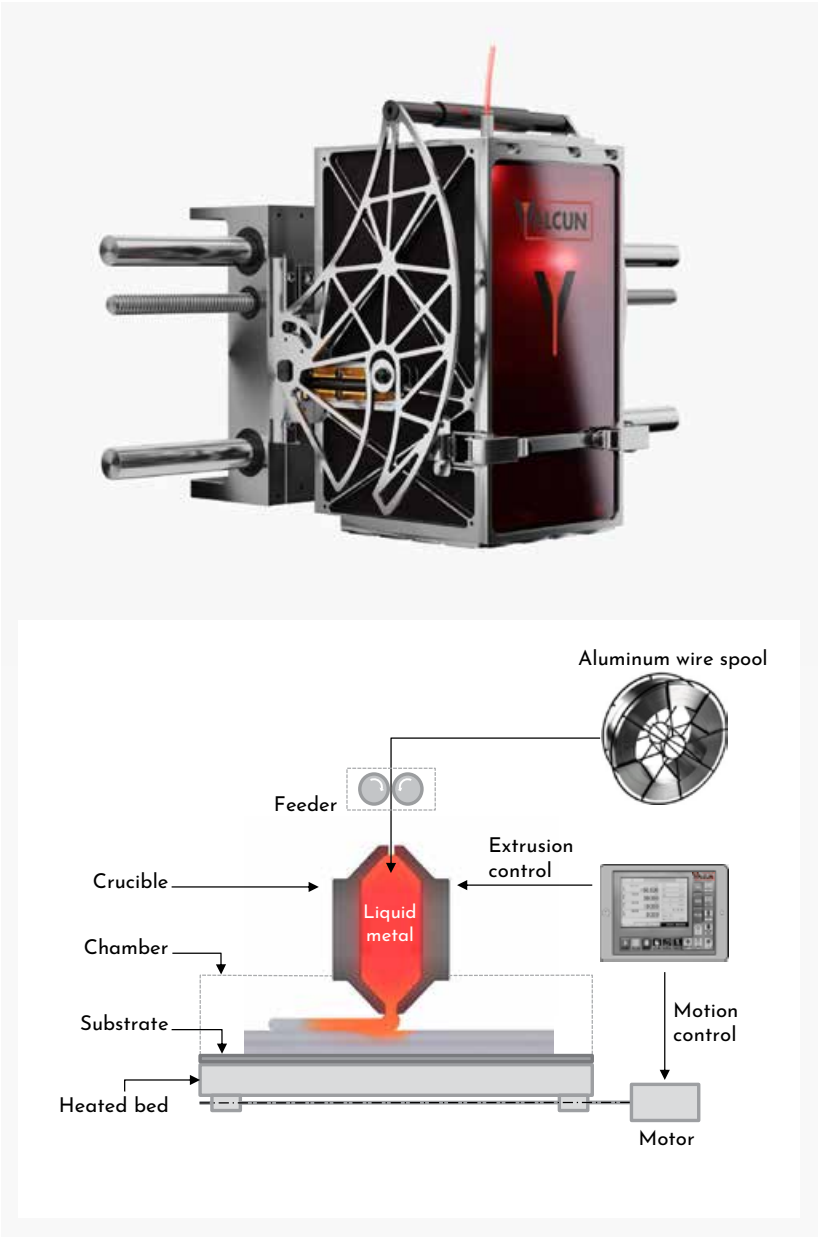

Fig. 2 Top: The Minerva print head. Below: A schematic of the MMD process (Courtesy ValCUN)

"...we are addressing these challenges head-on with a solution for the production of aluminium parts on-demand, when you need them, and where you need them... We believe that our technology is the easiest on the market to deploy and operate for metal parts production."

and titanium. Aluminium, however, has faced slower adoption using conventional AM technologies such as Laser Beam Powder Bed Fusion (PBF-LB) and Binder Jetting (BJT). These powder-based methods often face limitations in alloy selection, as well as issues with safety, material cost, and complex processing, all of which hinder the development of technically or commercially viable applications.

By directly depositing aluminium alloys using wire, challenges associated with powder handling, laser absorption in PBF-LB, and oxide formation are eliminated. Aluminium's lower melting temperatures, of course, make it easier to process in wire form, and the company is working with well-known aluminium alloys, such as the 6000 and 7000 series.

ValCUN believes that the underutilisation of aluminium in the AM industry presents it with a significant opportunity to capitalise on growing markets in sectors such as aerospace, automotive, and defence. Jonas Galle, CEO and co-founder of ValCUN, stated, "AM is still not mainstream in manufacturing, accounting for less than 1% of the market. Countless government and commercial organisations are investing heavily in identifying the right technology platforms to reduce lead times, get to market faster and secure the supply. However, along with a shortage of AM specialists in the labour market, deployment challenges, safety concerns, materials costs, and other factors have to be addressed in order for AM to scale up in production."

Jan De Pauw, co-founder & CTO, continued, "Thankfully, the metal AM industry is changing its approach from one of being a disruptive technology to one that offers integrated solutions, and at ValCUN, with our MMD technology, we are addressing these challenges head-on with a solution for the production of aluminium parts on-demand, when you need them, and where you need them, with a cost-effective, easy-to-

Fig. 3 Minerva AM machines installed at the company's headquarters in Ghent, Belgium (Courtesy ValCUN)

deploy and easy-to-use solution. We believe that our technology is the easiest on the market to deploy and operate for metal parts production." He concluded: "Quite simply, we offer a unique no-powder aluminium AM solution that is user-friendly and has a low barrier to adoption."

Returning to the issue of AM's labour challenge, Galle stated, "Today, most metal AM technologies are difficult from a user perspective. AM is all too often new to organisations, and a high level of training is required for the most well-known processes, making AM complex to integrate into manufacturing. Companies often struggle to find the right skill sets for employees. These barriers diminish the economic value that metal AM can offer. Our solution reduces these barriers, making AM economically viable for a much wider range of industrial applications."

"Today, most metal AM technologies are difficult from a user perspective. AM is all too often new to organisations, and a high level of training is required for the most well-known processes, making AM complex to integrate into manufacturing."

Deployable manufacturing: defence

Across the globe, as a result of many live conflicts, defence and security organisations are scaling up investments. This is evident in the AM market, where adoption is increasing. However, adoption is not progressing as quickly as many people would like, with rigorous safety requirements, limited deployability, and part qualification and material certification being lengthy processes.

De Pauw stated, "We are in the early stages of working with several defence organisations to explore the benefits of this deployable technology for use in the field. Today's modern warfare is ever-changing, with a need for quick, effective and affordable AM solutions for part repair and replacement."

Fig. 4 Top: An HVAC fan assembly featuring seven blades produced by MMD. Below: The new Compuational Fluid Dynamics (CFD)-optimised blade geometry (left), which the customer is unable to produce today on an industrial level (Courtesy ValCUN)

"Deploying AM capabilities in harsh environments demands portable/deployable solutions, robust supply chains, and adaptability to diverse operational conditions, enabling forward-deployed units to produce critical parts on demand – a key message from the recent MILAM event held in Florida. Armies and, indeed, navies around the globe are now engaged with AM manufacturers to mobilise the technology so that it can work in the field as a tactically and agile deployed asset."

ValCUN's MMD technology aims to address these needs, offering a straightforward, deployable, and low-complexity solution that can operate in challenging environments. As De Pauw concluded, "Here, of course, a robust and lower-complexity technology can win."

Industrial applications using MMD

There has been an increasing focus on where AM can offer tangible solutions for industrial manufacturers, particularly in areas such as reducing costs, improving efficiency, and enhancing production uptime. More recently, there has been a shift toward integrating AM into existing manufacturing processes rather than attempting to replace them altogether.

ValCUN aims to bridge the gap between conventional manufacturing methods and the advanced capabilities of AM. The company's technology is particularly well-suited to the production of complex geometries, near-net shapes, shell structures and lattice structures, as well as components that require aluminium's heat conductivity. Additionally, ValCUN is exploring the potential of hybrid manufacturing, integrating subtractive and additive methods to broaden the scope of applications, as well as printing on top of existing parts.

MMD has proven itself to be ideal for small to medium-sized batches

of thermal management solutions. These can include heat exchangers (for example, in electric vehicles), power electronics, data centres, and high-end computing. The technology enables economically viable production of efficient and reliable heat exchangers with specialised meshes and infills, all optimised for effective heat extraction.

Case study: MMD-produced data centre ventilation

One notable example of ValCUN's success comes from a recent collaboration with a prominent global HVAC manufacturer. This company, with a turnover exceeding $1.2 billion, faced challenges in optimising fan blades for its data centre cooling systems. The company had been relying on conventional manufacturing technologies that limit fan efficiency, directly contributing to higher energy consumption.

By adopting ValCUN's MMD technology, the company was able to produce optimised fan blades with an improved design, achieving a 10% increase in blade efficiency (Fig. 4). This improvement is calculated to generate over $6 million in annual electricity savings across 7,000 fans in more than ten data centres. The ability to produce highly efficient, cost-effective parts with minimal post-processing represents a significant benefit for manufacturers in industries requiring high-performance components.

Fig. 5 ValCUN's co-founders, Jan de Pauw, CTO, (left) and Jonas Galle, CEO (Courtesy ValCUN)

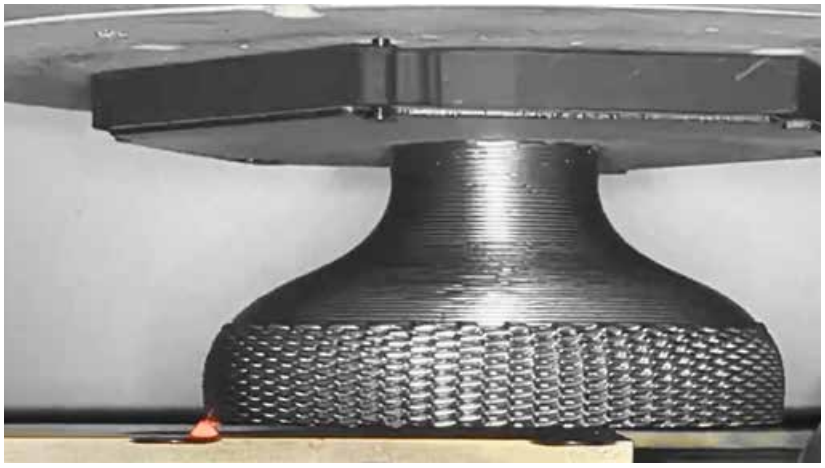

Fig. 6 Demonstration setup for upside-down printing (Courtesy ValCUN, supported by ESA)

ValCUN pushes towards in-space manufacturing with MMD

ValCUN's team has ambitions to see its technology used in space. While some metal AM technologies face limitations due to gravity and safety restrictions, ValCUN's MMD technology shows promise in overcoming these challenges. With support from the European Space Agency (ESA), the company successfully demonstrated aluminium printing in an inverted position (Fig. 6). This marks a significant step towards manufacturing in low-gravity environments, such as space, and also highlights ValCUN's ability to perform multi-axis printing on Earth.

This achievement demonstrates the adaptability and scalability of MMD technology, with its potential to produce large, lightweight, high-performance aluminium components for aerospace, defence, and industrial applications using robotic systems. Looking ahead, ValCUN is continuing to refine its technology for high-strength aluminium alloys and preparing for space condition testing, with the aim of advancing in-space manufacturing capabilities and further expanding the scope of additive production.

Looking to the future

ValCUN's growth is supported by backing from the European Space Agency (ESA), the European Union, and the Flemish government. Collaborative projects with organisations

Fig. 7 Guests at a recent open day at ValCUN's Ghent headquarters (Courtesy ValCUN)

such as LEVITAD (Defence), 3DoP (3D Printing Optimised Production), DIAMETER, and Green AM are further expanding the scope of MMD technology. The company's relocation to larger premises in Ghent reflects its increasing success and, in the near future, it plans to diversify its material portfolio to include metals such as magnesium and copper in response to growing customer demand.

"We are excited to announce the shipment of our first metal AM machine orders to the US," said Galle. "Customers are stressing the need for an easy-to-use, easy-to-deploy solution that reduces post-processing and time-to-part while remaining cost-effective. MMD technology delivers this, and we are looking forward to supporting our customers in their metal AM utilisation."

With continued R&D and a growing customer base, ValCUN is well-positioned to advance aluminium AM technology and contribute to the industry's future.

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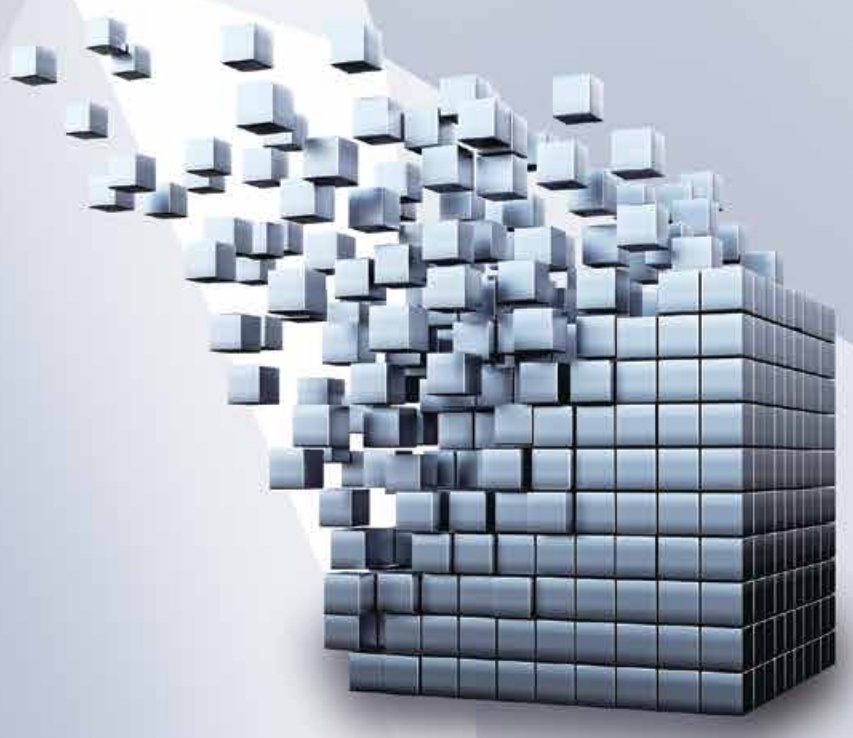

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Enhancing quality and reliability in metal Additive Manufacturing: The role of laser calibration

In metal Additive Manufacturing, precision and reliability are critical, particularly in highly regulated industries. Ensuring consistent quality requires meticulous laser calibration and process control. 3D Systems addresses this need by integrating advanced laser beam analysis and power measurement solutions from MKS's Ophir brand. As the company reports, by leveraging Ophir's high-precision sensors, 3D Systems enhances laser performance monitoring and process stability, helping its customers meet stringent industry standards and produce the highest-quality metal AM components.

In the healthcare, semiconductor, and aerospace industries – or wherever complex or individualised parts are needed – Additive Manufacturing offers enormous potential. These industries, in particular, require that the finished parts meet exceptionally stringent specifications. 3D Systems, a leading Additive Manufacturing solutions provider, is fully embracing its users' need for reliability in their production processes. For its Laser Beam Powder Bed Fusion (PBF-LB) Additive Manufacturing machines, the company has developed a testing and calibration service to provide its machine users increased reliability through advanced laser beam calibration. Core measurements within the 3D Systems Advanced Service Package are performed with the Ophir® BeamPeek® high power laser beam analysis and power measurement device from MKS, a global leader in precision measurement solutions and the parent company of the Ophir brand.

Proven quality is the key to success

3D Systems' AM machines are used in regulated industries such as healthcare and aerospace, where process repeatability is paramount. Machine users need to prove and document the process stability of their machines over time, and 3D Systems wanted to support users with this task.

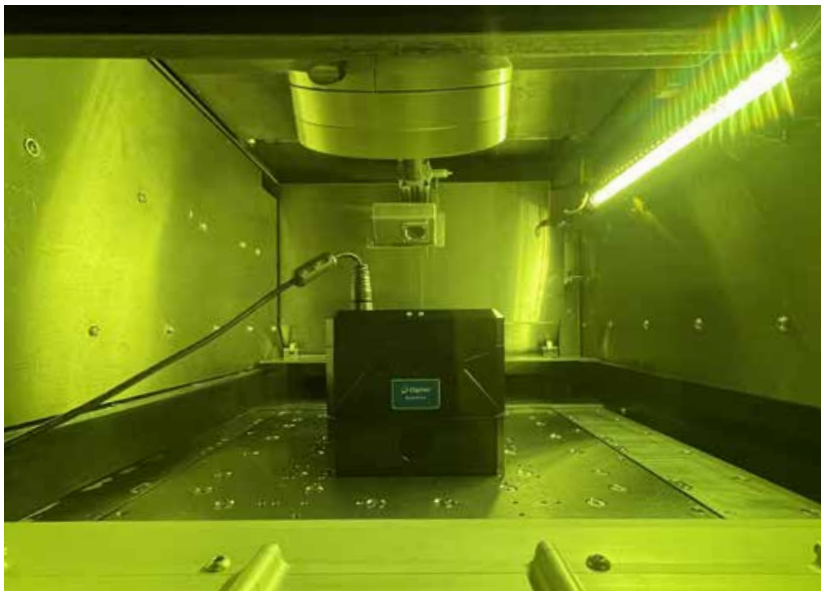

Fig. 1 An Ophir BeamPeek high power laser beam analysis and power measurement machine from MKS inside a 3D Systems DMP Factory 500 (Courtesy 3D Systems)

Fig. 2 Laser calibration underway at 3D Systems using MKS' Ophir technology (Courtesy 3D Systems)

"Our customers, particularly those in regulated industries, must prove that their manufactured parts meet high-quality standards. Consequently, they must adhere to standards like ISO 52941, which governs control procedures and acceptance criteria for laser metal powder-bed fusion machines for metallic materials in aerospace applications."

The goal was to offer advanced measurement and on-site calibration procedures with dedicated documentation features, enabling the machine's users to consistently meet the highest standards of production.

Demanding industry standards

In Additive Manufacturing, every single layer counts. The laser-based optical systems in PBF-LB machines must meet precise specifications. This is one of several critical factors in ensuring the finished part has the desired properties, with other factors including powder quality, shielding gas, scan strategy, and recoater operation, etc.

The main optical process parameters are the laser power, the beam caustic (the path of the beam diameter coming from the processing optic to the focus and after it), and the position of the laser beams. 3D Systems' engineers monitor these parameters in the development and production of its metal AM machines – but they also wanted to enable service technicians to check the performance and stability of the optical systems at the customers' sites on a regular basis.

Wouter Polspoel, R&D Programme Manager at 3D Systems, explains, "Our customers, particularly those in regulated industries, must prove that their manufactured parts meet high-quality standards. Consequently, they must adhere to standards like ISO 52941, which governs control procedures and acceptance criteria for laser metal powder-bed fusion machines for metallic materials in aerospace applications. Our goal was to define a set of service procedures that cover all relevant requirements set forth in the applicable standards and guidelines."

One particular challenge was measuring the beam caustic of high-power laser beams under operating conditions. Just in time,

MKS introduced the Ophir BeamPeek integrated power and beam analysis instrument. This innovative measurement technology enables substantially shorter measurement cycles and high versatility in the field.

Extensive testing for best practices

In long-running tests with the Ophir BeamPeek device on the DMP Factory 500, a PBF-LB machine with a build volume of 500 mm x 500 mm x 500 mm and three fibre lasers, 3D Systems' engineers developed specific measurement routines, defined the deviations, and created a comprehensive checklist that is performed within the Advanced Service Package.

"The Ophir BeamPeek device proved its versatility and simplicity of use," stated Polspoel, explaining, "The stability of the power output as well as of the accuracy of the beam caustic is key to achieving high-quality parts. With the BeamPeek device, we also measure the beam quality factor M^2 of each laser in the centre of the working plane."

Additionally, an Ophir thermal power sensor is used within the Advanced Service Package routine to check the stability of the laser power. The fan-cooled FL1100A-BB-65 sensor, which is combined with a handheld power meter, is used to read out the power values when setting up the laser and after a set time of fifteen minutes at maximum rated power.

Measurement technology inspires confidence

With this additional service offering, 3D Systems' customers gain security and flexibility, explains Wouter Polspoel: "Even though we don't expect the laser parameters to change significantly, as we use high-quality components and our processes are very stable, we want to offer our customers the option to have their process parameters verified and documented on a regular basis. Thanks to Ophir BeamPeek we are able to adhere to the stringent process control and calibration requirements of the ISO standard within our Advanced Service Package."

The Advanced Service Package is suggested to be used every six months; however, some industries will have individual schedules for machine monitoring and maintenance.

Fig. 3 The BeamPeek 800 W from Ophir (Courtesy MKS)

"...we want to offer our customers the option to have their process parameters verified and documented on a regular basis. Thanks to Ophir BeamPeek we are able to adhere to the stringent process control and calibration requirements of the ISO standard within our Advanced Service Package."

Optimised design

The Ophir BeamPeek device is not only used by service technicians, as Viktor Valckenaers, R&D Project Engineer at 3D Systems, explains: "We have made extensive tests with the BeamPeek device in the design phase of new laser-based Additive Manufacturing machines. In particular, the laser beam waist location measurements reveal interesting correlations between gas flow, contamination of the components

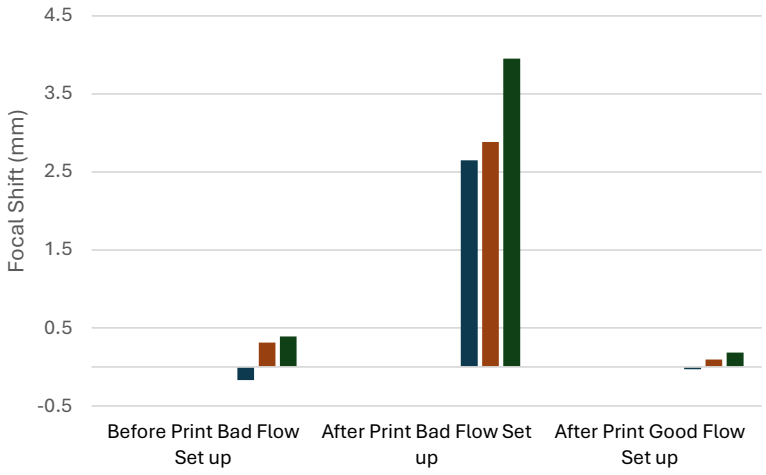

Fig. 4 The differences in the focal shift of the three laser beams in the machine (laser power above 400 W each) under varying gas flow scenarios (Courtesy 3D Systems)

> *"Once all the parameters were defined and the prototype finalised, each machine underwent intensive testing for several months. During this period, measuring the laser beams with the device plays a central role in checking the caustics and documenting the stability of the process."*

and beam parameters that help us optimise our machines." The argon flow within the build chamber greatly affects the quality of AM components; therefore, engineers invested a lot of effort to position the gas nozzles optimally.

Initially, simulation software was used in the machine's design phase to identify possible geometries. Once the initial testing of the prototype started, the Ophir BeamPeek measurement device was utilised to measure the beam position before and after a build job under varying gas flow scenarios.

In the development of the DMP Factory 500, this testing revealed the direct impact of gas flow on the waist location. Fig. 4 shows the shift in the laser beam waist location between non-optimised and optimised gas flow conditions. Valckenaers states: "It is common knowledge that the quality of a build depends heavily on the gas flow in the chamber. Nevertheless, it is a great help to objectively quantify how much the minimal waist position is influenced by contamination caused by a suboptimal gas flow."

Once all the parameters were defined and the prototype finalised, each machine underwent intensive testing for several months. During this period, measuring the laser beams with the device plays a central role in checking the caustics and documenting the stability of the process. Valckenaers outlines another advantage of the measurement tool: "The Ophir BeamPeek caustic measurement device can be used for both low and high powers. This is extremely valuable as we can use it for our complete test series."

A cooperative relationship

Questions occasionally arose during both the intensive testing process and the integration phase, which the 3D Systems experts clarified with the Ophir development team."We had several good discussions, and the teams on both sides were really dedicated to quickly resolving any issues," says Polspoel. The result is already a great success: "Within months, we were able to improve our on-site service procedures. Secondly, the broader beam quality measurement capabilities shortened our machine development time. As a result, I believe confidence in Additive Manufacturing technology is bound to increase significantly."

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veranstaltungen.dwt-sgw.de/?v=168

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www.americamakes.us/events/trx-spring/

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www.rapid3devent.com

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formnextforum.jp.messefrankfurt.com/tokyo/en.html

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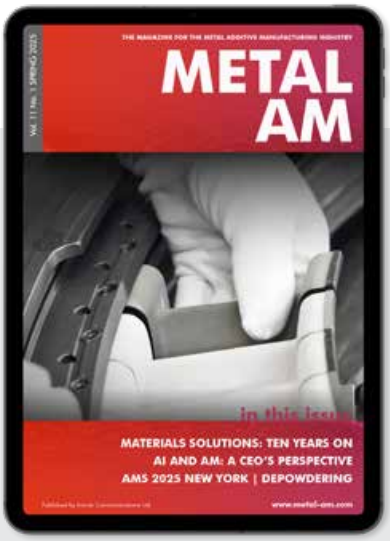

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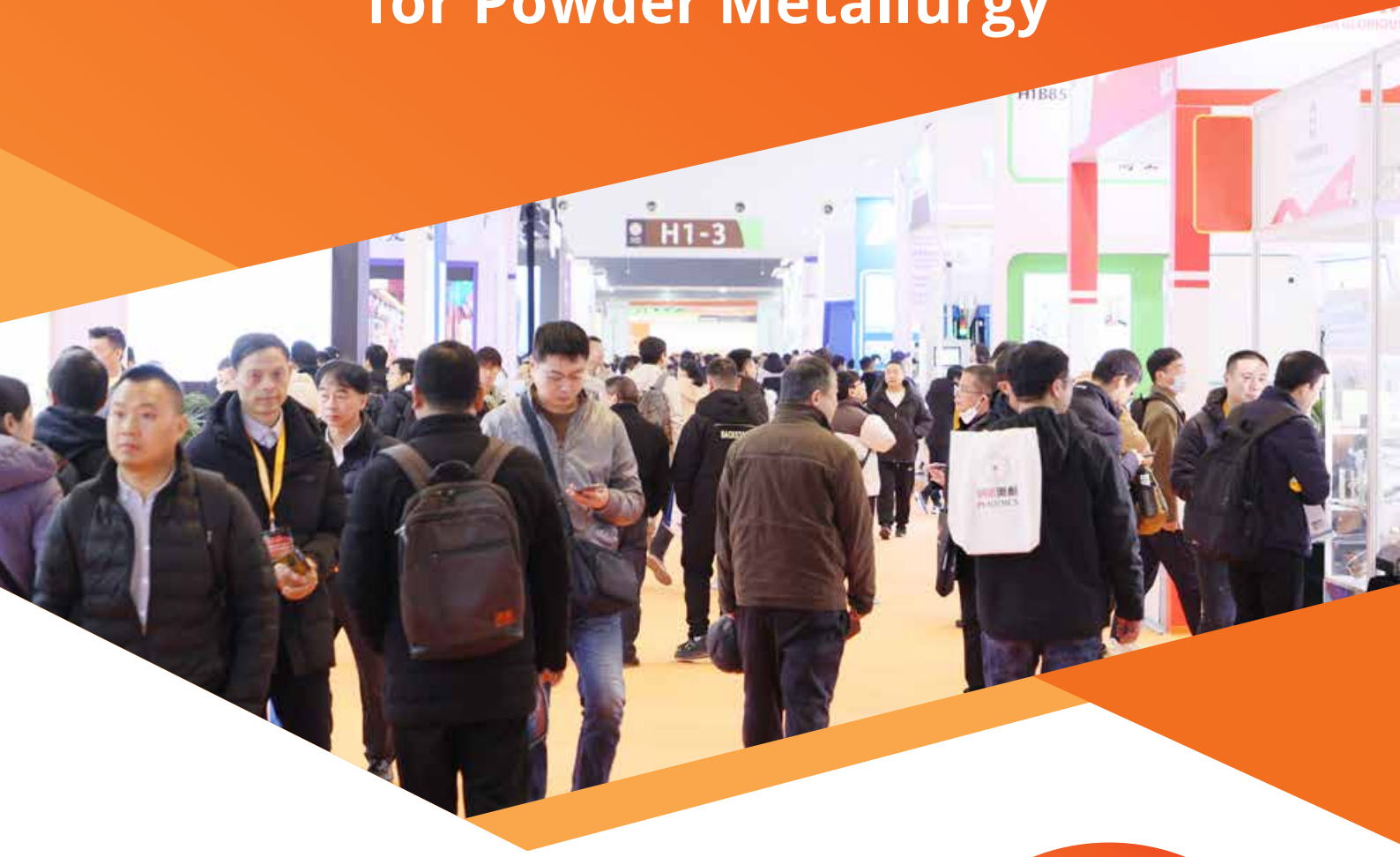

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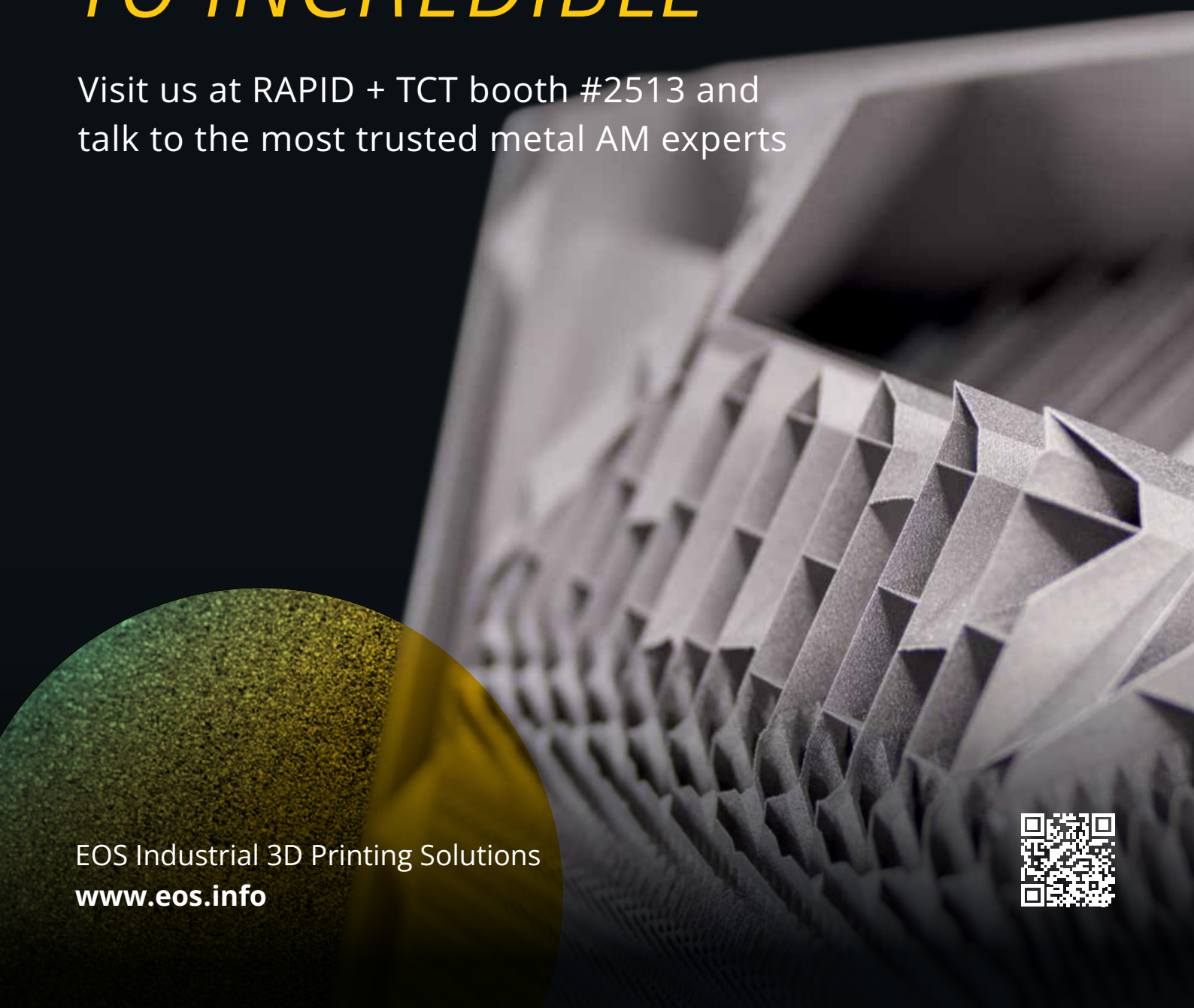

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