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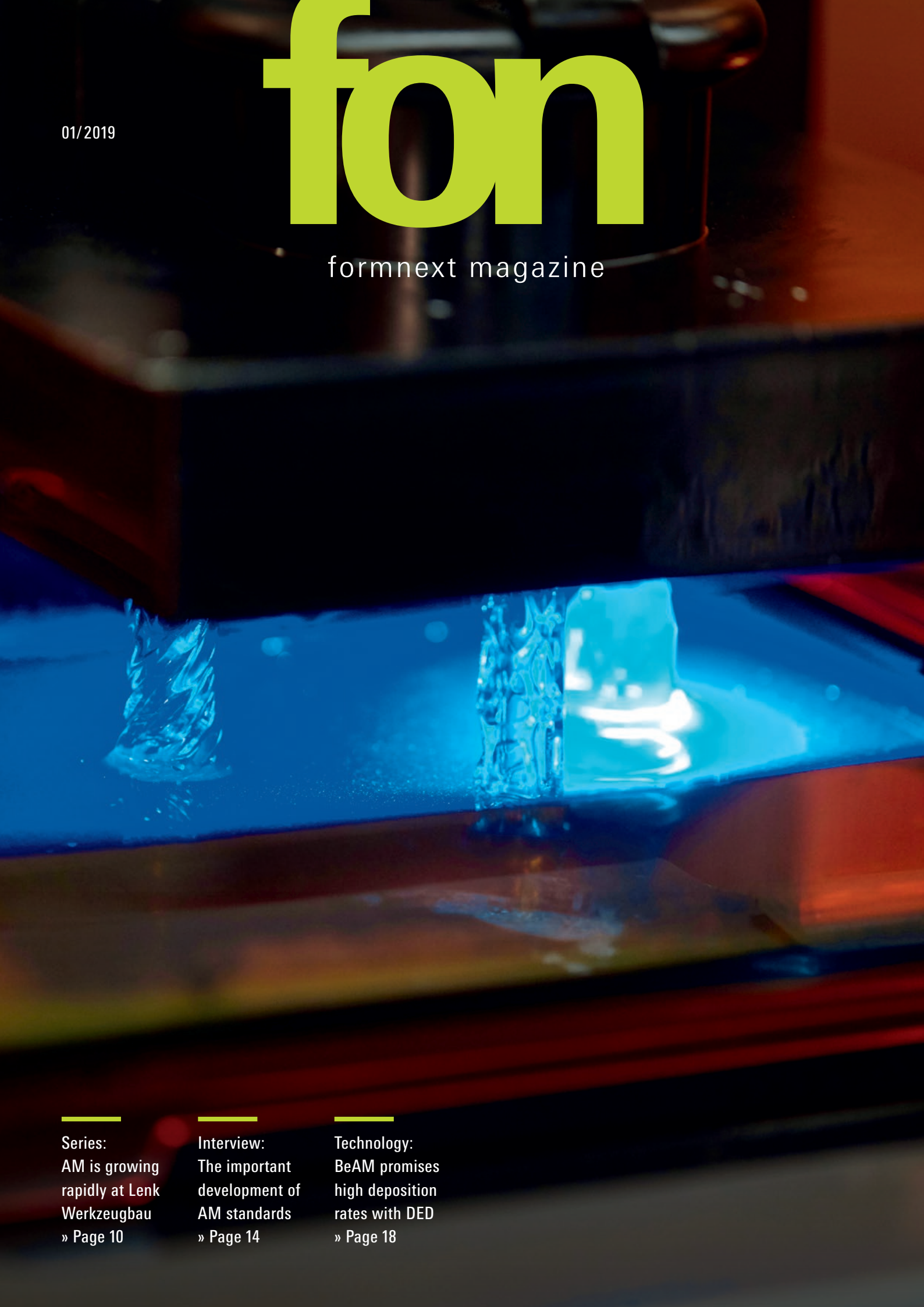
formnext magazine



With artificial intelligence we are summoning the demon.

[Elon Musk, Co-founder Paypal, SpaceX, Tesla]

AI is going to be one of the trends that is going to be the next big s hift in technology.

[Satya Nadella, CEO Microsoft]

Cover: Formlabs

EDITORIAL

The future has always been an important topic for mankind – and in our current age, it is perhaps more important than ever. Never in human history has the future been so close at hand and the present so rapidly outdated as they are today.

Fortunately, this is not the case in all areas of life. However, technology is developing at a dizzying speed. Artificial intelligence is making inroads into new areas on an almost daily basis, and our industry, additive manufacturing, is also developing at a breathtaking pace. This was evident at Formnext 2018, where the future of manufacturing was literally tangible in the corridors and at the exhibition booths.

Formnext ideally reflected just how quickly additive manufacturing applications are spreading in industry, medical technology, mechanical engineering, and other sectors, and how they are increasingly gaining traction in series production. The industry has long since moved on from pure prototype assembly and has now expanded into many other areas.

In the world of additive manufacturing, new processes are being developed all the time. This also increases the number of potential business applications. In this issue, we'll be introducing you to one of these fledgling technologies, DED (page 18), which is transitioning from its former niche status to a wide field of application.

But additive manufacturing has long since ceased to be merely a vision of the future. For years, it has been generating opportunities for commercially successfully manufacturing – and for earning good money. To demonstrate this to you, we regularly visit midsize production companies that deploy additive manufacturing technology. On page 10, you can discover how one such company, Rolf Lenk Werkzeug- und Maschinenbau, has established a promising additive production department.

Personally speaking, what excites me about our industry is not just its tremendous growth and this steadily growing, close-knit community. It's also our sense of shared identity and the desire of everyone in the industry to press ahead with and develop additive manufacturing as a life-changing technology. I look forward to your continued active support.

Sincerely,
Sascha F. Wenzler
Vice President Formnext

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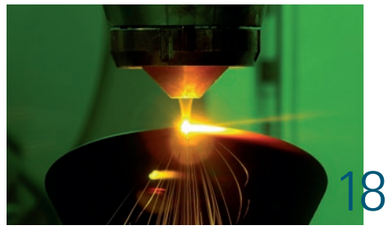
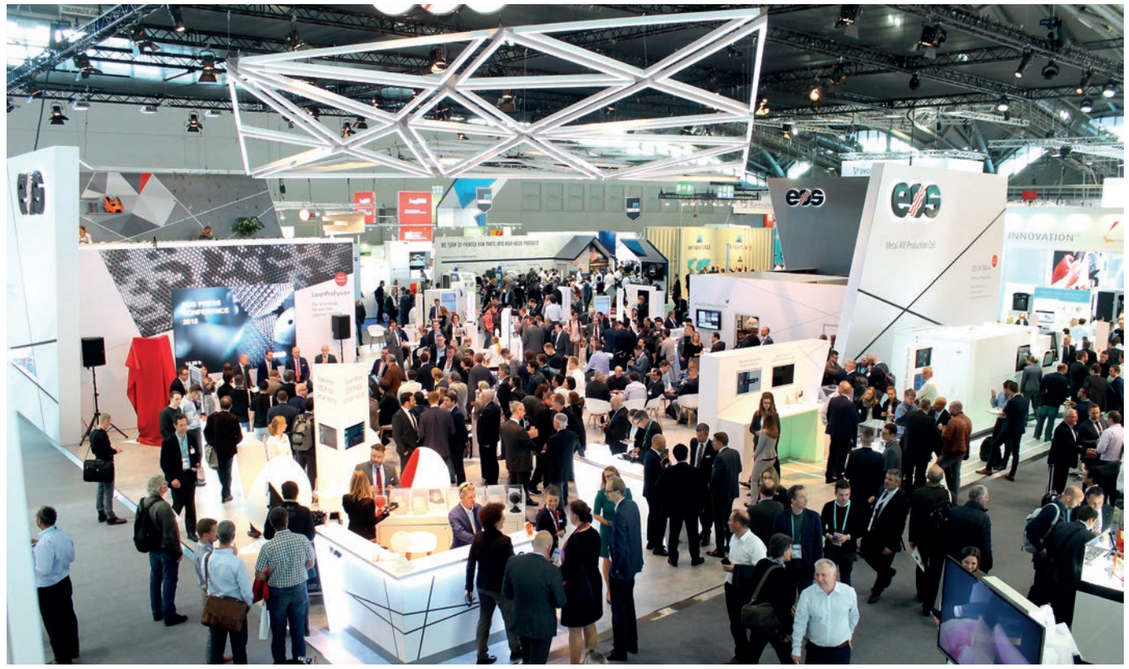


Photos: Thomas Masuch (2), BeAM, Mesago / Mathias Kutt

FORMNEXT NEWS

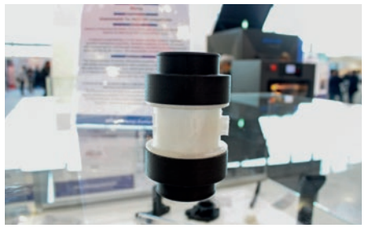


»WE TOUCH THE FUTURE OF INDUSTRIAL MANUFACTURING«

For industrial 3D printer manufacturers, business means more than bringing better and faster machines to market every year: At Formnext, for example, market leaders as 3D Systems, Arburg, BigRep, DMG Mori, EOS, GE Additive, HP, Renishaw, Siemens, Stratasys, Trumpf or Voxeljet focussed their presentations on holistic solutions, new materials and quality assurance.

The fact that new technologies come onto the market every year makes the additive manufacturing industry more lively than almost any other industrial sector. This was also evident at Formnext: with 26,919 visitors from all over the world, Formnext achieved a record result. The leading trade fair for additives manufacturing also set a new record for the number of exhibitors with 632. The dynamic growth of Formnext is set to continue in the coming year. The fair, which was almost bursting at the seams in 2018, is moving to Halls 11 and 12 in Frankfurt. For the first time a partner country, the USA, will also be represented at Formnext.

»At Formnext, we touch the future of industrial manufacturing.«, confirmed Ilaria Guicciardini, Marketing Director of Roboze, an Italian manufacturer of 3D printers, in November in Frankfurt. Guicciardini's statements are exemplary for the development of the entire additive manufacturing industry and the world's most important industry trade fair, Formnext. An industry that years ago was still strongly influenced by a large number of innovative start-ups is becoming more and more mature and is focusing more and more on concrete business. The number of applications is growing just as fast as the number of technical possibilities. Manufacturers and users cannot afford to miss technological development.



Photos: Thomas Masuch

FORMNEXT ECHOES

»The show continues to be the benchmark for AM events. With regards to networks and technology it is globally leading.«
» Simon Marriott, Company Director IMCRC (Australia)

For Kristian Arntz, Managing Director and Partner of ACAM, Aachen Center for Additive Manufacturing, Formnext has long been the most important fixture in the annual exhibition calendar: »It's no longer a question of whether you'll meet up with people at Formnext, but when. These days, it goes without saying that you'll be there.«

At Formnext, Desktop Metal showcased major updates for its production system, which is now even faster (up to 12,000 cm^3/h) and offers a larger build envelope. CEO and Co-Founder Ric Fulop (right) was impressed by the response: »Every year, Formnext is getting better than the year before. It is the place to be.« In addition to more than 500 components, the U.S. company also presented its Fab-Flow software solution, a simplified workflow management system for manufacturing operations. Rick Chin, Co-Founder and Vice President Software (left) was one of those who provided visitors with an introduction.

»Formnext and the industry have developed. This year, we had both more and better qualified visitors. People know already our products and ask for concrete solutions. At Formnext, we touch the future of industrial manufacturing.«
» Ilaria Guicciardini, Marketing Director Roboze (IT)

Andreas Becker, from Altena in the Sauerland region of Germany, came to Frankfurt with 19 trainees from various industrial companies. »A wide range of industries for which additive manufacturing is relevant are represented here,« says Becker, who is a technology scout for regional technology transfer organization Transferverbund Südwestfalen. Visiting Formnext was an ideal opportunity for the budding mold makers, toolmakers, and designers »to gain an excellent impression of various technologies in additive manufacturing and other industrial sectors«.

Photos: Thomas Masuch

NEWS

»OVERALL, THE MARKET HAS A BETTER UNDERSTANDING OF REQUIREMENTS«

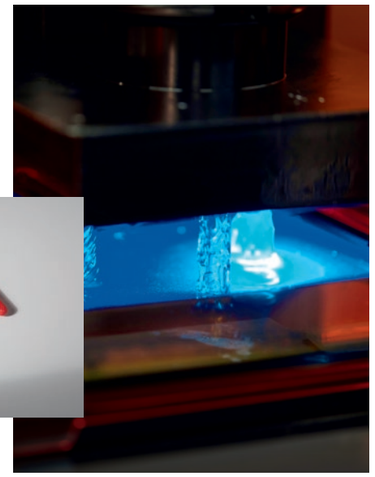
The additive world is growing from year to year, and ever more companies are successfully establishing themselves in the market. For a »traditional« market leader like Stratasys, which has for years played a part in shaping the industry, this brings exciting challenges, as Eric Bredin, Vice President of Marketing EMEA (photo on rigth), explains in an interview with Formnext magazine. »The environment has changed. And our customers' requirements and expectations have become more specific as a result,« says Bredin.

At Formnext, Bredin noted that the number of customers visiting the exhibition with specific challenges and in search of corresponding solutions has risen. »Visitors' knowledge has continued to grow, and they now have a clearer idea of the issues involved. Overall, the market has a better understanding of requirements.«

That's why Stratasys placed particular emphasis on its experience and the breadth of its product portfolio, which ranges from qualified material and software to various hardware solutions and consulting services. »This allows us to get customers into production very quickly.« Andreas Langfeld, President EMEA Stratasys, adds that the offerings must include more than printers and materials.

At Formnext, Stratasys also shone with many new developments in hardware and materials, including a new 3D printing technology developed in-house. In the LPM (layered powder metallurgy) process, the shape of the workpiece is »written« into a layer of metal powder with thermal ink. According to Stratasys, the process is a combination of powder metallurgy and PolyJet technology. The advantage of the procedure is that it delivers high density and purity by dispensing with binder material inside the component. According to Andy Middleton, Executive Vice President EMEA of Stratasys, the new process will also boost the importance of additive manufacturing in mass production in the coming years.

Cover photo



Photos: Formlabs (below), Thomas Masuch (on top)

It may still be a pilot project, but it has the potential for mass production: At its factory in Andover, north of Boston, USA, Gillette is producing 3D-printed handles for its razors. The Razor Maker project allows U.S. customers to choose designs and colors and order their made-to-measure razor for between USD 19 and USD 45. The products are manufactured on Form 2 printers from Formlabs, also based in Boston. As this is still a pilot project, Gillette did not want to give away too many details of production and volumes just yet. But Donato Diez, Global Brand Manager at Gillette and co-founder of Razor Maker, says the company has already taken »a crucial step in our customization journey.«

+ FURTHER INFORMATION:
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NEWS

ADDING A DASH OF SEASONING TO THE PARTS

During prototyping, the processes are relatively straightforward: »You get a file, and you print it,« explains Jurgen Laudus, Vice President of Materialise Manufacturing. But when it comes to functional parts made of metal, the challenges are tougher. At Formnext, we had the opportunity to talk to Jurgen Laudus (photo above) about how the listed company Materialise is responding to them.

According to Laudus, the challenge lies primarily in end-use parts. Here, being involved in the design process is key. After all, it's not just a matter of optimizing the component; supporting structures also have to be taken into account. And cost-effective production requires the building plate to be filled as well as possible. In other words, it's not just the component design, but also the component environment that matters.

A design and engineering team at Materialise handles these tasks. »They add a dash of seasoning to the almost finished component,« say Laudus with a smile. The goal is clear: to make production, and therefore the component, more affordable.

This involves working hand in hand with the customer to create the production-optimized design, because this also gives the customer's design engineers the opportunity to develop their skills. »They know they need design rules,« explains Laudus. But these rules aren't always known.

METAL SECTOR GROWING MORE RAPIDLY

According to Laudus, Materialise currently serves some 5000 active customers. Plastic parts are still the ones most frequently ordered. But Laudus rates the metal sector as very important and says it is also growing more rapidly. »Plastic parts can sometimes be a door-opener for metal parts,« he adds.

The company has eight laser melting machines at its disposal for handling these parts. In addition, the acquisition of German metal casting company ACTech GmbH in 2017 gave Materialise excellent access to key production processes such as postprocessing, heat treatment, and automation. Over the past twelve months, this production expertise has also been transferred to the site in Bremen, where Materialise has concentrated its additive metal production.

As Laudus sees it, expanding the production process has also brought about a change in the company. »We're on our way to becoming a manufacturing company – and no longer just a 3D printing company.«

Photos: Thomas Masuch

NEWS

NO LONGER THE CLASSIC JOB SHOP

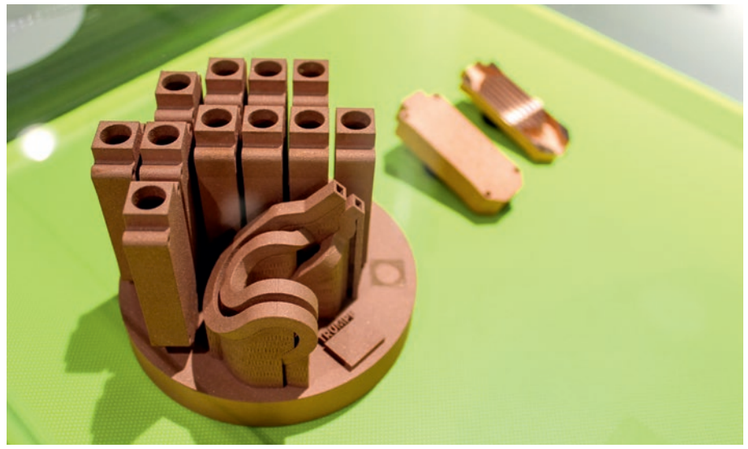
Trumpf is among those championing the industrialization of additive manufacturing. As Thomas Fehn, Head of Sales at Trumpf Additive Manufacturing explains, the company, based in Ditzingen (southern Germany), devoted between 30 and 40% of its presence at Formnext to Industry 4.0. All TruPrint 3D printers at Formnext were connected to a production management system (MES) and an ordering platform. »Additive manufacturing is no longer the classic job shop,« says Fehn.

When it comes to moving up to the next level, establishing a digital value chain and automation are key. »The two have to go hand in hand,« says Fehn.

Tobias Baur, Head of Technology at Trumpf Additive Manufacturing, adds that robust processes are a prerequisite here and that Trumpf can contribute its experience from the machine tool sector.

Trumpf also impressed with two important new AM systems: The company's TruPrint 5000 promises printing of components using high-strength tool steel without cracks thanks to 500°C preheating. »We expect this to fuel major growth in other areas, such as tool and mold making,« says Tobias Baur. The new green laser, which Trumpf presented to the public for the first time at Formnext, is intended to open the door to new applications, for instance in the jewelry industry and in plant engineering. For example, the developers have connected the new TruDisk 1020 disk laser to the TruPrint 1000 3D printer to process precious metals or pure copper.

Overall, Trumpf is satisfied with how its additive manufacturing activities are developing. More than 100 TruPrint 1000 machines are now on the market, and business with the TruPrint 3000 is also gratifying, explains Fehn. Tobias Baur believes there is still significant scope for the future. »AM has been hyped for years, but we're not yet seeing it in widespread production.« At the same time, developing the process chain through to completion calls for a great deal of patience.



JUST WHAT THE DOCTOR ORDERED FOR MEDICAL TECHNOLOGY

At Formnext, Heinz Gaub, Managing Director Technology at Arburg, reported high demand for the freeformer – especially in the field of medical technology – and cited companies such as Aesculap, Karl Leibinger Medizintechnik, and Samaplast as references. Gaub (photo left) said that the parts manufactured included functional components made from soft materials or hard / soft combinations. He added that the freeformer is also currently being deployed in other industries.

As Gaub stated, Aesculap is one of the companies expressing great interest in Arburg's »big freeformer,« which had its world premiere at Formnext. With its new freeformer 300-3X, Arburg has increased the size of the build chamber by some 50% to around 300 square centimeters. In addition, three materials can be processed in one component – either three plastic components or two plus a support material. »This is unique in the industry,« says Gaub. In addition, the build chamber, which can be heated to temperatures of up to 200 degrees Celsius, allows processing of high-temperature materials. Arburg's developers have also incorporated automation into the new model, for example through a robotic system interface.

Arburg also debuted its All-in-Package for the tried-and-tested freeformer 200-3X at Formnext: This allows the machine to be rented for 12 months. What's more, Arburg manufactures a benchmark part and provides access to its material database.

Series: The path to additive series production

»IT PAYS ITS WAY«

Text: Thomas Masuch

Midsize users provide ideal examples of the suitability of additive manufacturing for industrial applications. That's because the technology has to deliver a return relatively rapidly at companies of this kind. Rolf Lenk Werkzeug- und Maschinenbau in Ahrensburg, Germany, has achieved this: Its additive metal manufacturing is growing rapidly, thanks not least to its good interplay with the company's conventional production activities.

A key pillar of additive manufacturing at Lenk can be found right next door to the company's laser sintering machines. The production halls adjoining the AM department are home to many milling, turning, and erosion machines. »A good additive contract manufacturer needs expertise in machining,« explains Gregor Sodeikat, Managing Director and shareholder at Lenk Werkzeugbau. »It's about more than just setting up a 3D printing machine. Customers generally expect fully functional components.«

After the additive manufacturing process, supporting structures usually have to be removed, holes or threads drilled, or individual surfaces milled. The printed metal parts are often intricate, irregularly shaped and have a rather rough surface, making them difficult to clamp. »If you don't think about postprocessing during additive design, it will cost you further down the line,« says Gregor Sodeikat with a smile. That's why his company optimizes components for production at the design stage. In addition to the milling machines, the tool shop contains numerous jigs that gently clamp additive components for postprocessing.

ROOTS IN TOOLMAKING

As the company name shows (»Werkzeugbau« is German for »toolmaking«), Lenk's roots are in toolmaking and traditional metalworking. Over the years, the midsize enterprise, which is based in Ahrensburg, about halfway between Hamburg and Lübeck, has also built up extensive expertise in additive manufacturing and, according to Managing Director Sodeikat, is »northern Germany's largest service provider for additive metal production.«

»We deliver everything from the initial idea right through to the finished component,« adds Matthias Otte, who has been responsible for additive manufacturing at Lenk for two years as project manager. For some customers, Lenk prints according to customer specifications and delivers the parts as they leave the machine; for others, the service ranges from component optimization to postprocessing.

Working closely with customers, Lenk has already optimized many components and prints them in 3D.

NO POWDER-RELATED RISKS

The company's large-scale projects include aluminum engine mounts for the Bugatti Chiron. Each year, 125 units are produced in Ahrensburg. Because production volumes generally tend to be in the single-digit range, Sodeikat refers to this as a »series«. The order also includes a measurement report for every fifth part. »The process is running smoothly,« states Otte. Powder is also an important element in the process: Lenk Werkzeugbau purchases the material directly from the machine manufacturer. Specific powder suppliers are cheaper, says Sodeikat, but then you have to check each batch yourself. »And with a part costing several thousand euros, it makes little sense to jeopardize process reliability and ultimately the entire build job just to save €40 on powder.« »

Photos: Thomas Masuch

Lenk has successfully made the leap into series production – with the number of units in some projects running into triple digits.

If you don't think about postprocessing during additive design, it will cost you further down the line.

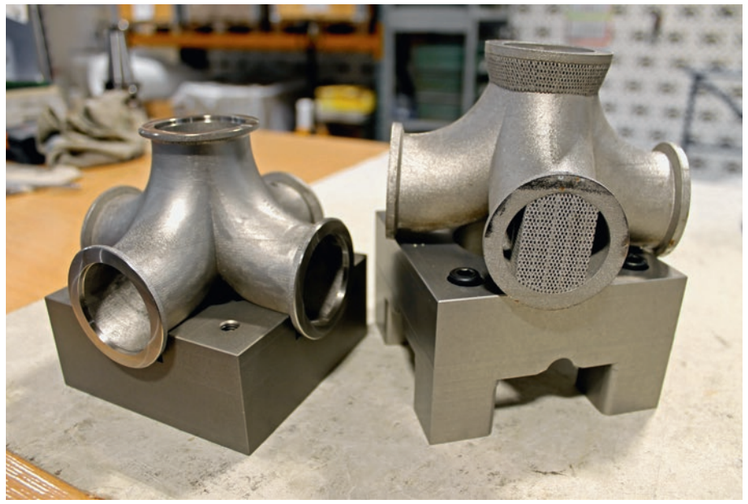


Photo on top:
Special clamping tools have been developed for postprocessing.
Photo center:
The production hall that houses the conventional manufacturing technologies is right next door to the AM unit.
Photo below:
Gregor Sodeikat (left) and Matthias Otte in Lenk's AM-production.

You can't create a good additive product if you're not in contact with the customer.

AM ESTABLISHED AS A GROWING BUSINESS AREA

Managing Director Sodeikat first came into contact with the world of 3D printing back in 2006, when he received an order for conventional prototype components from SLM Solutions in Lübeck, just 40 kilometers away. Since then, the 59-year-old has been fascinated by additive manufacturing. »That's why I'm actively driving it forward,« he says – adding that it is, of course, important that »it all pays its way«.

»Once the additive manufacturing process was running smoothly, we bought our own machine.« Two more followed in 2016 and the fourth in 2018. All powder bed machines are from SLM Solutions. These currently include two SLM280 Twin and two SLM500, which are equipped with four lasers. In the meantime, Lenk has also acquired a Gefertec deposition welding system and uses it to manufacture ship propellers, for example.

At the company, which has 29 employees in Ahrensburg, additive manufacturing has now developed into an important business area, alongside toolmaking and mechanical engineering. Seven employees work exclusively with 3D printing: four in production, and three in customer service. »And additive manufacturing is growing faster than the other areas,« says Matthias Otte.

IT TAKES TIME TO DEVELOP EXPERTISE

The first orders were placed through trade fairs, with some also coming from the classic car scene. Sodeikat recalls that it took »a good year to develop the technical expertise for additive production. And during that time, we had to throw a lot into the scrap bin«. Today, the production level is significantly higher, »but the scrap bin isn't empty yet,« Otte openly admits. »Producing 100 percent good parts remains a challenge.«

Thanks to the manufacturing knowledge they have acquired, Lenk's employees can also suggest optimizations of individual components to existing customers and manufacture these using additive manufacturing methods. Components of this kind include a grabber originally milled from aluminum: Otte was able to persuade the customer to print the grabber using titanium. This makes the component a little more expensive, but it now has around four times the former service life.

»INVOLVE CUSTOMERS IN DESIGN«

Sodeikat and Otte can now cite numerous examples of optimized components. The prerequisite for optimization, however, is to continually convince customers of the advantages of additive design. »If we are to succeed in this, customers need to understand how to make additive products,« explains Otte. »That's why we try to involve customers in the design process,« he adds. This approach gave rise to the idea of constructing a scraper for meat processing that was hollow on the inside. »That meant we had less distortion, needed less material, and could manufacture the product faster.« Sodeikat therefore considers dialog with customers essential. »You can't create a good additive product if you're not in contact with the customer.«

Otte now regularly visits customers to train design engineers in the special features of additive manufacturing and has seen dynamic development in this area. »The training enables customers to give their imagination free rein when it comes to additive parts.« However, the process takes time and is often also a generational issue.

Sodeikat does not expect customers to draw on their enhanced knowledge of additive manufacturing to establish their own production facilities, though some occasionally consider doing this where large volume are involved. »But they often give up on the idea because of the high investment.« Just having a machine is not enough. »You also need the peripherals, the machining, a saw, and a whole lot of expertise.« Even if you only take the costs for the technology into account, an AM system has to be used to at least 75 percent of its capacity. »And that means you first have to have the right number of parts.«

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TALKING ABOUT

»Critical for any industry to develop and mature«

Interview: Thomas Masuch

At first glance, standardization might seem a rather dry topic, but everyone is talking about it at the moment. At Formnext 2018, for example, the first transatlantic »AM Standards Forum« was organized in conjunction with the US Commercial Service. Here, experts from Europe and the United States discussed the international developments in production standards. We spoke with experts from the USA and Europe about recent trends in this field.

Why is standardization so important for the world of AM?

DR. MARKUS HEERING Standards are becoming increasingly important as a result of the successful transition from rapid prototyping to industrial series production. Product liability alone requires manufacturers to verify the quality of additive serial components and ensure reproducible quality when setting up their manufacturing processes. Standardized processes and procedures in quality assurance are the means of choice when it comes to avoiding having to repeat quality certification for every component. And they will be the basis for any kind of certification for AM providers going forward.

Photos: Mesago / Mathias Kutt, Pat A. Picariello, Terry Wohlers, VDMA

PAT A. PICARIELLO In order for the technologies that live under the additive manufacturing umbrella to be fully embraced by the diverse collection of industry sectors that presently exists, confidence is needed to ensure that things made using AM will perform in a way that's comparable to things made using more traditional subtractive technologies.

TERRY WOHLERS For most of the AM industry's 30-year history, it has lacked international standards. They are critical for any industry to develop and mature. Imagine not having standards for electricity, lighting, computing, fuels, automobiles, aircraft, and traffic control. Life would be much less efficient, and in some cases, chaotic and unsafe. Almost everything would cost more to produce and purchase and life would be very different.

There have been various efforts in this area for many years, one of the most recent being the AM Standards Forum at Formnext. How far along are we in the AM industry?

PICARIELLO Standards, and the consistency they provide, are critical to market acceptance. How do we know that a particular material, process, system, or service will behave as intended (and marketed)? Standards development is a barometer in areas such as this, and in that regard, the AM industry has never been more evolved than right now.

WOHLERS The additive manufacturing industry has made good progress in recent years with standards. Each standard comes with a lot of hard work, often by expert volunteers, many of which are very busy people. This can make it challenging, even difficult, to create new standards. That's why they often take years to develop. Yet, they are vitally important to the growth and maturity most industries. A lot has been accomplished since 2009, but a mountain of work is ahead.

HEERING Standardization processes take time in any industry, not least because the players involved often have different interests. A young, innovative technology like AM is driven by different players, each acting independently. Efforts to achieve standardization start as soon as a number of them agree on common interests. It's not really possible to give a specific answer the question of how far along we are with standardization as an industry. AM is a vast, heterogeneous technological field that is constantly producing new processes and procedures. While some manufacturers are already supplying additively manufactured aircraft parts and medical implants subject to strict regulations, the AM industry as a whole is still laying the groundwork for standardization.

Especially in the metal sector, AM usually requires postprocessing with other technologies. What challenges does this present?

WOHLERS Standard procedures for powder removal, handling, storage, and recycling are important. Likewise, it is important to standardize other post-processing steps, such as thermal stress relief, hot isostatic processing, surface treatment, and inspection. For processes to remain repeatable, it is critical that a very specific and consistent set up steps are followed to maintain quality standards. Developing and following these steps can require a great deal time and effort, but companies have no choice if they want to apply AM to production applications.

HEERING The interfaces are one of the major challenges – both the data interfaces and the purely physical transfer of components from one station to the next. So it is necessary to uniquely identify them, and the parts ultimately have to find their own way through the post-processing chain – which puts us firmly in Industry 4.0 territory. Inline quality assurance is also a major issue. Our road maps make it clear that there many challenges still lie ahead in postprocessing.

Various AM standards have already been published. Most relate to one manufacturing technology (e.g. powder bed) in combination with one particular material. The increasing number of AM technologies and materials available raise the question of whether these ever growing numbers of combinations can be covered. Or will we need a different approach in the long term?

WOHLERS I believe the 80/20 rule applies. About 80% of the time, users will use 20% of the AM processes and materials currently available. These numbers are a rough approximation, but I hope you get the point. In other words, not all AM processes and materials will be used for production applications, and therefore do not require the same types of standards associated with them. Even so, a great deal of work is still ahead.

HEERING That is indeed the question. One result of our VDMA working group is a committee dealing with the application of additive components within the scope of the European »

Photo on top:
Terry Wohlers, based in Fort Collins, Colorado, has been a leading AM expert for more than 30 years. As Chairman of the ASTM F42 Terminology Subcommittee, he was directly involved in the standardization process for several years and also moderated the AM Standards Forum at Formnext 2018.
Photo center:
Dr. Markus Heering has been Managing Director of the VDMA (German Engineering Federation) Printing and Paper Technology Association since 2008 and also Managing Director of the Additive Manufacturing Working Group (AG AM) within the VDMA.
Photo below:
Pat A. Picariello, Director Developmental Operations at ASTM (American Society for Testing and Materials). ASTM is an international standards organisation based in West Conshohocken, Pennsylvania, USA.

Road maps of VDMA Working Group Additive Manufacturing
With the VDMA Working Group Additive Manufacturing, Germany's Mechanical Engineering Industry Association (VDMA) has created a platform on which almost 150 member companies contribute their expertise from all areas of the process chain and share their views on the technology. Together, they have developed two road maps on powder bed processes for plastics and metals. The VDMA deliberately started out with a step-by-step analysis of the process chains. These road maps show the development and standardization requirements for each step, from the first preliminary consideration right through to packaging of the finished AM component.

Pressure Equipment Directive (PED). Manufacturers of chemical equipment and fittings, and manufacturers and operators of large-scale plant from the chemical industry work together with representatives of the DIN Standards Committee Mechanical Engineering in the VDMA as well as with experts from various monitoring bodies. Manufacturers of molded parts, materials specialists, and representatives from the world of research and from universities are also involved. Together, they have developed an internationally agreed draft for a DIN standard, which is to be incorporated into international standard procedures. This example shows one possible approach: The users involved know the regulations in their industry better than anyone else. And they have the greatest interest in rapidly achieving standardization.

PICARIELLO Committees operating under the ASTM umbrella tend to develop standards that are very targeted and focused – tending to eat the elephant 1 bite at a time – and this is certainly reflected in the current F42 portfolio. There is also a need for standards that focus on use of a single AM technology, using a single feedstock, to produce a part. How this evolves remains to be seen, but my sense is that at some point there will be sufficient micro-standards activity to generate comfort in the development of more macro documents.

Different industries and sometimes even companies develop their own certifications and standards. Does that really make sense? Isn't there a danger of unchecked growth? And how could this be countered?

PICARIELLO We operate in a world of multiple paths, and this flexibility has both positive and negative impacts. As long as there is communication among the entities operating in the AM space, a variety of options is beneficial. If, however, organizations operate in a vacuum and somehow miss or ignore what currently exists or is under development, we run the risk of duplicative or much worse conflicting activity.

WOHLERS Corporations will develop company-specific standards, guidelines, and procedures. These same organizations will also adopt industry standards published by ASTM, ISO, and others, using a combination of them and their own. Making industry standards available to all organizations helps to advance them and specific industries, such as additive manufacturing.

HEERING Standards or even certifications without transparent and comprehensible origins and requirements are no use to anyone. They tend to make users uncertain. In the VDMA, we took the initiative a good five years ago and, with the Working Group Additive Manufacturing created a platform, where players from all parts of the AM value chain get together to share and discuss their experiences. This dialog is the ideal prerequisite for preventing unchecked growth before it begins.

+ Standards and the consistency in production are decisive for market acceptance.

Committee F42
ASTM Committee F42 on Additive Manufacturing Technologies was formed in 2009. F42 meets twice a year. The Committee, with a current membership of approximately 400, has 6 technical subcommittees; all standards developed by F42 are published in the Annual Book of ASTM Standards.

+ DETAILED INTERVIEWS:
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POTENTIAL ON A PAR WITH THE POWDER BED PROCESS

In the five short years since it was founded, French company BeAM has developed rapidly. Its first machines made in Strasbourg have been in use in the French aviation industry for two years. Following the company's acquisition by AddUp, its pace of development and production capacities have increased further.

Photo on top:
Test components for engine nozzles for the aviation sector in Inconel 625.

At a newly built industrial facility in a suburb of Strasbourg, men in face masks work under tents several meters high made of white plastic tarpaulins. The intense white light in the production building is reminiscent of the set of a sci-fi movie. BeAM's employees are working on the latest machines of the Modulo series, which BeAM showcased at Formnext 2018, and for which a large number of orders have been received.

The Strasbourg-based company's machines are built on DED (Direct Energy Deposition) technology. The young French enterprise's aim is to make additive manufacturing of metal components considerably more cost-effective. Compared to the powder bed method, the technology delivers significantly higher deposition rates, enabling it to further expand the application areas for additive manufacturing.

Although BeAM has been on the market with its machines for just three years, the French company wants to quickly catch up with the »older« additive machining processes. »The potential of our technology is on a par with that of the powder bed process,« says Frédéric Le Moullec. The Director Business Development at BeAM also considers laser sintering to be within technological reach: »While laser-sintering systems have been on the market for many years, a lot of R&D machines are still deployed in this area. In two years' time, we want to be at the same industrial level with DED.«

FIRST STEPS WITH COMPLEX AVIATION PARTS

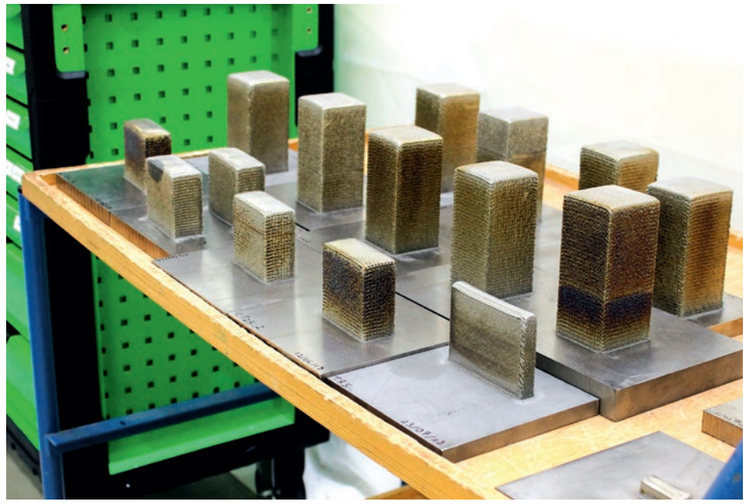
In the world of additive manufacturing, rapid developments are the name of the game. Nevertheless, the history of French company BeAM is extraordinary. In 2012, researchers at the IREPA Institute in Illkirch near Strasbourg used conventional deposition welding as a basis for developing DED technology for additive manufacturing and integrated the new method into a CNC machine. The technology was evolved under the BeAM umbrella – initially with just two employees and at a comparatively moderate pace. »

[1] DED technology is similar to methods such as laser deposition technology (LDT), laser metal deposition (LMD), or powder deposition welding (also known as the powder nozzle method).

Text: Thomas Masuch

Photos: Thomas Masuch (left), BeAM (right)

At the deposition head, the powder, surrounded by argon, flows in a thin stream onto the component and is melted by a laser with rated power of up to 2000 watts.



ADDUP
AddUp was established in 2016 following the creation of Fives Michelin Additive Solutions the year before. Based in central France, the company is a joint venture between French companies Michelin (tires) and Fives (engineering) and focuses on additive manufacturing with a workforce of around 180. In addition to the DED systems, the AddUp portfolio includes powder bed fusion systems. At the end of 2018, AddUp also acquired Poly-Shape, one of France's leading AM service providers.

Photo on top:
Titanium test blocks.
Photo below:
Frédéric Le Moullec, Director Business Development at BeAM.
Photo rigth:
Protective tents around the machine.

The company gained a major boost to its development activities when aviation companies Safran and Chromalloy ordered two machines in 2015. Safran wanted to use them forge ahead with its AM development; Chromalloy wanted to repair flying parts, Le Moullec recalls. »We had two customers with very high expectations. These requirements have shaped the further development of the machines and the company and have determined BeAM's DNA.«

Investments by French industrialists enabled BeAM to increase its headcount to 25 in twelve months. The first prototype was developed into a production machine in just one year and was delivered in 2016. And the reference projects generated further inquiries and orders. In the meantime, says Le Moullec, BeAM has delivered 20 machines, mainly to big-name aviation suppliers as well as test and research institutes.

The company's acquisition by AddUp in mid-2018 fueled another leap forward. BeAM will continue as an independent company under the AddUp umbrella, Le Moullec promises. At the same time, BeAM benefits from synergies: for example, when it comes to producing systems based on CNC machines from Fives or ADF. Currently, BeAM is planning production capacities of more than 20 machines per year.

»AddUp has given us the resources to significantly expand our industrial capability,« explains Le Moullec. And that includes stepping up international activities, with new branches in Singapore and in Cincinnati, an important center for aviation in the USA.

FAST AND WITH NO SUPPORTING STRUCTURES

One reason BeAM is able to build highly complex systems with a relatively small team is because the company buys in many components such as powder conveyors, laser sources, and controllers. BeAM's closely guarded technical expertise focuses chiefly on the integration of these components and on the deposition head. Here the powder, surrounded by argon, flows in a thin stream onto the component and is melted by a laser with rated power of up to 2000 watts. In the five-axis machine, the component plate can be rotated about two axes (B and C) so that additive manufacturing can be carried out in different directions, even without supporting structures.

The great advantage of the DED technology is its high deposition rate of 0.1 to 2kg per hour and its large building envelope, explains Le Moullec: »Besides, you don't have to fill an entire powder bed to make a thin wall piece.« However, DED technology also has its limitations: Internal cavities or lattice structures with optimized topologies are not possible. In addition, the wall thicknesses of the component are determined by the thickness of the stream of powder.

Photos: Thomas Masuch (on top left and right), BeAM (below left)

AddUp has given us
the resources to significantly expand
our industrial capability.

In addition to repairing additive components and adding to conventionally manufactured parts, Le Moullec considers the BeAM machine's field of application to lie primarily in areas where powder bed technology or milling reach their limits in terms of cost-effectiveness: for example, where large components made of stainless steel or titanium are involved. »We want to manufacture conformal components to minimize postprocessing.«

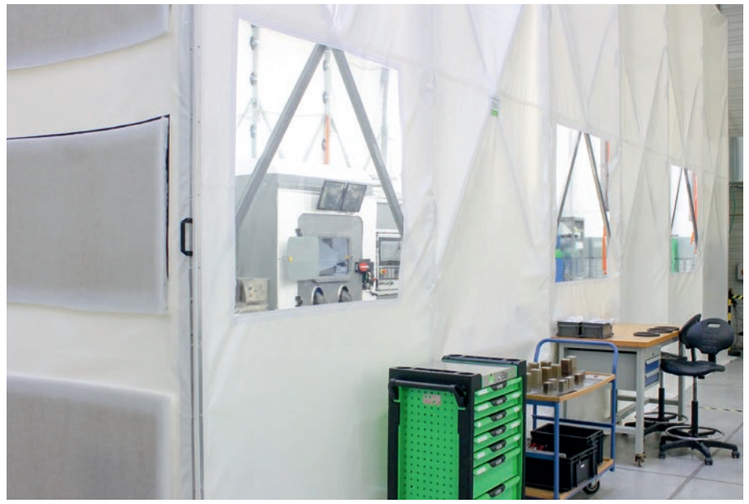
A GOOD FIT FOR THE WORKSHOP

At Formnext 2018, BeAM premiered its newly developed, more compact Modulo 250. The machine enables a system for automatically removing components to be connected via a small antechamber on the side, for example. »Even if we may be bringing this to market a little early, the future is modular,« explains Le Moullec.

To operate the systems, CNC, welding, and machine operation specialists are in particularly high demand, explains Director Le Moullec. »This expertise is often already available at the factories, and that's why our machine is such a good fit for the workshop.«

FURTHER INFORMATION:

» fon-mag.com
» formnext.com/amfieldguide



»OUTSIDE THE BOX«

Illustration: iStock/RaStudio

Text: Thomas Masuch

Office Bots

Futurologists often predict that artificial intelligence and digitization will ring the changes for many occupation profiles. They even expect some professions to disappear entirely: Instead of surgeons, robots will cut out our appendix. Instead of chefs, 3D printers or automatic cooking machines will be stirring things up in restaurant kitchens – but just who will handle the washing-up afterward remains unclear.

Back in 2013, in their study »The Future of Employment«, the Oxford professors Carl Benedikt Frey and Michael A. Osborne, reckoned that 47% of all jobs in the USA were at risk. Those potentially affected include bus and car drivers, parcel delivery staff, bank clerks, and accountants.

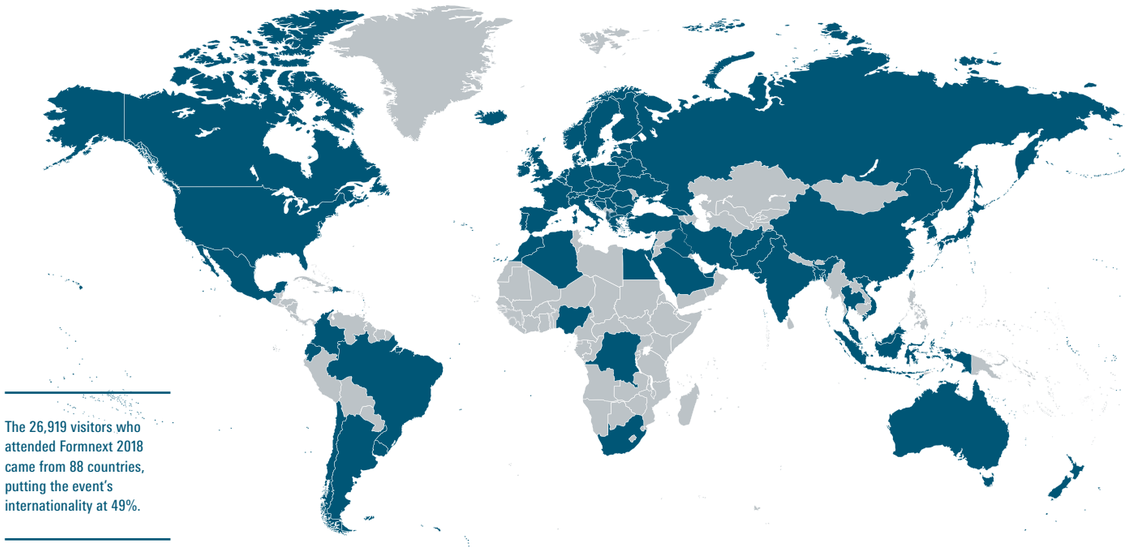
However, supermarkets show that real life doesn't always dance to the futurologists' tune. According to the forecasts, flesh-and-blood cashiers should now be a thing of the past. But for some reason, self-service terminals haven't yet completely replaced them – perhaps because people like to see another human face from time to time. Nevertheless, companies including Amazon have launched pilot projects in China and the USA, with cameras, sensors, face recognition, and artificial intelligence promising to deliver a totally new shopping experience.

Some researchers also paint the future for journalists as being black as printers' ink. After all, copy is already generated automatically: for example, for news, sports articles, and live sports tickers. Some of these pieces read quite well, while others are about as gripping as a telephone directory. And, for the moment at least, it's doubtful whether business people or politicians are likely to agree to be interviewed by a robot.

But here, too, developments will be rapid, and we'll keep you up to date with them in both Formnext magazine and the e-Mag. And while we may be enthusiastic about technology, we'll still be the ones doing the typing and will draw on our (non-artificial) intelligence to come up with new stories ...

formnext

VISITORS OF FORMNEXT 2017 CAME FROM THE COUNTRIES SHOWN ON THE MAP



The 26,919 visitors who attended Formnext 2018 came from 88 countries, putting the event's internationality at 49%.

IMPORTANT FACTS:

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» Messe Frankfurt, Hall 11 and 12
» Further information: formnext.com

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