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EDITORIAL

More innovation, at more locations, from more people who focus on more and smaller niches. Together, all of these new products will reinvent the industrial economy.

[Chris Anderson, journalist and author, founder of 3D Robotics, on the future of Additive Manufacturing]

Cover: Formlabs

A few weeks back, Usain Bolt ran the 100-meter dash for the last time in his career. The six-foot, five-inch Jamaican world record holder and eight-time Olympic champion had dominated the world of sprinting seemingly at will since 2008. There were even instances where Bolt ran with a shoe untied, took his foot off the gas after just 80 meters, and still won gold. It was almost as if his place at the top of the podium had been written into the rules of the sport. Then came Bolt's final race, however, where it was astonishing to watch him grit his teeth, fight all the way to the finish line... and come in third. Even legends like Usain Bolt are forced to realize that in sports, someone will eventually rise up and pass you by.

In the industrial realm, one's personal best in the 100 meters is decidedly less important than competitive advantages in knowledge and efficiency. That said, speed (in the form of time-to-market) does play a definitive role in modern production and Additive Manufacturing. Perhaps more than any other sector, the additive world is full of innovations and driven by a pace that is virtually unmatched in the wider industry. After all, resting on the laurels of one's previous achievements can quickly become dangerous. Countless companies are already on the starting blocks, just waiting to dash past those who fail to keep their finger on the current pulse.

Having been assembled just three years ago, the formnext team is still

only as old as many start-ups. Over that period, formnext has undergone an impressive transformation and established itself as one of the world's leading exhibitions. Meanwhile, those of us on the formnext team have worked to preserve part of our start-up character. We're still curious, open to new developments, and willing to explore the roads less traveled. This reflects the spirit of the exhibitors and partners with whom we maintain a close and constructive dialog.

It never fails to amaze us how fast-paced and dynamic our industry is, and formnext 2017 will once again be packed with an impressive amount of innovation. In this issue, we want to give you a taste of the breakthrough solutions and technologies our exhibitors plan to show off this year.

I hope you enjoy the read and look forward to seeing you at formnext in November!



Sincerely,
Sascha F. Wenzler
Vice President formnext



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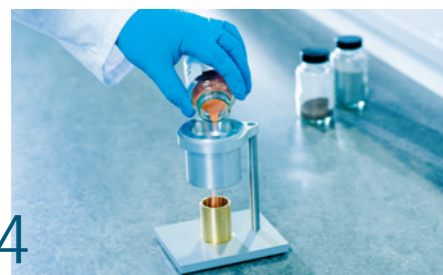


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FORMNEXT NEWS

»APPROACH THE TOPIC WITH AN OPEN MIND«

In June 2017, formnext and the Working Group Additive Manufacturing (AG AM) within Germany's Mechanical Engineering Industry Association (VDMA) entered into a new partnership. This paved the way for the AG AM to become formnext's conceptual sponsor. In an interview, Dr.-Ing. Markus Heering, CEO of AG AM within the VDMA, talks about the new partnership and how the industry is developing.

Mr. Dr. Heering, what gave you the incentive to become the conceptual sponsor of formnext?

HEERING We've been in contact with formnext and the organizer, Mesago Messe Frankfurt, for some time. After all, formnext has become the most important Additive Manufacturing exhibition in Europe, and due to its high level of innovation, even a global leader. It's the right platform for us to drive the industry even further forward. The desire to strengthen the collaboration came directly from our group of members.

How is the AG AM structured within the VDMA, and what goals do you have?

HEERING We have around 120 members. Besides machine and equipment manufacturers, our

members include users, suppliers, and universities. Our goal is to strengthen the integration of Additive Manufacturing into industrial processes even further. How this can be done successfully is something we'll be showing at formnext using best-practice examples.

Where do you see the current challenges in industrial use of Additive Manufacturing, and how do you expect the industry to develop?

HEERING A huge challenge for industrial integration is to interlink all of the process steps of Additive Manufacturing. One example is the area of software, where we need a solution that enables data exchange across machines and processes. The construction business, too, is facing a challenge. Additive manufacturing is useful particularly where additional functions can be created by this manufacturing techno-

logy. However, for decades, engineers have learned how to design for traditional manufacturing techniques. If manufacturing technology becomes faster at the same time, then we'll continue to experience this high level of growth in the coming years.

What would you recommend for midsize companies with regard to Additive Manufacturing?

HEERING Whether the technology is worthwhile depends on the product and the company. There's little point in taking a conventionally manufactured component to the exhibition, for example, with the aim of producing it using Additive Manufacturing methods. What's important is to think differently: this topic needs to be approached with an open mind. All things considered, it's highly recommended to learn more about the technology.

Mr. Dr. Heering, thank you for taking the time to talk to us.



+ FULL-LENGTH INTERVIEW AT:
» fon-mag.com

HONEYWELL, VOLKSWAGEN, AIRBUS, AND OTHERS

The third annual formnext powered by tct conference will feature more presentations, covering more cutting-edge applications and technological developments than ever before.

Big names such as Honeywell, Volkswagen, and Airbus will be complemented by academics from seven countries and representatives from

the European SME community to deliver a truly comprehensive overview of the development and applications of additive technologies.

This year's conference will be split across two stages, allowing twice as many topics to be addressed and better representing the breadth of the formnext exhibition floors.

The conference will take place in a dedicated suite right on the show floor, meaning attendees have unparalleled access to the exhibition during breaks and after the programming has concluded. With refreshments and lunch provided, conference attendees will be

educated and entertained across all four days of the event.

+ FURTHER INFORMATION:
» formnext.com/conference

Photo: VDMA

EXHIBITION PREVIEW

Simply limitless.

Engineers think like children. There are no limits, only possibilities. Join us and be inspired at formnext, the international exhibition and conference for Additive Manufacturing and the next generation of intelligent industrial production.

Where ideas take shape.

3D PRINTER THAT DRIVES THE FACTORY OF THE FUTURE

In the course of digitization, industrial production is currently going through a fundamental change. The goal is to establish a digital smart factory of the future that is fully networked. Production is hereby streamlined considerably and offers much more flexibility, eliminating intermediate stocks.

With a wide range of system and service offerings, EOS is helping companies to implement the relevant transformation process suc-

cessfully. In the factory of the future, additive and conventional technologies will be optimally networked within existing production environments – allowing access to the best from both worlds.

» EOS at formnext 2017: 3.1-G50



»WASHING MACHINE« FOR MICROPARTICLES

Spark discharges from excess metal particles gave Quill Vogue the impetus to develop the »SLM Wash« station. It can be used for cleaning SLM-manufactured components, because excess powder can lead to real problems in downstream machining: the potentially combustible dust can, according to Quill Vogue, cause dangers in production facilities and endanger the health of employees.

The new »washing machine« will be presented for the first time at formnext. SLM Wash removes and filters microparticles from SLM parts, even with complex structures. It can be used in manufacturing with titanium, nickel, stainless steel, and aluminum. The water used in the system is recycled, whereby all particles down to as small as 0.5 micrometers in diameter are filtered out. During cleaning, the machine operator can set the water pressure to between 0 and 50 bar according to workpiece and material, and

various nozzles are available to achieve optimum cleaning results.

» Quill Vogue at formnext 2017: 3.0-G20



Photos: EOS (on top), Quill Vogue (below)

EXHIBITION PREVIEW



ADDITIVE MANUFACTURING MEETS VW CADDY YOUNGTIMER

The »3i-Print Project«, initiated by CSI Entwicklungstechnik, shows how the front-end structure of a VW Caddy youngtimer can be built using Additive Manufacturing. The project, which involved the companies Altair, APWORKS, EOS, GERG, and Heraeus, aims to demonstrate the full potential of industrial 3D printing and functional integration for the automotive industry.

Within the project, the companies covered all of the steps in the process chain – from design, through layout, calculation, and const-

ruktion, to building and postprocessing of the 3D-printed assembly. The resulting 3D-printed front-end structure is particularly light, very stable, and has a high degree of functional integration.

The »3i-Print Project« is an open platform for collaboration, enabling rapid realization of new ideas. The project focused on two objectives: due to the electrification of the drive, the energy storage requirements, and the increasing electrification of actuators, the focus was above all on heat management, as well as

reducing installation space and weight. At the same time, the structural requirements in terms of safety, performance, and comfort had to be met.

» The »3i-Print Project« will be presented at formnext 2017 at the booth hosted by Altair and APWORKS: 3.1- F70



Lasersintering at Much Less Cost

With the new Fuse 1, Formlabs wants to make it considerably cheaper to switch to SLS printing methods. According to Formlabs, the laser sintering system can be purchased from as little as €9,999. Available materials are Nylon 12 and 11, which are suitable for 3D printing of particularly robust functional prototypes and end products. One example is pictured on the cover of this edition: 3D-printed ski goggles. With Form Cell, Formlabs is also creating a concept for fully automated production. »Form Cell combines the capability of the most-sold 3D printer on the market with industrial automation,« says Dávid Lakatos, Chief Product Officer at Formlabs.

» Formlabs at formnext 2017: 3.1-D14

+ MORE EXHIBITOR HIGHLIGHTS:

- » fon-mag.dcom
- » formnext.com/exhibitorlist

THE MODERN FAST TRACK TO SERIES PRODUCTION

Text: Thomas Masuch



Series production of the e.GO Life is already scheduled to begin in Aachen in mid-2018. This urban-minded electric vehicle is designed to make e-mobility more attractive, especially in terms of its price.

Photo: e.Go

At e.GO Mobile's showroom on the RWTH Aachen Campus, the current prototype is on display along with the chassis of one of the company's first models.



From a prototype to mass production in two years: What sounds like a start-up fairytale is actually the reality Dr. Bastian Lüdtkke is overseeing right now. As head of industrial engineering at Aachen, Germany's e.GO Mobile AG, Lüdtkke is developing an urban-minded electric vehicle and simultaneously drawing up plans to produce up to 10,000 of them per year. Among other aspects, the tremendous pace of this project is being made possible by Additive Manufacturing and intelligent production techniques.

If everything goes according to the ambitious plans of e.GO Mobile AG, its first mass-produced electric vehicles will start rolling off the assembly line at its factory in Aachen in mid-2018. With its new model – dubbed the e.GO Life – the company is hoping to carve out a market niche for electric vehicles that are simple, stylish, and affordable.

Having been in business for just two years, e.GO Mobile has put itself on a remarkably fast track to series production. On the verdant periphery of storied Aachen, the company's sleek showroom on the RWTH Aachen Campus currently features two of its six drivable prototypes between an aluminum monocoque and colorful upholstered chairs. Visitors can appraise the fresh look and interior of the 11-foot-long, nearly six-foot-wide vehicle and even fill out a preorder form.

A little over two years after its foundation, e.GO Mobile is already planning to commence series production of the e.GO Life in May 2018, with the first deliveries following in July. An estimated €30 million was invested in the company's rapid development, and Additive Manufacturing has also played a prominent role. In the beginning, e.GO Mobile incorporated numerous 3D-printed plastic components into its

prototypes, including part of the dashboard. »Around 30% of our first prototype was made up of additive parts,« Bastian Lüdtkke recalls.

While this percentage gradually declined on the path to series production, it grew in terms of the manufacturing resources involved – support mounts and positioning aids, for example. 3D printing will continue to be a key manufacturing technique at e.GO, as well: Development has already commenced on its next prototype, a self-driving bus known as e.GO Mover.

700 PREORDERS PROVIDE A MOTIVATIONAL BOOST

Despite its young age, e.GO Mobile now employs 100 people and still has plenty of job offers open on its website. In other words, the company isn't planning on slowing down its growth any time soon. It has quickly evolved from a start-up whose assembly operations and offices stood side-by-side into a midsize organization. e.GO Mobile's employees have since moved into a freshly built complex on the RWTH Aachen Campus, and the atmosphere at the company has followed suit. »We've started operating like a growth company,« reports Christine Häußler, who oversees e.GO Mobile's

Photo: Thomas Masuch



Photo on top: Additive Manufacturing has played a key role in constructing the prototypes. The light-gray section of the dashboard was 3D-printed, for example.

Photo below: One of e.GO Mobile's first prototypes is still carefully preserved in the company's assembly hall.

public relations efforts. At the same time, she says you can still sense the same youthful spirit and high degree of creativity in the air. »Here, nobody says 'that's the way we've always done it' because everything is so new,« Bastian Lüdtkke affirms.

Meanwhile, considerable interest and the 700 preorders already received for the e.GO Life have led to a surge of motivation at this up-and-coming firm. In spite of all the market research and feasibility studies it performed, Häußler admits that »no one actually knew how well the vehicle would be received«.

According to Lüdtkke, operating so close to other young companies and the research institutes on campus was »a huge help« in driving e.GO Mobile's development and refining its technology.

THE CHALLENGES OF SERIES PRODUCTION

In the Rothe Erde district of Aachen, construction is under way on a new factory centered on cutting-edge industrial production techniques. It will focus in particular on information logistics, which involves continuously monitoring and recording processes in order to make



e.GO Mobile AG

e.GO Mobile AG was founded in 2015. In developing the e.GO Life for urban environments, the company based its work on the designs created by another Aachen-based firm, StreetScooter. This company, which was founded by Aachen professor Dr. Günther Schuh, produced concepts for both electric transport vehicles and an electric car designed for private use. Deutsche Post AG then acquired StreetScooter (along with its utility vehicle division) in 2014. Meanwhile, Dr. Schuh and several partners founded e.GO Mobile AG on the basis of StreetScooter's passenger car concepts. Along with the e.GO Life, development is under way on the e.GO Mover, a self-driving compact bus. Production of the e.GO Life is scheduled to begin at the company's new factory in May 2018. Günther Schuh is now chairman and CEO of e.GO Mobile AG, which currently employs around 100 people and plans to expand to 250 in 2018.

ongoing optimizations. »It's definitely going to make us a reference factory when it comes to Industry 4.0,« Lüdtkke states. From his perspective as an industrial engineer, another advantage lies in »being able to eliminate interface problems through improved data continuity« – that is, no longer having to convert between different data formats. This also makes production more precise and leads to less post-processing work.

As work continues at the factory site, prototype development is always progressing back on campus. The assembly hall there is currently producing two or three designs every month, some of which then undergo trial runs at a track near Aachen. According to Lüdtkke, the goal of e.GO Mobile's ongoing prototype production is to »keep improving our varying levels of maturity«. Besides testing the models' long-term durability, this includes efforts to further optimize their insulation and reduce clearance gaps in their body shells.

ATTRACTIVE PRICES THANKS TO A NEW APPROACH TO VEHICLE CONSTRUCTION

The concept behind the e.GO Life is designed to make e-mobility attractive, especially in terms of its price. Starting at €15,900, this compact four-seater is looking to appeal to city dwellers and cost more than €10,000 less than a VW e-up!, Kia Soul EV, or Nissan Leaf (including batteries). It does have a range of just over 100 kilometers, however, which means the e.GO Life will indeed be limited to trips in urban areas in most cases.

Photos: e.Go (on top), Thomas Masuch (below)

Around 30% of our first prototype was made up of additive parts.

As Bastian Lüdtkke explains, his company was able to achieve a relatively low price thanks mainly to »a different approach to vehicle construction«. Based around an aluminum chassis, the vehicle's outer shell (including the roof, doors, and hood) is made of plastic rather than sheet metal. »That means our production operations don't require expensive metal presses and similar tools,« Lüdtkke points out. Since its plastic body components can already be produced in the right colors, there's also no need to paint the e.GO Life. Customers can choose from a variety of base colors, and further detailing can be added in the form of foil patterns.

In addition, the e.GO Life eschews the typical high-voltage unit in favor of a 48-volt

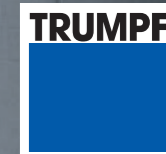
Bosch drive system weighing just 810 kilograms. »For the battery and motor, we took Bosch up on an offer it had made us and collaborate on some further adjustments,« Lüdtkke says, adding that the vehicle's lower voltage will simplify both production and eventual maintenance. He also reveals that it will be possible to plug the e.GO Life into a common household outlet and recharge it in five to six hours.

+ FURTHER INFORMATION:

- » fon-mag.com
- » e-go-mobile.com



Dr. Bastian Lüdtkke (I.) in the prototype production department.



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TALKING ABOUT

WHEN DOES IT MAKE SENSE TO BRING AM IN-HOUSE?

When getting into Additive Manufacturing, midsize companies in particular often face a major decision: Should we buy our own machine, or work with a service provider? Dr. Maximilian Munsch, a partner in the Hamburg-based consulting firm Ampower, has come up with some insightful answers in an extensive study of the AM service provider market in Germany, Austria, and Switzerland.

Mr. Munsch, your market study involved surveying over 50 service providers (that have more than 120 AM systems at their disposal) and comparing their offerings. What were your main findings?

MUNSCH One thing we found was that the price of additive services varies a great deal in metals. For printed aluminum, for example, you can pay between €3 and €10 per cubic centimeter. What's surprising is that it depends on whether the vendor is a start-up or a more established company; you see big differences among the more prominent vendors, as well. Meanwhile, there's also a lot of variance between orders involving series production and those for component prototypes.

Don't customers compare vendors' prices?

MUNSCH No, it doesn't seem like they take a good look around on the market when it comes to price. In a lot of cases, there are also very close relationships between specific customers and vendors that aren't based on price. At the same time, we've seen that the market is still in the process of finding itself.



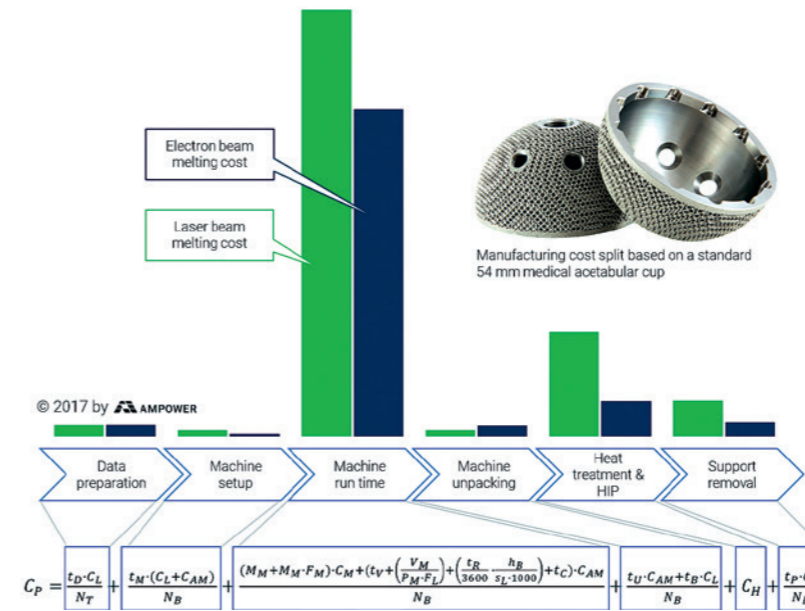
What conclusions does this offer to user companies, particularly those in the mid-market?

MUNSCH Well, the first insight is that getting offers from several vendors can definitely be worth the effort. This also enables a company to get a general idea of the current market prices and determine whether in-house production makes sense for specific applications and components.

Ampower's leadership team: Dr. Maximilian Munsch (center), Matthias Schmidt-Lehr (left), and Eric Wycisk.

Interview: Thomas Masuch

Photo: Ampower



This illustration shows how much each individual process costs in Additive Manufacturing. Here, Ampower has also differentiated between laser (SLM) and electron-beam (EBM) techniques.

What answers do you have for companies facing a decision like this?

MUNSCH The make-or-buy decision depends primarily on the volume of parts you're looking to produce every year, of course. With aluminum (AlSi10Mg), you break even at around 125 kilograms per year; with stainless steel (316L), it's 420 kilograms. In our view, aluminum is the most attractive option for those getting started in AM. The market prices on stainless steel, on the other hand, are so low relative to the cost of production that an in-house investment hardly makes sense right now.

Could you give us a bit more background on that aspect?

MUNSCH AM operations with aluminum require more expensive equipment and a great deal more expertise. In contrast, it's possible to manufacture high-quality stainless steel using simpler, older machines. These production machines are often already amortized, which enables the respective companies to offer competitive prices on the market.

Is it possible to answer the make-or-buy question based on price?

MUNSCH When you're establishing a foundation for AM, you also have to take other aspects into account. Along with infrastructure for the overall process, highly qualified employees are a key factor. The current shortage of specialists in this field in particular can present a real challenge to small and midsize enterprises.

Having equipment in-house thus offers the chance to build up internal expertise, as well.

You and Ampower just recently entered the market. What are your current goals?

MUNSCH We've been around since early 2017, and we're one of the few truly independent consulting firms specializing in the industrial application of AM. Along with our partners, we've actually been dealing with qualified Additive Manufacturing in various industries for over 20 years. We now advise our clients on investment decisions and manufacturing solutions, and also offer assistance in gathering internal expertise and optimizing additive components and processes. Besides putting all the experience we've amassed in laser-based pro-

Having equipment in-house thus offers the chance to build up internal expertise.

cesses at our customers' disposal, we also provide all the help they need in implementing electron-beam technology.

In terms of its target customers, your company focuses mainly on SMEs. Why is that?

MUNSCH Our customers also include a number of larger corporations, but the SME market is where we see the actual demand for our consulting services. For corporations, the decision to get involved in AM is typically a strategic one – which they then make a dedicated effort to see through. That means they invest in their own AM center and hire the specialists they need, which enables them to build up both corresponding knowledge and a cutting-edge reputation. Meanwhile, SMEs that have been working in conventional production see their first steps in Additive Manufacturing as an investment that has to make financial sense. Since we also know the market and its prices on top of our technical experience in AM, we're in a position to provide comprehensive support.

Mr. Munsch, thank you for taking the time to talk to us.

+ FURTHER INFORMATION:

- » fon-mag.com
- » Ampower at formnext 2017: 3.0-F31

FINE METAL POWDERS NOW A HOT TOPIC

Just as high-quality dishes call for only the best ingredients, metal powders are key elements of innovative and reliable components in Additive Manufacturing. A number of international corporations have recently developed a taste for the production of and market for fine powder, which is making the surrounding industry even more dynamic.

Two years ago, the long-standing German corporation Linde officially opened the new Global Development Center Additive Manufacturing (GDC) just a few kilometers north of Munich. For Linde, which generates around €17 billion in revenue each year, Additive Manufacturing was »a hot topic« in the words of Pierre Forêt, who established the GDC and oversees it today.

Linde had actually already come into contact with the world of 3D metal printing over a period of several years: Argon, nitrogen, and the other industrial gases the corporation sells flow through countless powder atomization systems around the world, and also see use in the inner workings of Additive Manufacturing equipment.

BIG NAMES ENTERING THE MARKET

Since Linde supplies numerous material manufacturers across the globe, Forêt was in an excellent position to observe the industry's development. »In the past, the market for materials was shaped by a large number of smaller manufacturers,« he recalls. »Now

the big corporations are getting involved.« Some of these heavy hitters are bringing with them considerable expertise in the traditional production of metal powders used in sintering. In Forêt's eyes, this and the impressive financial clout such corporations wield are significantly accelerating the entire industry's progress toward higher quality and greater volume.

Sweden's Höganäs, which supplies 500,000 tons of metal powder for various applications every year, is another corporation that now views the growth in metals for Additive Manufacturing (AM) as »very exciting« according to Rachel Spieczny, Höganäs's lead AM consultant. Spieczny believes this is based on the exponential growth seen in production quantities over the past 6 to 12 months.

At the same time, the number of metals available has also risen significantly. As Pierre Forêt explains, the nickel alloys and different types of tool steel commonly known from traditional machining have increased the acceptance of Additive Manufacturing – particularly among SMEs – and opened the door to many new applications.

NO MAKEUP IN PRODUCTION AREAS

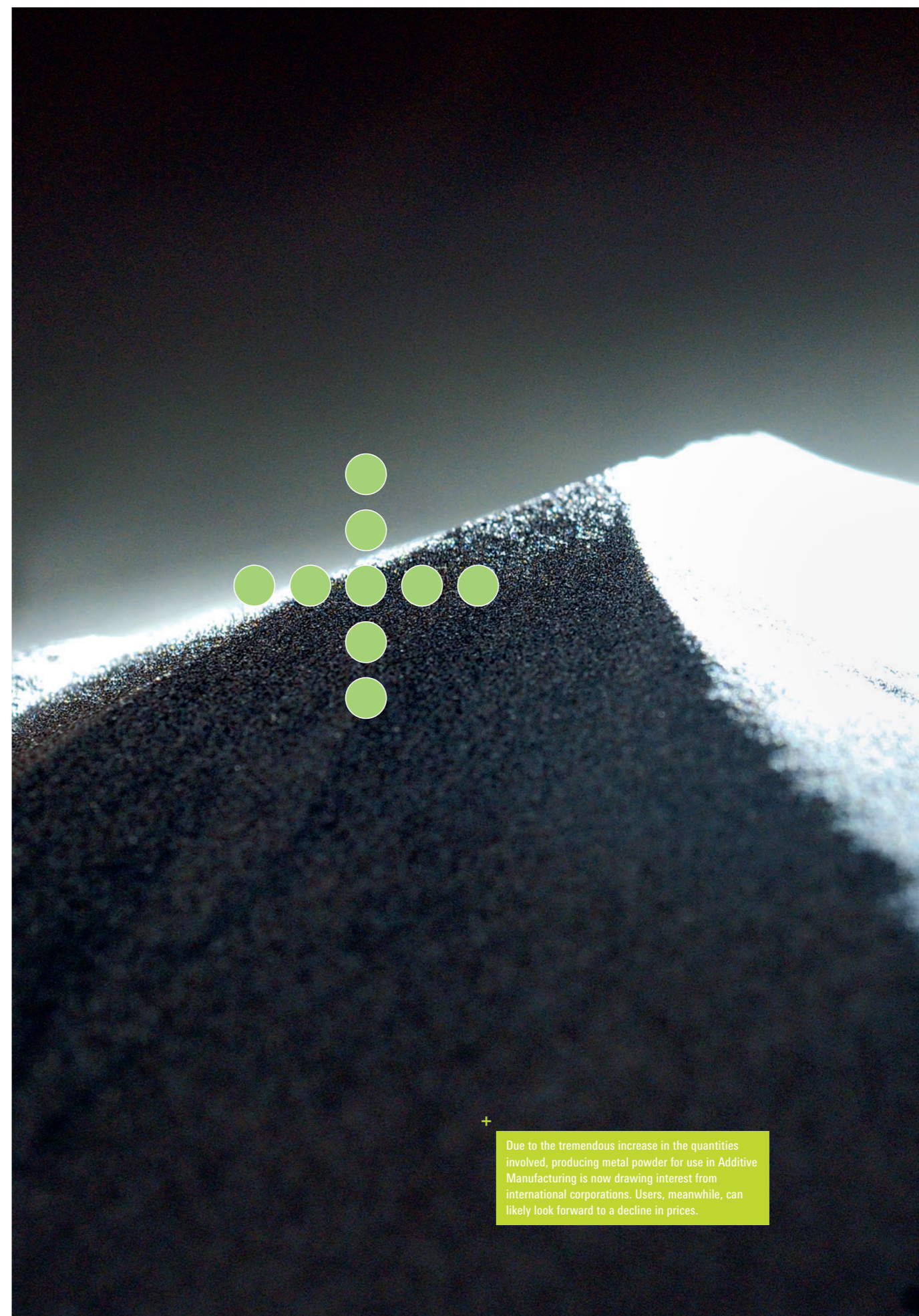
In the city of Widnes (near Liverpool), England, construction is under way on a new powder factory that will boast an annual production capacity of up to 1,000 tons. The British powder manufacturer LPW plans to cut the ribbon on the over 9,000-square-meter facility by the end of 2017. When it does, the factory »

The Global Development Center Additive Manufacturing (GDC), part of Linde AG

Linde's GDC facility in Unterschleißheim (near Munich), Germany, already has five employees at work, with a further 10 set to follow. »We have a concrete business case in Additive Manufacturing,« affirms Pierre Forêt, who oversees the center. Along with products for the AM market, Forêt and his colleagues have developed ADDvance O2 Precision – a measurement and analysis system that monitors atmospheric conditions inside 3D printing machines. The GDC is also working on additive applications for Linde itself to use. The facility has two metal printing machines and a powder characterization lab at its disposal, which have already produced two multipurpose burners using additive techniques. »AM is enabling us to try out special designs much faster and achieve further performance gains,« Forêt explains.

Text: Thomas Masuch

Photos: LPW



Due to the tremendous increase in the quantities involved, producing metal powder for use in Additive Manufacturing is now drawing interest from international corporations. Users, meanwhile, can likely look forward to a decline in prices.



Now, powder quality and price are becoming extremely important.

Photos on top and below: The production of metal powder for Additive Manufacturing is becoming more and more sophisticated. In clean-room environments, manufacturers are working to achieve further reductions in powder impurities.



will be looking to set all-new standards in quality as the world's largest site dedicated to AM powder production.

For chief operating officer Ben Ferrar, ongoing advancements in quality will play a central role in the years ahead. »Users are achieving higher and higher production levels, so future innovations will mainly emerge in the form of quality improvements in existing metal powders,« he reports. For an international corporation like LPW, which currently employs 100 people and sells 200 tons of AM powder each year, continuing to reduce impurities in its products is a primary concern. »That's why our employees in clean-room manufacturing won't be allowed to wear makeup or jewelry, for example,« Ferrar explains, adding that such efforts are to make Widnes the home of the purest metal powders in the world.

Meanwhile, the quest for ever-increasing material quality is no longer limited to the production process. »Atomization is only the first step,« points out Pierre Forêt, who goes on to explain the importance of how powder is handled. Various methods are used in packaging alone, from simple plastic bags to containers filled with inert gas.

Powder handling is one of the crucial issues in AM for Ben Ferrar, as well. »With every process step, there's the potential for the powder to change,« he reveals. At formnext, LPW will be unveiling a comprehensive solution that covers everything from orders and transport to storage and material analysis while making it possible to track the origin of the powder used in each manufactured component.

A POTENTIAL 50% DECLINE IN PRICES

When new facilities begin pumping greater volumes into the market, changes in the price of materials will likely not be far behind. Accord-

ing to Pierre Forêt, a price decline of 50% or more on certain metal powders would come as little surprise in the coming years. Rachel Spieczny, meanwhile, has seen user perceptions change in this regard. »Until recently, metal AM was focused on prototyping; the price of metal powder didn't play a central role in decision-making,« she says. »Now, powder quality and price are becoming extremely important.«

Since higher production quantities mean higher sales in industrial gases, Linde is also profiting from the market's growth. Manufacturing titanium powder, for example, requires large amounts of argon. A corresponding powder atomization machine consumes up to 2,500 cubic meters of this noble gas every hour. Gas alone thus accounts for a significant proportion of production costs.

To optimize its production operations, Linde is working with its customers on an argon recycling system. While this system would cut into the corporation's revenues, Pierre Forêt believes that »it's also in our interest to see the industry advance as a whole.«

+ FURTHER INFORMATION:

- » fon-mag.com including an interview with LPW's Ben Ferrar
- » Höganäs / Linde AG / LPW at formnext 2017: 3.0-G10 / 3.0-E91 / 3.1-D48

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EXHIBITION PREVIEW

FREEFORMING WITH STANDARD MATERIALS

With two freeformer exhibits, Arburg will show innovations in industrial Additive Manufacturing of individual functional components and small series from certified standard granulate. This includes PP processing and Armat 12, the soluble support material developed especially for this purpose. The open system produces a PP functional component for the packaging industry »live«. Prototypes for the packaging industry will be produced from semi-crystalline materials as an example.

According to Arburg, the open system allows users to work independently, whereby

they can even certify their own original materials, for example, as used for injection molding, and optimize process parameters according to the relevant application they require.

Visitors have the chance to get their own impression of what the freeformer and innovative APF process can deliver, by getting a hands on feel of around 40 sample functional components.

» Arburg at formnext 2017: 3.1-E70



SOPHISTICATED HYBRID MACHINE

The »Lasertec 65 3D« and »Lasertec 4300 3D« are two hybrid machines that DMG Mori already has in its portfolio. With »Lasertec 30 SLM«, which has a work area of 300 x 300 x 300 millimeters, DMG Mori focuses on the manufacturing of complex-shaped workpieces. Here, customers can benefit from an intelligent powder concept that is to enable material change in less than two hours. This allows components made of different materials to be built more quickly on the same machine.

Thanks to the intelligent power module concept that allows material change in less

than two hours, the »Lasertec 30 SLM« can manufacture components made of different materials within a short space of time. As a machine tool manufacturer, DMG Mori focuses on the entire process chain, including downstream machining of components.

» DMG MORI at formnext 2017: 3.0-E80

GREEN LIGHT FOR COPPER PRODUCTION

The use of copper in Additive Manufacturing requires a special laser. The Fraunhofer Institute for Laser Technology ILT in Aachen has developed such a laser, and at the same time, has used it to design a complete system that can turn pure copper into workpieces.

The key challenge in Additive Manufacturing of copper is that, in the customary wavelengths of 1,000 nanometers, up to 93 percent is reflected – unlike for steels and alloys with titanium, aluminum, nickel, and cobalt.

A green laser, however, with a wavelength of 515 nanometers, is absorbed seven times better. Since such a beam source was nowhere to be found in the market, Fraunhofer ILT developed a fundamental mode laser that has a maximum output of 400 watts in continuous operation.

By the end of the year, Fraunhofer ILT intends to create a system prototype for »SLM in green« (selective laser melting in green), with which the process is to be further developed as part of a research project.

» Fraunhofer-Institut für Lasertechnik ILT at formnext 2017: 3.0-F50



Photos: Arburg (on top), DMG MORI (below)

EXHIBITION PREVIEW

MULTI-CELL ADDITIVE MANUFACTURING PLATFORM

At formnext Stratasy's will demonstrate its unique multi-cell Additive Manufacturing platform for continuous production. Making its premiere for the first time in Europe, the Stratasy's Continuous Build 3D Demonstrator is composed of a modular unit with multiple 3D print cells working simultaneously, driven by a central, cloud-based architecture, setting a new standard of production throughput with Additive Manufacturing.

Designed to produce parts in a continuous stream with only minor operator intervention, the Continuous Build 3D Demonstrator automatically ejects completed parts and commences new ones. Each 3D print cell can produce a different job and additional cells can also be added to increase production capacity as and when demand requires.

Stratasy's will also present the very best of its core FDM and PolyJet 3D printing solu-

tions on the stand, together with high-profile customer applications from the automotive, aerospace, medical and consumer goods industries including Airbus, Boeing, BMW, Opel, Siemens, and more. Visitors will learn how to optimize Additive Manufacturing across a number of design and manufacturing applications.

» Stratasy's at formnext 2017: 3.1-F40



The Continuous Build 3D Demonstrator is designed to produce parts in a continuous stream with only minor operator intervention.

PRINTED AS IF CAST

Hot lithography is the name of an Additive Manufacturing production principle developed by Cubicure, a start-up from Vienna. The principle is based on a stereolithography method in which new types of photopolymers developed by Cubicure are used.

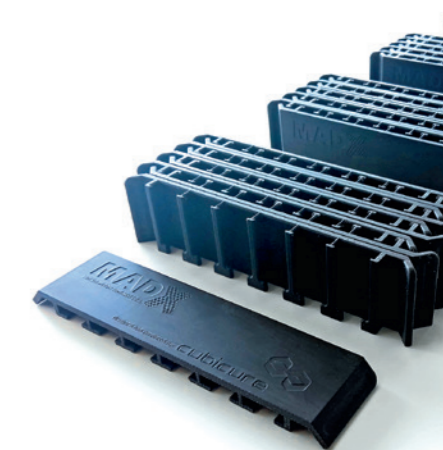
This allows the Cubicure Caligma 200 production system to produce high-precision plastic components that are break-proof and temperature resistant. As a result, Cubicure promises quality that was previously only known from injection molding, combined with a flexibility that only Additive Manufacturing can offer.

In hot lithography, a laser with a beam diameter of 10 to 100 µm projects light from the bottom up and hardens the material on

the component. In the Cubicure Caligma 200, components with any surface qualities can be manufactured that fit into the installation space of 200 x 100 x 300 mm.

With hot lithography, Cubicure wants to resolve the »dilemma of 3D printing«: up to now, high-precision plastic components produced using Additive Manufacturing would often not stand up to the high loads of the industry and everyday use, and instead are relatively fragile.

» Cubicure at formnext 2017: 3.1-G57



Photos: Stratasy's (on top), Cubicure (below)

EXHIBITION PREVIEW

FIVE AXES, XXL, AND TITANIUM

A company waiting to premiere several products together at formnext is Hage Sondermaschinenbau. The Hage3D division of the Austrian company, which has longstanding experience in fused deposition modeling (FFF/FDM), will present a 5-axis printer, an XXL printer, and titanium printing in the SDS process.

According to Hage, the new 5-axis printer promises a high degree of reliability and precision thanks to an absolute encoder and ball screw drive in XYZ and two NC tilted axes. This allows even complex forms of up to 500 x 500 x 450 mm in size to be manufactured largely without supporting material. Using the 5-axis printer, Hage3D will present an example of 3-axis control and a work area capacity of 1,200 x 1,200 x 1,200 mm.

Besides the two machines, Hage3D will demonstrate the SDS process (shaping, debin-

ding, and sintering). This Additive Manufacturing process, which was developed together with partner company OBE and the University of Leoben in Austria, uses among other things a special titanium composite material. This produces components that are nearly 100 percent titanium.

» Hage Sondermaschinenbau at formnext 2017: 3.0-F78



UTILIZING THE HIGH THERMAL CONDUCTIVITY OF COPPER

Sisma, together with the Istituto Nazionale di Fisica Nucleare, has made major progress in copper processing at Additive Manufacturing plants. As a result, the special properties of copper can also be transferred to complex internal structures. The high thermal conductivity of copper delivers many advantages, for example, with internal cooling ducts.

Copper offers numerous areas of application for applications with Simsa's MySint machinery. This includes manufacturing of tool inserts and products in the field of high-performance semiconductors. Compared to production with traditional methods, the components would have the same or even better properties.

» Sisma at formnext 2017: 3.0-D10

ADDITIVE UP TO 3 TONS

GTarc 60-5 will celebrate its world premiere at formnext 2017. With its additive wire smelting machine, German manufacturer Gefertec wants to make Additive Manufacturing attractive for large components and volumes.

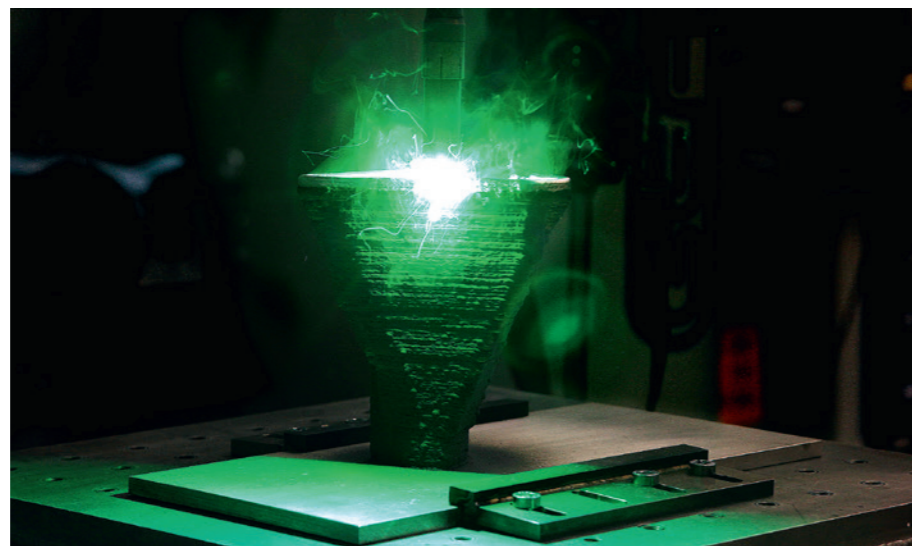
The »3D Metal Print« technology (3DMP) used by Gefertec is based on inert-gas welding and uses wire as the base material. This allows a workpiece to be »printed« weld bead for weld bead. The structure of »GTarc 60-5« is reminiscent of a classic machining center and uses a CNC controller. »We've had a good response from the industry because the technology has been known for years,« says Marcus Ortloff, sales engineer at Gefertec.

With »GTarc 60-5« and its older brother, »GTarc 3000-3«, Gefertec can use the 3-axis

model to manufacture components weighing up to 3 tons and with a volume of up to 3 m³. In contrast, component volumes and weight are much lower with the 5-axis variant, but supporting structures are not required here in the manufacturing process, according to Gefertec.

Even in terms of buildup rates, Gefertec promises significant advances: up to 600 cm³/h with aluminum and up to 450 cm³/h with titanium. Large components in the heavy industry, such as screw propellers, are among the potential fields of application, believes Ortloff. »We're starting at the point where you stop with powder.«

» Gefertec at formnext 2017: 3.1-F89



Photos: Sisma (on top), Gefertec (below)

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SPECIAL STEEL FOR THE WORLD'S TOP PERFORMERS

EXHIBITION PREVIEW

AUTOMATION OF DESIGN PROCESSES

With its »Paramate« software, Trinckle has automated the design process for a robotic gripper. In collaboration with the production service provider and robotic specialist Kuhn-Stoff, Trinckle has created a software application that is to reduce the average design time from about eight hours to just a few minutes. At the same time, the intuitive web-based configurator enables practically any user, even those without CAD experience and no knowledge of Additive Manufacturing, to manage the design process.

According to Trinckle, the »Paramate« software can even automate complex design processes with the help of intelligent algorithms. This would make diverse customer-specific product modifications possible – from prostheses that can be fitted exactly to the body of individual patients, to mechanically optimized industry components and personalized jewelry.

» Trinckle at formnext 2017: 3.0-B20



OPTIMIZING PROCESSES WITH A DIGITAL TWIN

With a »digital twin«, the Fraunhofer Institute for Production Technology IPT is documenting every single production step of a component or complete device in its Smart Manufacturing Network. The information saved can be assigned to a real component by way of identification systems. The necessary data for this is delivered by intelligent sensors, machines, control systems, simulation tools, and databases, which merge real data and generated models.

On the basis of this data, process planners can optimize production to a high degree even before the first real machining tests. All of the

data and services for networked and adaptive process control are available, allowing for flexible design of process chains.

On smartphones or smartglasses, the processes can be visualized and involve the process developers as well as machine operators. The Smart Manufacturing Network thus offers a digital assistance system for networked, adaptive production.

» Fraunhofer IPT at formnext 2017: 3.0-F50

WORLD'S FIRST INTEGRATED METAL 3D PRINTED PART REMOVAL

Additive Industries presents at formnext not only its recently launched MetalFAB1 Process & Application Development Tool and 4-full-field laser MetalFAB1 version. The Dutch innovators of metal Additive Manufacturing for series production have planned the world premiere of the next functional module at formnext in Frankfurt. The engineering team of Additive Industries has succeeded to integrate both product removal and build plate resurfacing in one module that can be integrated in its MetalFAB1 platform as an option. According to the company, this Product Removal Module allows MetalFAB1 users to keep the build plates in the machine and reduces the need for postprocessing outside of the 3D metal printing system.

» Additive Industries at formnext 2017: 3.0-F40

COMPACT MULTILASER SYSTEM

At formnext 2017, laser and laser system manufacturer Trumpf will present, among other things, the metal-powder-based 3D printer TruPrint 1000 with a multilaser option for industrial applications. The compact and robust TruPrint 1000 has a multilaser option featuring two 200-watt laser beam sources – its basic version has a 200-watt laser. Compared with the standard variant, the TruPrint 1000 with multilaser option offers increased system productivity. While maintaining the same level of output, the machine generates up to 80 percent more components; the pure process time for building components in the powder bed is reduced by almost half.

» Trumpf at formnext 2017: 3.0-E50

Photos: Trinckle

EXHIBITION PREVIEW

»HIGHLY DYNAMIC LASER BEAM GUIDANCE«

Greater speed is the next step that can reinforce the importance of Additive Manufacturing of components and entire products. However, the speed of additive metal production plants depends to a large extent on the speed of the laser beam deflection units, exact control of the laser source, and fast focusing of the laser beam.

Raylase promises to deliver a solution for this with its »AM module«. The first model variant to go into series production, »AM Module Next Gen«, will be presented by the German company for the very first time at formnext 2017. Raylase considers the most important application industries to include aerospace, automotive, and medical technology.

The module is equipped with completely new digital control and electronics, and according to Raylase, offers »optimal position stability of the laser beam, homogeneous power distribution on the workpiece, highly-dynamic laser beam guidance with targeted modification of the spot diameter, and process monitoring with autonomous focusing.«

» Raylase at formnext 2017: 3.0-B88



AUTOMATION POWER AND FLEXIBILITY

At formnext 2017, Materialise will address three major market demands: speed, quality, and technology innovation. With new software releases and the expansion of its Factory for 3D Printing, Materialise will showcase how it's enabling customers to take 3D printing to the next level.

New automation tools in the Materialise Streamics and Robot software enhance the overview of production sites, reducing operating times and expenses associated with manual labor.

The new Magics 22 brings exciting integration tools with simulation software, and Materialise will be offering live demonstrations of

how to use digital tools to add the control and quality necessary to print a part right the first time around.

The company will also be showcasing how industries are taking full advantage of 3D printing, from developing better products to optimizing supply chains to innovating business models. Furthering this commitment to help their customers make full use of innovations in 3D printing, Materialise is expanding its 3D printing capacity to a total of six HP Jet Fusion 3D 4200 machines, becoming one of the largest service providers of Multi Jet Fusion printing worldwide.

» Materialise at formnext 2017: 3.0-C48

Photos: Materialise (on top), DWS (below)



LAMP AND SPEAKER IN ONE

The designer speaker »Alux« from Alice Barki is a current example of what DigitalWax 030X from Italian manufacturer DWS can offer. Production of the speaker, which also serves as a lamp, takes 48 hours on the stereolithography printer. Postproduction, which lasts a good 20 minutes, comprises a water and alcohol bath and UV irradiation.

DWS specializes in hi-tech solutions for prototyping and rapid manufacturing using

stereolithography. The Italian manufacturer's production range includes jewelry and accessories, dental products, industry and design products, as well as professional consumer goods, and it exports to more than 60 countries worldwide.

With a build volume capacity of 300 x 300 x 300 millimeters, the DigitalWax 030X can create filigree objects with high-quality surfaces from plastics such as ABS, polypropylene, elastomer, or nanoceramics.

» DWS at formnext 2017: 3.1-E88

EXHIBITION PREVIEW

GE ADDITIVE, CONCEPT LASER, AND ARCAM TOGETHER AT ONE BOOTH

At formnext, GE Additive will show for the very first time its range of product offerings from engineering consultancy services to materials, Concept Laser, and Arcam's additive machines.

In 2016, GE established GE Additive to become the world's Digital Industrial Company, transforming industry with software-defined machines and solutions that are connected, responsive, and predictive. GE Additive includes additive machine providers Concept Laser and ArcamEBM; along with additive material provider AP&C and additive service provider to the medical industry, DTI.

For the first time, at formnext Show, GE will highlight innovations from these companies in one main area. GE is organized around a global exchange of knowledge, the »GE Store,« through which each business shares and accesses the same technology, resources, and intellect.

» GE Additive at formnext 2017: 3.0-E30

ADDITIVE INNOVATIONS FROM SPAIN

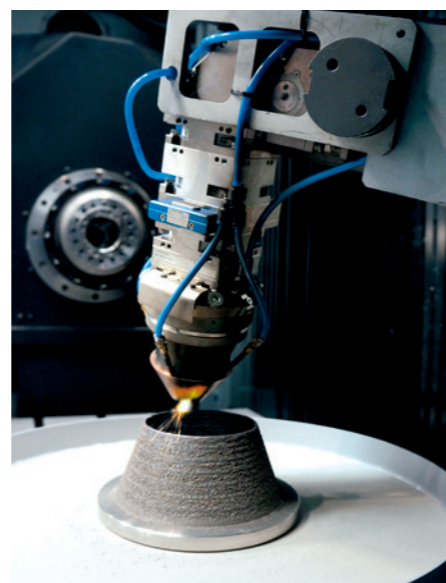
The diverse range of services offered by the Additive Manufacturing industry in Spain will be showcased at formnext by Addimat (the Additive & 3D Manufacturing Technologies Association of Spain) together with five member companies at a shared booth.

The companies Addilan, Ibarria Innovatek, and Fagor Automation offer innovative solutions in the areas of wire arc Additive Manufacturing, hybrid machines (see photo), and process monitoring. In addition, the research institutes CEIT and Lortek will present numerous application examples of Additive Manufacturing and the latest research findings.

Addimat represents around 60 member companies, including material providers, service providers, research institutions, users, and others. In Spain, the association also participates in research and development projects. One example is the Addispace project, which is aiming to drive forward the application of Additive Manufacturing technology in the aerospace industry. At formnext, Addimat will present the first ever published industry catalog that fea-

tures an almost complete list of all companies in Spain that are associated with AM technologies.

» Addimat at formnext 2017: 3.0-B30



LOW-MAINTENANCE MONOBLOCK DESIGN

In the new tomograph »TomoScope XS«, Werth Messtechnik combines compact dimensions with powerful fluoroscopy and high accuracy. Werth hereby promises »technology of the Big Ones, in the format of the Small Ones.« Particular properties of the tomograph include a small focal spot even during high performance, as well as a low-maintenance monoblock design of tube, generator, and vacuum generation. This is the first time something like this has been realized as an open type of construction. The Werth TomoScope hereby reduces downtimes and enables – when combined with the associated Mess software WinWerth – fast process-accompanying measurements in real time as well as traceability of measurement results.

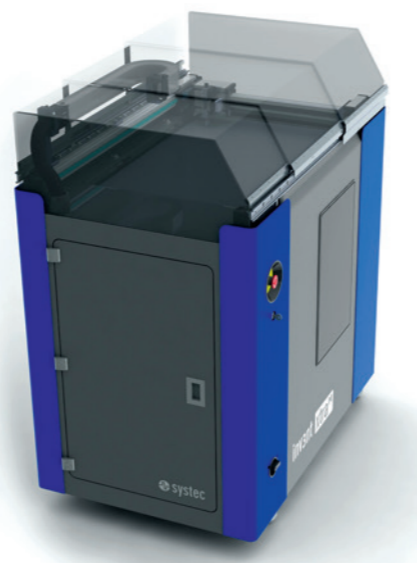
» Werth at formnext 2017: 3.1-G82

SPACE-SAVING LARGE CAPACITY PRINTER

This 3D printer from Systec, including its packaging, fits onto exactly one Euro-pallet, and with a width of 760 millimeters, will even fit through most standard doors. This is remarkable in that the FFF/FDM 3D printer »inv3nt xtra« provides a work area of 650 x 410 x 680 millimeters – workpieces can have a volume of more than 180 liters.

In »inv3nt xtra«, which will be presented at formnext, an Xemo controller drives a two-axis H-portal positioning system. This allows almost any number of printheads to be mounted for filaments or granulates. At speeds of up to 500 mm/s, repeat accuracy of 0.1 millimeters can be achieved, according to Systec. All device functions, including the heated continuous printing plate, are controlled via a touchscreen that features the CNC user interface Xemo NC 3D.

» Systec at formnext 2017: 3.1-A16




Photos: Addimat (on top), Systec (below)

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»OUTSIDE THE BOX«

Learning from Children

As most people know, milling, lathing, grinding, and similar machining techniques are considered »conventional« in the world of Additive Manufacturing. These technologies are used by thousands of midsize companies, which is where one sometimes finds a very specific type of entrepreneur: After cutting their own teeth on greasy machining equipment in ear-splitting production halls, they started companies around 20 or 30 years ago and have built them into fairly successful organizations over the years. Now hardened by crises and bolstered by their accomplishments, they are confident in their opinions, but remain down-to-earth, affable in their own way, and every inch the boss.

I myself am fortunate enough to call one of these entrepreneurs a friend. When we were discussing Additive Manufacturing over a year ago, I remember telling him that I thought the technology presented some exciting opportunities for his 50-employee production company. I also mentioned that he could do more to get young people interested about the firm and learning a technical trade.

At the time, my friend's response was less than enthusiastic. »You handle your business and I'll handle mine,« he retorted. »We're dealing with cutting machines here, not 3D printing.« That put the subject to bed – until we visited the training facilities of a chamber of crafts together a few weeks back. The young trainees we met in a class for cutting mechanics seemed a bit listless at first. When the subject turned to 3D printing, however, many of their eyes lit up; some even talked about how they were already coming up with designs on their own computers and printing custom phone covers and other creations for all of their friends.

In the next room, more than 20 students between the ages of 10 and 14 were taking

part in a summer vacation program offered by the chamber. It was easy to see how excited they were about turning their construction kits into FDM printers and taking them home the following afternoon. »Why isn't that part of our training program?« I heard my enterprising friend ask his company's training director.

It's always good when real men can learn so quickly from the shining eyes of children, isn't it?



Text: Thomas Masuch, Illustration: Feedback Media Design

+ IMPORTANT FACTS:

- » 14–17 November 2017
- » Messe Frankfurt, Hall 3

» Further information: formnext.com



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