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formnext magazine

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This is how precise, functional vehicle compontents are printed.
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More Important Than Technology: The Constructor Mindset.

[Rinje Brandis, CEO, Krause Dimatec]

EDITORIAL

When increasingly efficient printing methods made daily newspapers available to the masses some 200 years ago, many believed that the common book was on its last legs. This new medium was seen as modern and technically superior; it shaped the course of ongoing debates and gave publishers pivotal influence over both politics and society at large. Indeed, newspapers even determined the outcomes of revolutions.

As we now know, of course, books have lived on, while newspapers are now the ones facing ever-stronger competition from a new driving force: digital media. Here, those capable of putting the right pieces together have an edge on their rivals.

Additive technologies are the new driving force in industrial manufacturing. These modern advancements are capable of accelerating processes and giving rise to exciting innovations – but completely replacing milling, lathing, and erosion techniques? Quite the opposite. Additive methods represent helpful enhancements that often dovetail extremely well with conventional approaches like these. This is why it's crucial that companies identify their own ideal mix of development and production processes. At formnext 2016, you're certain to find plenty of inspiration that will help you assemble the perfect technological composition for your own organization.

Meanwhile, we've been making some changes and improvements to our up-and-coming formnext magazine. In particular, we'll be producing even more issues based on the outstanding feedback we received on the first three. fon magazine will also be appearing in a new design that really looks great, if we do say so ourselves.

I hope you enjoy reading our latest inspiring edition.

Sincerely,
Sascha F. Wenzler
Vice President formnext

Cover: Cipres

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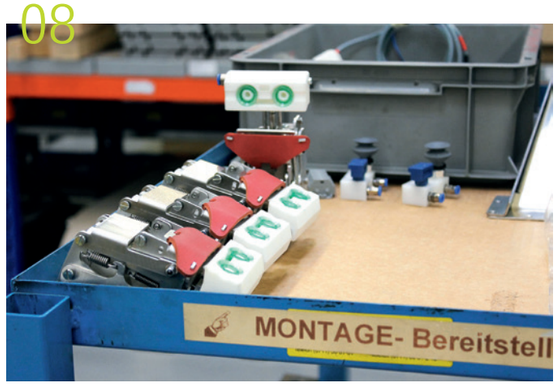

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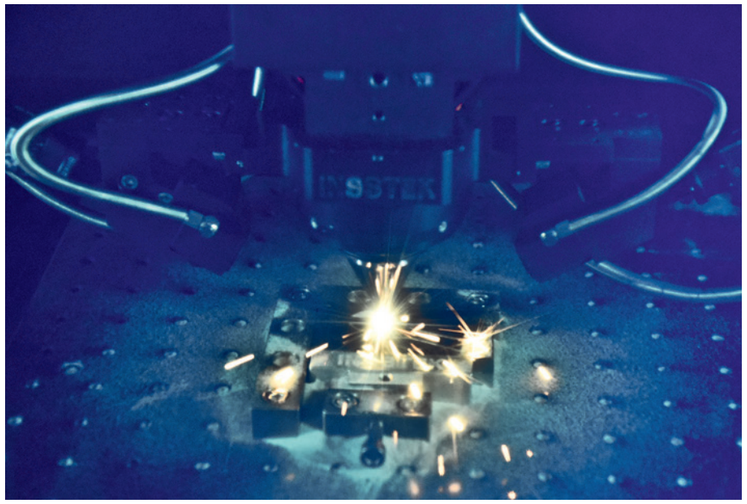
FORMNEXT NEWS

WORLD PREMIERES IN INTELLIGENT INDUSTRIAL PRODUCTION



At formnext powered by tct 2016, attendees can look forward to numerous world premieres and plenty of cutting-edge expertise in modern product development and manufacturing. Market leaders like 3D Systems, ARBURG, Concept Laser, EOS, Renishaw, Trumpf, Siemens, SLM, and Stratasys will not be the only ones showing off their latest advancements. On 15-18 November 2016 in Frankfurt am Main, industry giant HP will be on hand with its Jet Fusion Printing Solutions, along with Additive Industries with MetalFAB1; DMG Mori and Sauer with Lasertec; Hermle Maschinenbau with its MPA technology; and XJet with its direct 3D metal jetting system.

Formnext has undergone impressive growth in just its second year, with the event set to offer 40 percent more space to a lineup of exhibitors that has also expanded by 30 percent. Along with the companies listed above, Alphacam, EnvisionTEC, FIT, Formlabs, Materialise, Prodways, Realizer, Ricoh, Sisma, and voxeljet will be representing the global elite in 3D printing.

»At formnext, we'll be showcasing the next generation of intelligent industrial production,« states Sascha F. Wenzler, Vice President for formnext at event organizer Mesago Messe Frankfurt GmbH. Besides 3D printing, the formnext concept covers many other links in the process chain, including design, prototype construction, machine tools and industrial tool-making, materials, measurement technology, software, and various aspects of pre- and post-machining.

Meanwhile, the event has added software companies like Altair, Autodesk, Dassault Systemes, IKOffice, and MachineWorks-Polygonica to the many innovative tool-making firms on its agenda. The materials sector will also be seeing a boost thanks to leading companies like Heraeus, Höganäs, Sandvik Osprey, and the Airbus subsidiary APWorks.

+ FURTHER INFORMATION:
» formnext.com/exhibition

CYCLING, AUTOMATION, AND SERIAL PRODUCTION

Formnext conference brings together the greatest achievements in additive manufacturing

This year, visitors will once again flock to formnext conference powered by tct to be part of a leading think tank in the world's manufacturing industries. Following its remarkable success in 2015, formnext conference is expecting numerous first-rate speakers and international experts to turn all four days into another global forum on modern product development and production.

In cooperation with conference partner tct, the event will cover the latest findings from the realms of science and research and brand-new applications from prominent international companies. Among countless other subjects, attendees will find out how BMW is introducing 3D printing into its serial production processes, or how industry giant Procter & Gamble plans to 3D print consumer products in the future. Leading specialists will also discuss current topics of note, including in the areas of law, design, cutting-edge technology, and ongoing education.

One special highlight will be an appearance by Paralympic cyclist Denise Schindler, whose numerous championships and accolades include being named Germany's Disabled Athlete of the Year in 2012. On the first day of the conference, Schindler will report on how new technologies in disabled athletics are paving the way to success. She herself is contributing to work on a procedure that digitally scans amputation points to facilitate the 3D printing of better-fitting protheses.

+ FURTHER INFORMATION:
» formnext.com/conference

Photos: Mesago Messe Frankfurt

FORMNEXT NEWS

OUTSTANDING INNOVATIONS FROM THE WORLD OF 3D PRINTING

» formnext Start-up Area: 3.1-B60

A product comparison platform, a machine that produces printing material in-house, a new type of plastic printer – the winners of the formnext Start-up Challenge have come up with some outstanding innovations in the field of 3D printing. Even better, all of these offerings are now or nearly ready to market. The award-winning young companies behind these innovations will present their products at a joint stand at this year's formnext.

The 2016 formnext Start-up Challenge is being held in cooperation with Germany's 3D Printing Cluster. Among other aspects, an international jury has assessed the innovativeness and feasibility of the business ideas submitted to the competition.

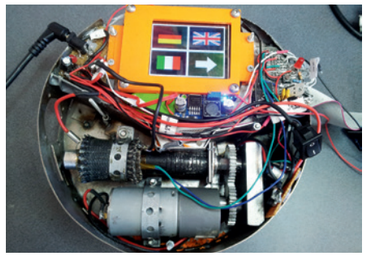
THE WINNERS

FAST, ACCURATE PRINTING

According to Dr. Andrei Neboian, CEO of Xioneer, the Xioneer X1 is a professional, extrusion-based 3D printer that offers a combination of excellent print quality and speed thanks to a series of patented innovations. Neboian also states that its fully automated calibration system can quickly create precision objects up to nearly 30 liters in size. Meanwhile, an efficient workflow and a cartridge-based material system make it possible to turn around print orders in a short amount of time.

COMPARE 3D PRINTING PRICES WITH 3YOURMIND

3YOURMIND has developed software that enables users to analyze and optimize 3D printing data, which saves time and money. The company also offers price comparisons to those looking for the right service provider in 3D printing. Its customers and partners already include firms listed on the DAX 30 and world-leading developers of 3D printers and CAD programs.



MAKE MATERIAL FILAMENT IN-HOUSE

The Re-Fila device from Mcubus is designed to create further material for use in 3D printing. According to its developers, the machine makes it possible to produce material filament out of defective prints or fresh purchased granulate. Re-Fila is also capable of recognizing when more filament is required and producing it »just-in-time« – even in the right color. This eliminates the need to maintain an inventory of material spools. Mcubus has filed for a patent on Re-Fila, which is in an advanced stage of prototyping.

LARGE-SCALE DESIGNS MADE COST-EFFECTIVE BY BINDER JETTING TECHNOLOGY

Munich's Additive Elements has come up with a technique for producing dense plastic components using the binder jetting process. The company utilizes a PMMA-based powder in combination with a methacrylate to manufacture high-quality synthetic parts. »Compared to the techniques that are common right now, this cold process will make it possible to produce much larger components at lower costs,« states CEO Thilo Kramer.

Photos: Xioneer, 3YOURMIND, Mcubus, Additive Elements

EXHIBITION PREVIEW

REUTLINGEN'S 3D PRINTING PIONEER SUPPORTING THE GERMAN OLYMPIC TEAM

After arriving at the Olympic velodrome in Rio with medals on their minds, Germany's track cycling athletes rolled up to the starting line with innovative technology from 3D-Laserdruck. Based in the southern German city of Reutlingen, this 3D printing company assembled a series of lightweight bicycle stems for Brazil's Summer Games in cooperation with the sports R&D institute FES. These torsion-resistant aluminum alloy designs connect the handlebars and fork to a carbon frame. In addition to optimized aerodynamics, each stem features a length and crankset that are tailored to one of the German team's 18 riders. From the very beginning, the engineers at 3D-Laserdruck provided FES with expert assistance in designing and implementing lightweight geometric forms.

These innovations enable athletes like Joe Eilers (pictured) to barrel down 250-meter wooden tracks and lean into curves at angles of up to 45 degrees while reaching speeds surpassing 70 km/h.

» 3D-Laserdruck at formnext 2016: 3.1-C70

Bringing Color to Printed Plastic Parts

The new e-coloring process from CIPRES is making it possible to give long-lasting color to printed plastic parts, including everything from eyeglasses and jewelry to enclosures and robotic arms. Following a number of refining procedures and the e-coloring process itself, products feature hues that are not only vibrant and resistant to light and weather conditions, but easy on the skin, as well.

» CIPRES at formnext 2016: 3.1-K73

+ MORE EXHIBITOR HIGHLIGHTS:

» formnext.com/magazine

» formnext.com/exhibitorlist

Photos: 3D Laserdruck (above), Cipres (right)

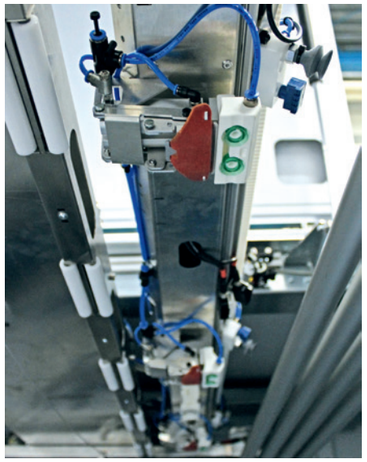
TURNING POWDER INTO PRINTED PRODUCTS

Text: Thomas Masuch

Rinje Brandis stands in front of the new 3D metal printer. Many finished parts are incorporated into HORSTMANNGROUP's adjacent mechanical engineering operations.

Photos: ZIKOMM; Thomas Masuch

While additive manufacturing established itself in the medical technology and aviation industries some years ago, it remains in its nascency in mechanical engineering. As the rapid evolution of Germany's Krause Dimatec GmbH shows, however, this field also presents a great deal of potential.



In the industry of Eastern Westphalia – the most prominent German region north of Baden-Württemberg when it comes to mechanical engineering – the prevailing mindset is still shaped by traditional engineering values. »A lot of parts are made of metal and so solidly built that they often outlive their constructors,« explains Rinje Brandis, who has his own mechanical engineering PhD and serves as CEO of Krause Dimatec. »Sometimes, convincing developers that the parts we sinter out of synthetic powder are just as sturdy is a major challenge.«

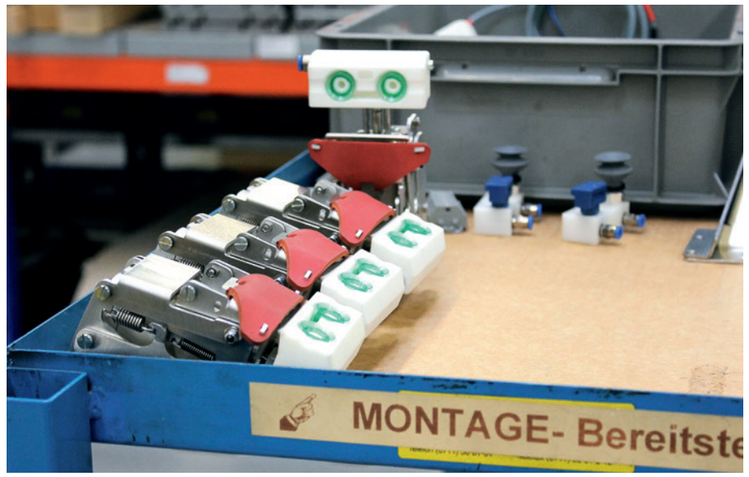
Since early 2015, Brandis has succeeded in doing exactly that: He has implemented numerous innovations, and not only at the companies belonging to HORSTMANNGROUP, which owns Krause Dimatec and employs 1,100 people.

»We manufacture special-purpose machines, so every area of our corporate group requires small batches of complex components – from fittings and levers to kneading hooks,« reports Brandis, who began searching for solutions in additive manufacturing several years ago as an assistant to entrepreneur Jürgen Horstmann. »Back then, there were plenty of service providers in aviation, but nothing suitable available for mechanical engineers like us.« The decision was thus made to assemble a corresponding division within HORSTMANNGROUP.

»SMALL NUMBERS OF COMPLEX COMPONENTS«

Krause Dimatec and its team began building up the necessary expertise along with the Direct Manufacturing Research Center at nearby Paderborn University. There, Brandis met with peers from other midsize mechanical engineering companies that were looking to take advantage of additive manufacturing, but had also come up empty in their search for solutions. »Everyone was facing the same challenge: producing small numbers of complex components,« he recalls.

Starting with two plastic 3D printers and several service providers from the field of industrial 3D printing, Brandis focused initially on meeting HORSTMANNGROUP's needs. The first orders from external customers began coming in around six months later. These days, Krause Dimatec also has a new metal-melting machine from Concept Laser and ships its products all the way to Stuttgart and Kiel. The share of orders it receives from companies outside of its own corporate group has risen to around 50 percent. As a result, Brandis is now hoping to expand his team. »Assuming we can find them, we want to hire four engineers as quickly as possible.« »



Photos above and below:
Components for printing equipment. The suction unit was not only produced using additive techniques, but also optimized in the process.

HORSTMANNGROUP
Krause Dimatec is part of HORSTMANNGROUP, a corporate entity that employs some 1,100 people from its headquarters in Bielefeld, Germany. The group includes numerous mechanical engineering companies, some of which operate in the furniture, graphic design, and baking equipment industries. HORSTMANNGROUP's dynamic development up to the present day can be traced back to 1975, when Jürgen Horstmann acquired Krause-Biagosch GmbH.

The additive evolution of the kaiser roll component: from injection molding to SLS plastic printing to AM stainless steel with an optimized surface

Rather than toys, we show our customers components and assemblies that are familiar to mechanical engineers.

MORE IMPORTANT THAN TECHNOLOGY: THE CONSTRUCTOR MINDSET

As a start-up company, Krause Dimatec began with the advantage of having young employees who had just dealt with additive technology during their university studies. In the first year following the company's foundation, however, Brandis already realized that technology was not the only key factor. »3D printing is definitely high-tech,« he explains, »but the way our engineers think is much more important.«

To find specific parts available within HORSTMANNGROUP or from customers, Brandis and his employees developed a process that factors in constructors' appraisals while searching through the company's inventory management system. It also accounts for the possibilities afforded by additive manufacturing right from the beginning – particularly when new developments are involved.

A SPACE APART FROM AVIATION AND MEDICAL TECHNOLOGY

The standards of quality and reliability in mechanical engineering are different from those common in aviation and medical technology. After all, a technical failure could at worst bring a machine to a standstill – not cause a plane to crash. Mechanical engineering does involve resource-intensive test series and simulations, but the lengths to which these efforts go in aviation and medical technology would not be affordable. Instead, mechanical blueprints are also based on the expertise of engineers and the experience gathered over long periods of machine use.

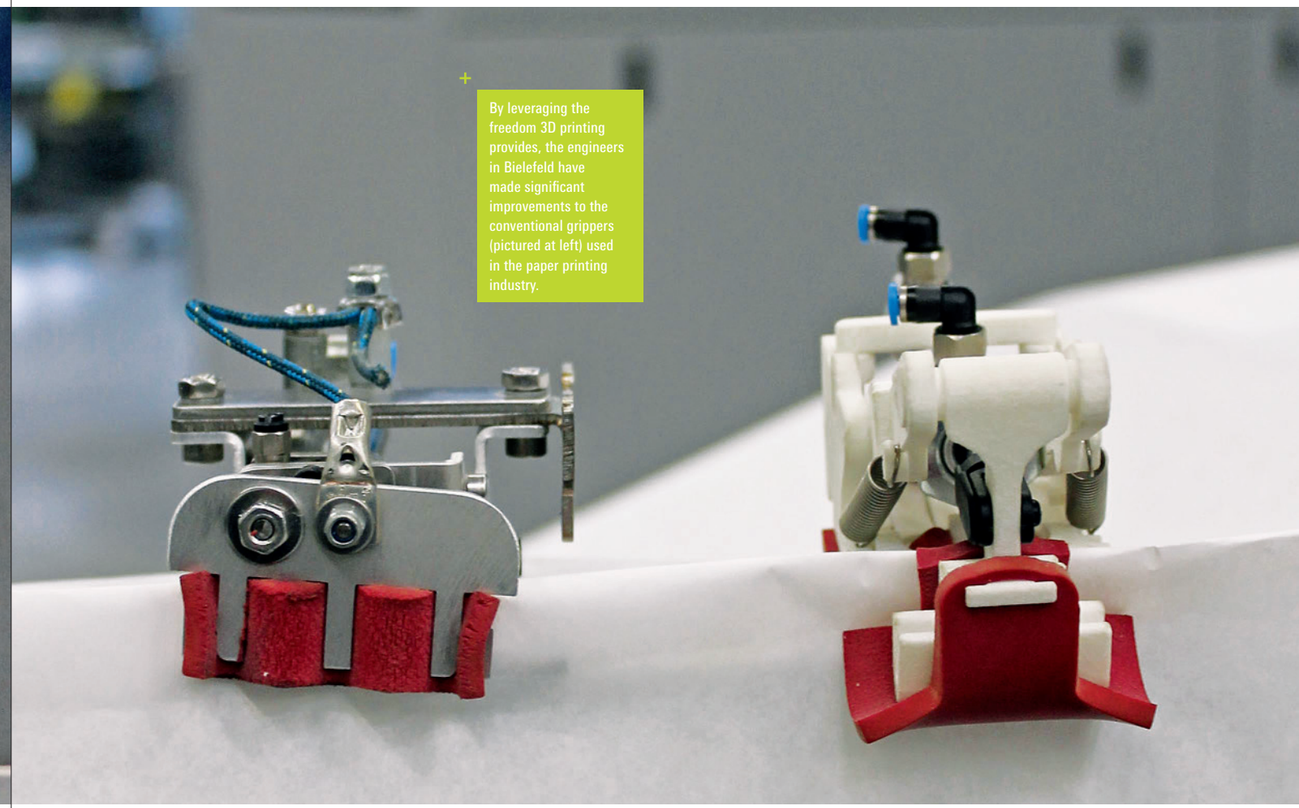
BACKING MINUS THE CONFIDENTIALITY

These are some of the reasons why Brandis views origin and experience as essential selling points in mechanical engineering. »Rather than toys, we show our customers components and assemblies that are familiar to mechanical engineers,« he points out, adding that his company's status as part of HORSTMANNGROUP means it is not subject to the confidentiality requirements typical in the industry. »In other words, we can demonstrate actual parts that are already in use,« Brandis explains.

Take, for example, the baking component that carves a pinwheel pattern into the top of traditional kaiser rolls. »For our baking equipment, we need 70 to 80 parts each year,« Brandis reveals. »The injection molding technique we used to employ in producing them wasn't the most efficient technology.«

Therefore, Brandis's team started by replacing the kaiser roll component with a 3D printed SLS part. They went on to make some geometric improvements, as well, which resulted in a 3D printed, stainless-steel kaiser roll component that prevents dough from sticking to its surface.

Meanwhile, Brandis and his three engineers have used additive manufacturing to optimize many other components within HORSTMANNGROUP. Krause-Biagosch alone installs 70 AM components and devices in machines used in printing plate exposure. »We've managed either to reduce costs or shorten delivery times,« Brandis proudly states. »We've become the engine of technological innovation for the entire group.«



By leveraging the freedom 3D printing provides, the engineers in Bielefeld have made significant improvements to the conventional grippers (pictured at left) used in the paper printing industry.

FURTHER INFORMATION:

» krause-dimatec.de

» Krause Dimatec at formnext 2016: 3.1-D07

EXHIBITION PREVIEW

BIONIC STRUCTURES HARMONIZING WITH NEW MATERIAL

Innovative 3D printed products are often based on the expertise of various areas along the process chain. This point is illustrated by Light Rider, a futuristic motorcycle that combines bionic structures with cutting-edge materials. This two-wheeled innovation was developed by Airbus subsidiary APWorks in cooperation with Altair.

»A hollow ramified structure as complex as Light Rider's is impossible to create using conventional manufacturing techniques like welding and milling,« explains Joachim Zettler, CEO of APWorks.

The motorcycle weighs 35 kilograms, with its frame accounting for just six. Its six-kilowatt electric motor can propel Light Rider from zero to 45 km/h in three seconds.

Along with the simulations that were run to optimize the motorcycle's topological design, the use of Scalmalloy was a key factor in the project's success. Developed by Airbus itself, this highly stable aluminum alloy is purported to be not only corrosion-resistant, but as light as aluminum and nearly as strong as titanium.

APWorks will present Light Rider at formnext 2016 along with its latest developments in innovative materials.

» AP Works at formnext 2016: 3.1-D51, Altair: 3.1-E50

3D PRINTER FOR CERAMIC COMPONENTS

In September 2016, the Dutch company ADMATEC will be bringing its first 3D printer to market – the ADMAFLEX 130. According to ADMATEC, its patented ADMAFLEX technology combines a cutting-edge ceramic printing system with sturdy, easy-to-clean materials.

The company also states that it subjected the printer and its materials to 5,000 hours of testing under production conditions in 2013, which would give it unparalleled experience in the field of ceramic printing.

The ADMAFLEX 130 can work with zirconium oxide, aluminum oxide, and melted silicon; successful tests have been conducted on silicon nitride and silicon carbide. »This system is poised to play a key role in the development of 3D printed ceramics in a wide range of markets,« declares Michiel de Bruijcker, managing director of ADMATEC Europe BV.

» ADMATEC Europe BV at formnext 2016: 3.1-K16

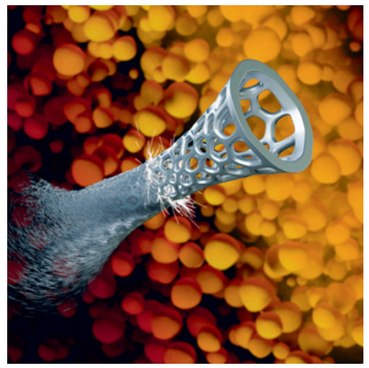
Photos: AP Works (oben), Heraeus (rechts)

HERAEUS PRINTS METALLIC GLASS FOR THE FIRST TIME

In cooperation with the Swedish start-up Exmet, Heraeus is expanding its portfolio of special construction materials by developing 3D printing techniques for amorphous components. Amorphous metals (or metallic glass), for example, are known for being extremely strong and hard.

Through this cooperation, Heraeus is hoping to tap into a new class of materials for use in 3D printing and other industrial applications, is combining its extensive knowledge of materials with Exmet's expertise in 3D printing amorphous metals. »In additive manufacturing in particular, fine-tuning the materials and processing techniques at hand down to the last detail is crucial to ensuring the highest possible level of quality and consistency,« asserts Tobias Caspari, head of 3D printing at Heraeus New Businesses.

» Heraeus/Exmet at formnext 2016: 3.1.-C20



Photos: AP Works (oben), Heraeus (unten)

EXHIBITION PREVIEW

THE FIRST FACTORY FULLY DEVOTED TO 3D PRINTING

FIT AG claims to be the first service provider in additive design and manufacturing (ADM) to have designed an entire factory to produce plastic and metal raw materials based on 3D printing. This facility is scheduled to start providing scalable, state-of-the-art technology for industrial mass production in 2017.

Meanwhile, FIT also asserts that it currently has the most private operational capacity in the world when it comes to the additive manufacturing of metal components. In addition to producing components using solely 3D techniques, the company optimizes parts for 3D printing.

» FIT AG at formnext 2016: 3.1-H74

Photos: Fit (oben), Sisma (rechts)

DEBUT: 3D PRODUCTION SYSTEM FOR HIGH-END METAL WORKPIECES

At the second edition of formnext in November 2016, Additive Industries will be unveiling its MetalFAB1 system for the first time. This modular and integrated 3D printing system will be presented in connection with the Additive World Platform.

According to its manufacturer, MetalFAB1 is the first integrated system that supports the generative production of metal workpieces with specific high-end requirements (for the aviation, medical technology, high-tech equipment, toolmaking, and automotive industries, for example). Along with the 3D printing process, MetalFAB1 also controls temperatures and automatically positions the workbench and material reservoir in a single industrial production system. Its modular design enables users to start with a basic configuration and gradually add in further enhancements.

Meanwhile, Additive Industries has developed the Additive World Platform to support the entire production process. With it, users can enter, store, integrate, and analyze all of their data (including designs, parts, configurations, and techniques). The functional scope of the platform also features inquiry processing, simulation, process management for 3D printing (along with resource planning), quality control for production processes, and infrastructure monitoring.

» Additive Industries at formnext 2016: 3.1-H60

20 PERCENT LIGHTER

The Formula Student team at the University of Padua (Italy) has optimized key components of a racecar with the help of additive manufacturing. Besides reducing the weight of the connecting elements in the vehicle's suspension by nearly 20 percent, these efforts also added a number of functions. The parts in question were produced by a Sisma MySint 100 3D printer using the disruptive laser metal fusion technique.

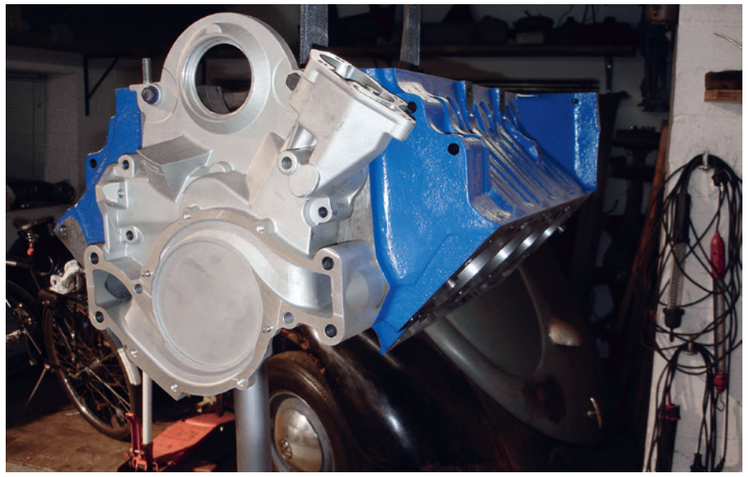
» Sisma at formnext 2016: 3.1-F10

INTERNATIONAL JOINT STANDS

In one of many firsts expected at this year's formnext, the shared Spanish booth headlined by Addimat will be demonstrating a combination of cutting-edge 3D printing, innovative machining centers, and wide-ranging research expertise. The Korean association NIPA will also be in attendance with presentations centered on 3D printing. Numerous companies from the Asian industrial powerhouse plan to show off their latest related solutions along with others in scanning and additive jewelry production.

EXHIBITION PREVIEW

FRESH HOPE FOR THOSE IN NEED OF ANTIQUE CAR PARTS



Ask the owner of a 1967 Cadillac Eldorado about additive technology, and you're still most likely to have a conversation about supplements for oil and gasoline. Just as in their younger years, cars recognized as antiques continue to run smoothly on relatively clean combustion thanks to products like these. More recently, however, the term »additive« has gained an all-new meaning in the old-timer scene. Word has spread that this type of manufacturing is often the last option available to those who need replacement parts for antique automobiles.

This opportunity was identified early on by Gregor Sodeikat, managing director of Rolf Lenk Werkzeug- und Maschinenbau GmbH in Hamburg, Germany. »In cooperation with SLM Solutions Group AG, we now have additive manufacturing processes running on three machines at dimensions up to 500 x 280 x 365 millimeters,« Sodeikat reveals. In addition to its usual customers, the company has »addressed the market for antique spare parts and met with a great deal of interest.«

And no wonder: a significant number of such parts are no longer available, and neither are the corresponding blueprints in many cases. The solution is 3D printing, as a timing chain cover created for the aforementioned Eldorado has shown to impressive effect. The original part, which had been rendered unusable by metal corrosion, was 3D scanned and reverse-engineered at Rolf Lenk. Based on the resulting CAD data, the company then printed the cover and finished it on a milling machine.

»We've been working with selective laser melting for three years now and know what it takes,« says a confident Sodeikat. »For example, we know what kind of support is needed and where in order to achieve form and positional tolerances under a 10th of a millimeter.«

» Rolf Lenk Werkzeug- und Maschinenbau GmbH at formnext 2016: 3.1-K49

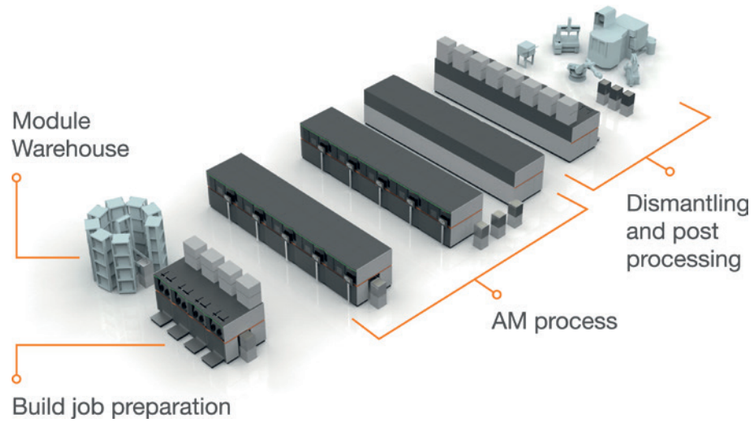
LIGHTNING-FAST 3D SCANNING ON THE GO

At formnext 2016, Creaform plans to unveil HandyPROBE Next – a portable coordinate-measuring machine (CMM) described as capable of delivering results that are twice as precise and accurate down to 0.064 millimeters, even without a rigid measuring setup. According to Creaform, its Metrascan 3D laser scanner takes 480,000 measurements per second, making it 12 times faster (the fastest on the market) and 1.5 times more accurate than the previous generation. The company will be selling the scanner in four variants. Its 350 and 750 lines will be available in standard and elite editions, which will differ in their level of precision and processing speed. Both lines employ Creaform's TRUaccuracy technology to filter out interference in measuring environments. This includes errors that can occur due to black, multicolored, or reflective surfaces.

» Creaform at formnext 2016: 3.1-D34

Photos: Rolf Lenk (oben), Creaform (unten)

EXHIBITION PREVIEW



REFILL MATERIAL FOR FDM AND POLYJET SYSTEMS

Refilling toner cartridges has been a common practice for some time in 2D printing. Thanks to iSquared, corresponding systems are now also available for 3D printers. Based in Switzerland, this company specializes in the development and sale of material refills for Stratasys FDM and PolyJet processes.

iSquared claims that its refill solutions make it possible to achieve significant cost reductions. It also states that ABS X-TREME and its material refills for the ABSplus P430, ABS P400, and ABS M30 have established themselves as reliable products on the market. Meanwhile, iSquared offers a refill variant for PolyJet systems in the JT-S014, which it says comes in recyclable cardboard packaging that helps protect the environment.

» iSquared at formnext 2016: 3.1-K25

ROBOT-DRIVEN 3D PRINTING

At formnext 2016, Envisiontec will be presenting its latest developments in robot-driven 3D printing technology for sand forms and form cores in two new 3D printers. »These innovations are going to draw a lot of eyeballs,« says a confident John Hartner, CEO of Envisiontec. The advancements in question came about through a strategic partnership with Viridis3D.

Meanwhile, Envisiontec will also be demonstrating technologies designed to manufacture large components and support the automated production of composite materials – including the most recent innovations in SLCOM (selective lamination composite object manufacturing).

Following its strong growth in the past several years, the company is now focusing on customer service and support according to Hartner, who expects the 3D printing industry's double-digit expansion to continue in the years ahead.

» EnvisionTEC at formnext 2016: 3.1-E10

Photos: Concept Laser (oben), Envisiontec (rechts)

CONCEPT LASER FOCUSING ON NEW MACHINE ARCHITECTURE

This year, a new machine architecture featuring modular system technology is on the agenda at Concept Laser. The company plans to bring standalone process stations to market that offer 400 x 400 x 400 mm^3 of space and support up to four laser systems with multilaser technology, as well as laser sources capable of producing between 400 and 1,000 watts.

Concept Laser is also promising additional speed based on its dual-axis coating process: Here, exposure occurs as the coating component returns to its starting position. The company has also developed an automatic tool-switching system similar to those available in CNC equipment.

In addition to its new machines, Concept Laser is hoping to play a leading role in quality management and monitoring. In QM Meltpool 3D, it already has an in-situ process monitoring system that delivers quality-related data in real time for monitoring and documentation purposes. Concept Laser compares the resolution this analytical tool provides to that of a computer tomography system.

» Concept Laser at formnext 2016: 3.1-F48

TALKING ABOUT

Photos: Niclas Waldheim

»YOU RUN INTO A LOT OF SELF-TAUGHT PEOPLE«

Prof. Thomas Seul, president of the German association of tool- and form-making companies (VDWF), talks about vocational training in the field of additive manufacturing.

Text: Thomas Masuch

Professor Seul, 2017 will be the first year in which you offer an advanced study program to those interested in becoming application engineers in additive techniques and rapid technologies at the University of Applied Sciences Schmalkalden. What was the main reason for this new venture?

SEUL In tool-making, for example, additive techniques have joined more conventional production methods like lathing, milling, grinding, and erosion as an established means of manufacturing. Only those who feel comfortable with all of these technologies and know their individual strengths and weaknesses will be able to make sound decisions – regarding the best way to produce a certain part of a tool, for instance. After all, tools are becoming increasingly hybrid constructions when it comes to manufacturing.

What role is the industry association VDWF playing in this context?

SEUL With the VDWF as our cooperation partner, we're working directly with the market on real-world scenarios and reaching out to the type of people our work-and-study program was designed for. The VDWF is also strategically involved in shaping the curriculum in question.

How have people acquired the necessary expertise in this field in the past?

SEUL You run into a lot of self-taught people working in additive manufacturing. Most of them have developed a great deal of corresponding knowledge on their own; until now, there wasn't any other way. Sharing that knowledge, gaining new insights, keeping the conversation going – these are the goals our advanced study program hopes to achieve.

What's unique about the ongoing training your university plans to provide?

SEUL First of all, it's an official course of study at the University of Applied Sciences Schmalkalden, so it includes exams and corresponding regulations. This also means that participants will be registered as students; after passing their exams, they'll receive a degree from the university. The lectures and seminars will be scheduled in blocks and held in various locations.

What overarching goal will the program be working toward?

SEUL We won't necessarily be training the next generation of 3D printing engineers, although that subject will obviously be covered. We want this study program to impart knowledge across all the areas of additive manufacturing. Among other things, graduates should then be able to make sound decisions when dealing with this field. At the same time, we want to put that knowledge of additive manufacturing processes on a solid foundation and set standards in terms of technology and quality. It's the only way to make components reproducible, which is particularly important in rapid manufacturing.

Since your approach covers a wide range of topics, you're also cooperating with institutes at other universities…

SEUL That's right. The course modules are combined into blocks, which makes things relatively flexible and enables us to take advantage of each institute's technical facilities and areas of focus. In Schmalkalden, we really delve into the details of quality assurance, fused deposition modeling, and other subjects. Our partners at the Institute for Toolless Fabrication (IWF, FH Aachen University of Applied Sciences) and the Rapid Technology Center (University of Duisburg-Essen), for example, focus on topics like selective laser sintering, stereolithography, and metal-processing techniques based on the expertise available in each location.

> We want this study program to impart knowledge across all the areas of additive manufacturing

Do you think a stronger effort needs to be made to provide training in additive manufacturing technologies in other settings, as well?

SEUL Definitely. This type of training still isn't nearly as well established as it should be at Germany's trade schools, for instance. 3D printing should be made a much more prominent subject, as well. More and more occupational categories are already having to deal with such topics, after all; that includes everything from structural engineering to quality assurance.

In other words, anyone currently involved in conventional metal processing – and tool-making in particular – should take a look at additive manufacturing.

SEUL I couldn't have said it better. Having the technology in-house isn't an absolute must, but some knowledge of it is.

Professor Seul, thank you for taking the time to talk with us.

+ FURTHER INFORMATION:
» hs-schmalkalden.de/rapid_technologien

Photo at right:
Tools featuring conformal cooling are just one of the many areas in which industrial additive manufacturing can be used.

A study program in additive manufacturing
Starting in the 2017 summer semester, the University of Applied Sciences Schmalkalden will be offering a study program in additive techniques and rapid manufacturing technologies in cooperation with the industry association VDWF, the Institute for Toolless Fabrication (IWF), and the University of Duisburg-Essen. This two-semester advanced course will teach prospective application engineers about the standards and guidelines pertaining to material and procedure characteristics, tool construction, and more. To ensure that this training is practical and »in tune with the latest developments«, Professor Seul and his colleagues are still looking for companies interested in a related partnership.

PROTOTYPICAL

Anyone interested in 3D printing large functional prototypes has to approach the job like a skilled lion-tamer: Numerous parameters need to be kept under control in spite of their best efforts to run riot. One person experienced in keeping powder quality, warpage, and bonded joints in check is Stephan Kegelmann, whose company uses additive SLS techniques to create precise, functional vehicle prototypes.

Text: Thomas Masuch

The CEO of Rodgau, Germany's Kegelmann Technik GmbH is particularly proud of his doors, which are used by a major automotive manufacturer for functional testing. »Car makers have dozens of their own 3D printers in-house, but they still send complex jobs like these to us,« Stephan reveals with a smile. Made of Polyamide 12 and sporting a blank white surface, these doors contain more expertise than one might guess at first glance. Due to its dimensions, the door prototype Kegelmann plans to present at formnext 2016 can't be manufactured in a single piece, even on the largest sintering machine currently available. Instead, the company assembles it from several segments using tenon joints similar to those used in wooden furniture. After all, the door needs to be sturdy enough to support the installation and functional testing of window lifts, cables, and handles.

IT'S ABOUT REPRODUCIBLE QUALITY

»The production process involved is highly complex,« Stephan says. He goes on to explain that the secret to precision manufacturing lies in controlling the numerous production parameters involved such that »the same exact quality can be reproduced in every new part«. One important parameter is the quality of the raw powder material used, which needs to remain constant across multiple machines.

Here, Kegelmann has developed a monitoring system that automatically measures the quality of the powder entering a machine and adjusts it when necessary. As the components at hand cool after reaching nearly 200 degrees (C) during sintering, they also shrink by three to four percent in some places. According to Stephan, this is why the process first needs to be simulated down to the last detail and incorporated into construction scheduling.

»We use our machines for more than just printing components based on CAD data,« he points out. »When the construction process is complete, we keep supporting our automotive partners all the way to the creation of various prototypes.«

MARKED REDUCTIONS IN DELIVERY TIME

Kegelmann Technik GmbH has been employing additive techniques in prototype construction for 27 years, giving it more experience in the field than virtually any other company. In 1989, Stephan Kegelmann acquired its first stereolithography system for producing master forms. Just a few years after the technology for laser-sintering polyamide hit the market in the early 1990s, the company was already using a corresponding installation to manufacture its first functional prototypes. Its CEO states that laser-sintering has been especially helpful in achieving huge reductions in delivery time. Indeed, Stephan indicates that bonding the aforementioned car doors together from laminates using conventional techniques takes two to three weeks and much more personnel, while sintering enables his company to deliver within a week.

Photos: Kegelmann Technik

Wide-ranging technological expertise: At Kegelmann, conventional tool- and form-making machines operate just a few meters away from the company's 3D printer.

The costs involved in producing SLS parts like these are relatively transparent. Kegelmann performs such calculations based on a formula that combines surface area and volume. »It's all standardized,« Stephan says. »Due to the short processing times involved, custom jobs really aren't feasible anymore.«

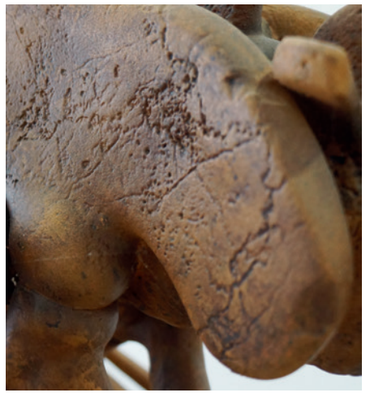
»WE'VE ONLY SCRATCHED THE SURFACE«

Meanwhile, Kegelmann Technik and its 110 employees have expanded more than just their product portfolio. At the company's facilities in Rodgau, modern injection-molding equipment now rubs elbows with tool-making and CNC processing systems. Its 10 laser-sintering and stereolithography machines were also recently joined by Kegelmann's first metal-sintering system, enabling the company to »cover the entire process chain«, as Stephan puts it. He describes this chain as including everything from bionic construction, finite element calculations, and additive manufacturing to follow-up CNC processing and computer tomography in quality assurance.

In addition to prototype construction, additive serial production has begun playing a greater role at Kegelmann. Tens of thousands of custom glasses frames have already been manufactured in Rodgau, which has kept the company's six SLS machines running at capacity. Its CEO believes that metals will be a topic of focus in the additive market's ongoing development. »That's where things are most dynamic,« Stephan affirms, citing the tremendous potential that remains in mechanical engineering. »We've only scratched the surface in that regard.«

» Kegelmann at formnext 2016: 3.1-D50

EXHIBITION PREVIEW



A DINOSAUR SKELETON IN EIGHT DAYS

A dinosaur research project involving a 3.66-meter velociraptor skeleton is showing just how fast and efficient the reproduction of primeval creatures can be. This skeleton, along with a preceding stegosaurus model, was recreated using voxeljet printers.

The existing bones were first scanned and then assembled into a complete skeleton by an animation program. After that, the remaining bones were printed over the course of three days, with infiltrated epoxy resin providing for added stability. To help the skeleton really shine when on display, the experienced film and prop specialists involved in the project painted its individual parts by hand.

»The combination of scanning and 3D printing is making the recreation of objects faster and more efficient than ever,« states Tobias King, Director of Marketing & Applications at voxeljet AG. »When putting on the finishing touches, these powder-based components are very easy to color and refine.«

» Voxeljet at formnext 2016: 3.1-E80

THE POTENTIAL AND ADVANCEMENTS OF FREEFORMER

At formnext 2016, Arburg will be demonstrating the potential and advancements of its freeformer system and the methods it uses in free-forming plastics. The company states that it is currently focusing on achieving further improvements in process stability and verifying additional types of standard granulate. A material drying component that integrates into freeformer's control system is now available as an optional enhancement, as well.

At the heart of Arburg plastic free-forming technique AKF, meanwhile, are proven types of plastic granulate, which the company believes gives it an edge on other methods of additive manufacturing. In a process similar to injection molding, granulate is first melted down and then applied in layers of droplets to the substrate in question by a nozzle using high-frequency piezo technology. Depending on the nozzle employed, the plastic droplets produced under pressure measure between 0.2 and 0.3 millimeters in diameter. The design space can accommodate parts up to 154 x 134 x 230 millimeters in size.

In its standard configuration, freeformer comes with two application units that enable it to produce components in various colors, with special haptic properties, or as combinations of hard and soft materials. Arburg also describes freeformer as suitable for those looking to use it in tandem with injection molding and Industry 4.0 technologies as a means of customizing mass-produced parts for specific customers.

» Arburg at formnext 2016: 3.1-F70

Photos: voxeljet

EXHIBITION PREVIEW

HP: FROM 2D TO 3D

HP, one of the largest players in 2D printing is entering the world of industrial 3D printers. The company describes its Jet Fusion 3D Printing Solution, for example, as 10 times faster than current 3D printing systems and capable of reducing costs by up to 50 percent.

The solution is also designed to make processes in rapid prototyping simpler and more cost-effective. HP believes that this will open the door to new applications in a wide array of industries.

The HP Jet Fusion 3D Printing Solution is based around two 3D printers: the Jet Fusion 3D 3200 and 4200 models, which differ in terms of their maximum output speed and the material thickness they can produce. Each can be expanded into an HP Jet Fusion Processing Station that automatically draws and combines different 3D printing materials from HP cartridges.

Stations based on the HP Jet Fusion 3D 4200 can also be enhanced with a unit that accelerates the workpiece cooling process. According to HP, this combination is suitable for both simple prototype production and the initial manufacturing of small series.

Meanwhile, the company is working on an app store for 3D materials that features manufacturers such as Arkema, BASF, Evonik, and Lehman & Voss. HP's software partners include Autodesk, Materialise, and Siemens, and it works with Nike, BMW, Johnson & Johnson, Jabil, and Shapeways in the wider industry. The company also belongs to a consortium that developed the 3D printing file standard 3MF.

» HP at formnext 2016: 3.1-K50

NEW COMPOSITIONS FOR METAL POWDER

Advancements in 3D metal-printing processes are still being hampered too often by the lack of truly suitable metal powders and versatile alloys,« states Dr. Jörg Fischer-Bühner, a metallurgy specialist who heads up development at Blue Power Casting Systems.

In two current projects that are being supported by the German Federal Ministry of Education and Research (BMBF), this company worked with the University of Bremen (Germany) and other partners on making specific improvements in gas atomization systems. These efforts have focused on creating metal powders that are optimized for 3D printing and designing new steel- and aluminum-based alloys, as well as combinations thereof. One initial requirement has been expanding the temperature range in question to an upper limit of 1,750° C.

By developing new metal powder compositions, Blue Power is seeking to reduce the weight and volume of printed components while making them more sturdy. This will make it possible to use such parts for a much wider range of purposes in automotive and aviation engineering, medical technology, and the production of electronic components.

» Blue Power Casting Systems at formnext 2016: 3.1-H99

TEN SCANS EVERY SECOND

Shining 3D will be presenting its handheld 3D scanner EinScan-Pro at this year's formnext. The device represents the Chinese company's effort to incorporate the technology found in its desktop 3D scanners into a portable model. According to Shining 3D, it supports a wide range of uses, from small objects on rotary tables to handheld 3D scans.

EinScan-Pro can take up to 10 scans per second, which can be fully colored (with the color pack) or offer even higher resolutions (with the industrial pack). Weighing in at just 800 grams, it is also light enough to be used on the go.

Shining also offers other 3D printers and scanners designed for everything from consumer use to industrial applications.

» Shining 3D at formnext 2016: 3.1-K29

Photos: HP (oben), Shining 3D (unten)

»OUTSIDE THE BOX«

Illustration: Feedback Media Design

Along with specific applications and breakthroughs in basic research, additive manufacturing is unearthing other intriguing developments that often astonish even our most imaginative contemporaries. The examples range from casts of babies still in the womb to formations of letters and geometric shapes derived from compositions by Béla Bartók.

Researchers in Japan are renowned for having bestowed upon the world groundbreaking innovations such as the rectangular watermelon and chopsticks equipped with fans. A team of researchers at the University of Tokyo has now succeeded in developing the country's latest coup: a cell phone on wheels. Besides its ability to literally keep up with those on the go, the 3D printing specialists at 3ders.org believe that the invention could »open the door to a new kinetic dimension.«

This revolutionary development consists of a 3D printed cell phone case and a small electric motor that powers its two wheels. The entire drive unit can be snapped onto a phone, which it also connects to through a corresponding interface.

According to the Japanese research team behind it, one of the unit's key features is its »runaway snooze« function: Say you've set your phone's alarm to wake you up in the morning, but want to hit the snooze button and get just a few more minutes of shut-eye when it starts to chime. The device can simply hit the gas and scoot out of arm's reach, sounding the alarm all the while. Then again, maybe that's not the type of »mobile« you're looking for.

On the slightly more practical side, a wheeled smartphone can move itself straight toward its owner when receiving calls or messages – provided it's lying in the right direction, of course. However, imagine leaving your phone in some random position on a restaurant table and watching it race right off the edge when that important call comes in. Or maybe it runs into a glass of sparkling water first … Are the Japanese already working on a waterproof version?

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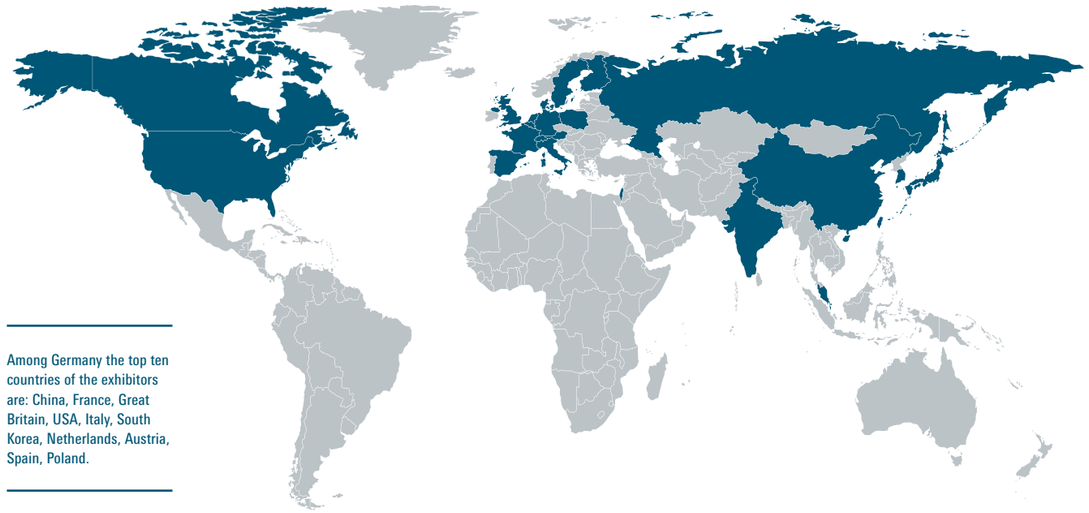

Among Germany the top ten countries of the exhibitors are: China, France, Great Britain, USA, Italy, South Korea, Netherlands, Austria, Spain, Poland.

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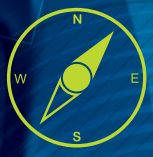

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