Customer Magazine

01|2019

BEYOND SURFACES

AEROSPACE

From brush to pen: Professor Sampath on the (r)evolution of thermal spraying

High up: Airbus launches the future of Big Data in aviation

Let's flex our muscles: Optimal strength training with 3D printing

oerlikon

«There is almost no other area in which the demands for **safety, weight, costs, and the temperatures to be mastered** are comparable to those of the construction of jet engines.»

Dr. Wolfgang Konrad holding an engine component with thermal barrier coating from Oerlikon Metco.

COATINGS THAT FLY

High tech for the aircraft and aerospace industry

The aerospace industry is unique. It has been growing for decades. And it will continue to do so in the coming years because mobility is and will remain one of the most important achievements of our society – one that we are hardly prepared to go without. But it also fascinates me as an engineer: The construction of jet engines is simply the supreme discipline in mechanical engineering. There is almost no other area in which the demands for safety, weight, costs, and the temperatures to be mastered are comparable. And those demands continue to become ever greater: The objective is to reduce consumption – and thereby CO_2 emissions – to avoid noise emissions and to increase the service life as well as safety. To accomplish this requires optimization of physical parameters in many different respects.

And that is precisely what motivates Oerlikon: Engaging in development work at the very limits of what is possible in cooperation with the industry's leading manufacturers. Together, we search out materials and methods that deliver ever greater performance and cost-effectiveness. An area in which our know-how is in particular demand involves what is known as "abradables". On one side stands a "standard product". On the other, we have high tech in its purest form. The coatings, developed from an intelligent mixture of metals and plastics, must be yielding, but also hard, which means they must wear as minimally as possible. Against the background of increasing pressures and ever higher temperatures in the compressors of aircraft engines, this is a balancing act between abrasive erosion and adhesion.

To accomplish this tightrope walk successfully, coatings have long since ceased to be viewed as mere component protection. Instead, they are designed in right from the beginning of product development. Professor Sanjay Sampath of Stony Brook University in New York is among the experts with the most profound knowledge of thermal spraying. In the article starting on page 10, he provides us with insight into how design engineers incorporate the advantage provided by the potential of coatings from the start of the development process. He sees the clearest, most concrete and most measurable advantages in turbine engineering. And Mirjam Arndt, Head of R&D Product Development at Oerlikon Balzers, relates starting on page 6 how we are able to open up a wide array of previously unexplored fields of application using new material systems and types of coatings.

Donough Tierney, Vice President Canada & Europe at Airbus, tells us, starting on page 20, how the largest European aircraft manufacturer appraises the future of air travel. He reports that, against the backdrop of a world population that continues to grow relentlessly and the associated increasing rise in density in our metropolises, the entire industry will change. One possible Airbus scenario involves "air taxis" which are envisioned as characterizing public transportation in the cities of the future. The prerequisite for this, however, is that new production methods and means of industrial mass production succeed in significantly reducing the manufacturing costs for flight vehicles of this nature.

However, what applies there, applies every bit as much in other industry sectors. That is why we also are working on this challenge on a daily basis. An example is our "Surface One", the first machine for thermal spray coatings. Oerlikon Metco's "intelligent factory of the future" can be converted very quickly to different applications and types of powders. We can learn about these starting on page 38.

Increasingly shorter development and manufacturing cycles, enormous quality and safety requirements and rising demands in the area of environmental protection: We are pleased to take on the challenge here. This issue of our magazine, BEYOND SURFACES, will show you a few examples of what we mean. Get ready to be surprised!

Cordially yours,

Dr. Wolfgang Konrad
Head of Business Unit
Metco Aero & Energy

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DIMENSIONS
THAT WERE PREVIOUSLY UNTHINKABLE

by Agnes Zeiner

Collaboration, cooperation, partnership. These words represent a recurring theme in our talk with **Dr. Mirjam Arndt, Head of R&D Product Development at Oerlikon Balzers.** And as we spoke, she covered a broad spectrum of topics, including her 15-member international team as well as colleagues in sales, customers and partners at academic institutes.

"The key question we pose to ourselves daily is: How can we create new coatings, and thereby new products, that the market is demanding, either consciously or unconsciously?" explains the metallurgist and materials scientist. Her department is engaged in innovation management – and that is interpreted in the broadest sense possible: "Our colleagues in R&D Technology develop the hardware components that are required for the coating process: for example, new arc evaporation sources. Our in-house engineering team and our R&D Technology department are together responsible for the development of systems," Arndt says. "Here in R&D Product Development, we use these results to create new coatings, on the one hand, but also to enable the production of existing coatings with new system technologies."

System technology – a defining moment

Her enthusiasm and passion for her job are clearly evident throughout our talk. After conferral of her doctorate and a post-doc year, she left her alma mater, RWTH Aachen University, for a position in industry at Germany's METAPLAS, which today is also part of Oerlikon Balzers and thus the Oerlikon Group. "I worked on an aluminum-titanium-nitride coating there that has ultimately proven to be very successful – but that also required a refinement of the systems involved. That was something of a defining moment for me," recalls Arndt.

Her later work in the R&D Surface Technology department of a large industrial user made it possible for her to enhance her knowledge in the area of machining. "But as users, we had absolutely no way of influencing the system technology there. Consequently, after projects in Germany, the USA and Israel, I came to Oerlikon Balzers in Liechtenstein exactly ten years ago. And now, I finally have the opportunity to influence not only coatings, but also the refinement and further development of entire technologies." And right away, Arndt cites the INNOVENTA platform as an example. This system now enables highly complex coatings to be deposited in a decidedly productive manner. That means a greater quantity of different coating materials for complex coating architectures and nano layers – and what's more, at speeds up to twice as fast as could be achieved previously. The result is that in addition to cutting applications, it is also possible to deal even better with the requirements for forming tools or certain precision components.

Real products instead of research work

Has researcher Mirjam Arndt ever felt drawn to return to a university context? She laughs. "Well, sometimes, yes, but I am in constant contact with various institutes and research colleagues across the whole of Europe. At a university, research leads to publication. We, on the other hand, end up with a real product in our hands, and customers can actually use it. In fact, it's not at all unusual for entirely new fields of application to be opened up, such as by our S3p technology [see box]. We also get feedback directly from the market – and that provides unbelievable motivation."

The team maintains close relationships with universities and research facilities across Europe to keep abreast of basic scientific research developments – for example, with RWTH →

«Every one of us must both comprehend our customers' applications and be prepared to **complement each other and provide mutual support.»**

Aachen University, with EMPA in Zurich, and with the Vienna University of Technology, where an additional joint Christian Doppler Laboratory has been set up that commenced work on March 1, 2019. Its primary focus is surface technology for highly loaded precision components, which is one of the strategic growth areas for Oerlikon Balzers. And, each one of these partners has Oerlikon Balzers systems installed, as Mirjam Arndt explains: "This ensures that we are conducting the basic scientific research on the 'right' systems. This research work produces ideas that can be incorporated in later product development projects. To do so, we prepare road maps for projects and products in cooperation with our business units, and a detailed market and competitor analysis helps ensure that our development work is on target to meet the needs of industry."

Win-win situation for customers and developers

There is close cooperation with customers, as well, because there are not laboratories geared to every specific application as there are with the in-house machining laboratory. Consequently, the team works together very closely with customers in the areas of forming tools and precision components, starting in the development phase. These partnerships achieve a win-win effect: "The customer gets a better coating, and we can improve our products thanks to the feedback from the customers and the results achieved in field tests."

Mirjam Arndt explains: "To develop a marketable coating, we need to understand precisely what the customers need, where the loading associated with the application arises – such as temperatures and forces – and what wear mechanisms are involved. We then translate this knowledge into the necessary coating properties. Fine tuning these is then the core expertise of my team."

And as for the team: When Mirjam Arndt talks about "her" 15 team members, who hold doctorates in materials science and physics and who come from twelve different nations, the pride she takes in her department is unmistakable. She started with only two staff members. "My job was to expand the team, which often entailed helping scientists who came to us directly from a university and had no experience

in industry to understand our application-oriented coating product development work. Every one of us must both comprehend our customers' applications and be prepared to complement each other and provide mutual support. We have no use for lone warriors. Moreover, Oerlikon offers an ideal environment that allows my staff to develop further within the company, either in their disciplines or in a management career, depending on their inclination. This 'internal network' then also ultimately benefits our department."

New materials require new coatings "beyond nitrides"

In addition to a well-filled development pipeline, the R&D Product Development also deals with future trends. Arndt sees the greatest challenge in the area of new base materials, which will need entirely new coating solutions. These can be new substrate materials, for one thing, that require innovative protective coatings – for example, in the area of precision components – or new materials requiring processing with cutting tools or forming tools.

For instance: a new class of material systems with greater thermal and/or chemical stability characterized by higher hardness. This will open up entirely new fields of application. At the same time, however, these materials are also highly brittle and therefore demand new coating materials beyond conventional nitrides. "In the aerospace sector, these can be new base materials for turbines, for example, that must be able to withstand significantly higher temperatures than previously," says Mirjam Arndt with a view toward the future. "Consequently, we will need to offer new protective coatings resistant to extreme temperatures and oxidation. In the energy production sector, we are dealing with lower temperatures, by contrast, but corrosion and erosion resistance are extremely important here, which we will need to achieve with coating development work outside of today's PVD spectrum."

Mirjam Arndt and her team won't be getting bored any time soon: "We want to be able to offer our customers products for these new applications," she says. "For us, that means we must begin to change the way we think – in dimensions that have previously not been imagined because they simply were not possible. This is the challenge that we are already working on together with our partners."

S3p – A Smooth Revolution

S3p technology combines the advantages of arc evaporation and sputtering technologies. The unique process window and the separate scalability of the pulse duration, pulse shape and current density open up new possibilities for customer-specific coating design that is marketed in the BALIQ product family. Application examples for this technology include micro tools or threading tools, which require precise and smooth high-performance coatings.

www.oerlikon.com/balzers/s3p
www.oerlikon.com/balzers/s3p-coatings

INNOVENTA

More loading capacity, lower maintenance requirements and many new functions. The INNOVENTA platform comprises PVD systems in three sizes for more flexibility, productivity and connectivity.

www.oerlikon.com/balzers/innoventa

THE PRECISION PIONEER

Prof. Dr. Sanjay Sampath is Distinguished Professor and Director of the Center for Thermal Spray Research at Stony Brook University in New York. He studied metallurgy at an institute in his native India, but a scholarship to complete his Ph.D. in the U.S. changed his career course.

by Randy B. Hecht

Metallurgy typically involves making big things like castings and forgings. “At Stony Brook, they were taking metals and even ceramic and basically making raindrops – thermal spray – and impacting on the surface,” Sampath says. “When you do that, you operate at extreme conditions of metallurgy or materials. That captivated my attention.”

He uses “pretty much all” of Oerlikon’s equipment, including plasma spray and supersonic combustion equipment, and more than a dozen of his former students have worked at Oerlikon Metco’s facility in Westbury, New York. Teaching remains important to him because “I start to realize how you should manipulate your own thinking,” he says. “Everyone should teach, because then they’ll know their subject better.”

How is thermal spray technology evolving?
Thermal spray was widely used by skilled practitioners, not necessarily scientists and engineers. That’s how the technology started. We made it into a rigorous scientific and technological capability. And that has paid dividends. We have effectively transformed the technology from an art form to a robust, scientifically strong engineering technology.

How does that translate to benefits to people, society and the planet?
When thermal spray started, only a few people could do it well. In manufacturing, you want the technology to be more scalable, reliable and reproducible. You want a rigorous manufacturing technology. And you can only achieve that if you understand the science and the technology behind the process.

The consequence of that is, we have a much larger market base, and the technology is used in more industries. Coatings were generally used as an afterthought to maybe improve functionality. Now design engineers are taking advantage of coatings as an actual capability. That has allowed the industry to flourish. Aircraft engines and power generation are the areas where the impact is most significant, with a double digit increase in efficiency, a significant reduction in CO_2 – those are where you actually see the tangible, measured benefits.

One area of your research is thermal spray processing of materials, synthesis, and application of multilayered surfaces. Can you help us understand that?
Let’s focus on the word multilayer, which I think is the future. When the technology was not very strong or the understanding was not very good, people just sprayed the same coating layer. But with our knowledge and the capabilities of the technology, we are depositing coatings not as monolithic uniform material, but as something more like designer structures. No one material can satisfy all your needs. By layering them in a clever, strategic way, →

«I tend to go out of my comfort zone, because you can convince yourself you know everything **until you see someone who tells you something completely different.»**

Prof. Dr. Sanjay Sampath
Distinguished Professor and Director of the Center for Thermal Spray Research, Stony Brook University

you can do many things at the same time, which is what we call multifunctionality. You basically stack materials (or material attributes) in layers, very similar to how they build semiconductor chips. We're trying to do something like that on a large scale.

Another area of your research is the evolution of microstructures associated with suboptimal conditions in terms of equilibrium. What should we know about that?
An important aspect of thermal spray that is not well appreciated is that we basically create these modern raindrops of very high-temperature materials. These things hit the surface and cool extremely fast – like a million degrees per second.

When meteorites impact with the Earth, you have craters, right? We do something like that at a very small scale. Each one of these droplets is the diameter of your hair. We're taking these things and projecting them at extremely high temperatures and velocities. They cool very fast and impact at high energies, and so we use the term that these are materials synthesized from extreme conditions. What we're trying to do is essentially bring in new ways to integrate these non-equilibrium processes. The global thermal spray community had to basically rebuild the whole research enterprise to think in a very different way that is not following tradition or established engineering thinking.

You also have "pioneered the development of mesoscale direct writing technologies based on thermal spray for applications in prototyping and manufacturing of wide-ranging thick film sensor structures, thick film electronics, and mesoscale multifunctional systems." Is there a way to understand that?
I'll simplify that. Thermal spray is a paintbrush. It creates broad, sweeping paint swaths. For a U.S. government project, I was asked to make a thermal spray pen rather than a paintbrush. That's what mesoscale direct writing means. We took a thermal spray paintbrush and made it into a thermal spray pen.

«We have effectively transformed the technology from an art form **to a robust, scientifically strong engineering technology.»**

The history of thermal spray technology:
collection of historical devices at Stony Brook University.

That's not easy to do. It took more than $10 million and a lot of labor to get there, because you can't simply miniaturize thermal spray. It takes a tremendous amount of not only understanding, but also hardware, to implement that. Because we can now write in addition to paint, now I can do interesting things with it. For example, I can write a circuit on top of a coating that will allow me to sense what the component operating temperature is or collect electromagnetic signals by printing antennas on structures.

This is a normal way to combine layering and printing and allows us to do direct writing. Imagine if I can pattern materials precisely the way I want in 3D. Not only do I need a pencil or a pen to be able to write, but I also need the robotics and machine tools that allow me to actually print a circuit on a 3D part. We can write an antenna on top of an existing part – for example, on a helmet or even an aircraft structure. In fact, that's what we did.

There are two important innovations. One is that we created a high-definition thermal spray printing process – which was revolutionary, and the technology is now being used commercially. And second, now we can take thermal spray and write as well as paint. We can build electronic devices, which are basically lines and layers. To do that, you need tremendous understanding of how you not only miniaturize these things but also get the correct material attributes. That required knowledge of thermal spray at a level that was not easily available. And if you're making things so small, can I still get the materials to work right? That was the second big challenge. These two had to come together for the technology to succeed. That was possible only because of all the foundational work we had done in thermal spray. →

So you are pioneering new levels of precision. How much further can that precision be taken?
This was considered a disruptive technology, so it came in sideways. The problem is, you then have a capability that's looking for an application. That's always a difficult thing to address. We have done a lot of innovation, maybe even reached the limit of what we can do with today's technology. The real future effort is taking advantage of this breakthrough to many applications. And that is going much more slowly than we thought. My guess is that in the next 10 years, people will start to see more and more concepts of these intelligent machines.

Which areas of industrial development of thermal spray technologies do you monitor, and how do they affect the direction of your research?
I tend to go outside the mainstream to seek ideas. If you talk among yourselves, you're not going to make progress. So I continue to collaborate with my peers, but I go out of my comfort zone. You can convince yourself you know everything until you see someone who tells you something completely different. Constantly challenging one's own view is in my mind very important.

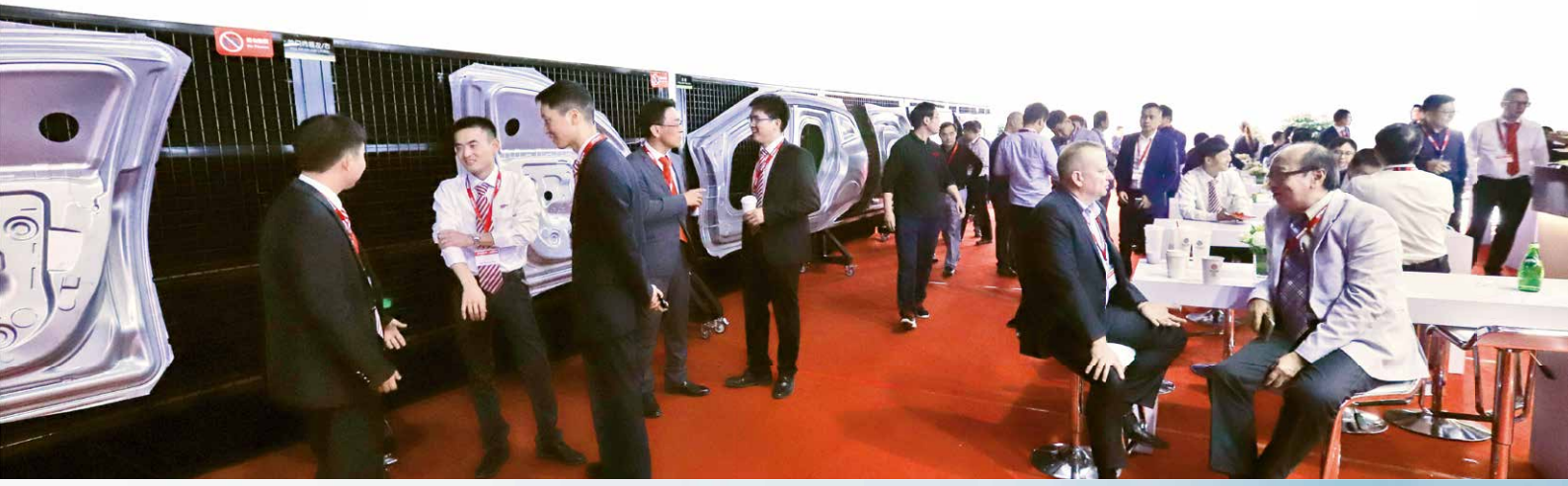
Where do you see the best opportunities for academia and industry to work together toward further development of this technology and its practical applications?
I created the Consortium for Thermal Spray Technology, which involves 30 companies. The idea is linking research to practice. Oerlikon is a founding member and a big supporter of it. And Oerlikon is a supplier of thermal spray equipment and materials, but its customers are companies like General Electric, Rolls-Royce, Siemens and Caterpillar. Our Consortium has all these companies as members. It's a unique business model because we have competitors and customers in the same room. And that has been a successful and rewarding journey. We've met every six months for 15 years, and generations of students have experienced this concept of consortium.

We've been able to convince the companies that our fundamental research can provide value to their products and manufacturing processes – essentially to their bottom line. You have to provide value to companies, give them something they can actually use, and at the same time, make them realize that your fundamental research has value for them. For that to happen, you must understand what their needs are so there's a very good partnership. Ultimately, we have to make the pie larger so we all can have a bigger piece of it.

Successful first Asia Press-Shop Meeting (APM)

LEARNING FROM THE BEST

Exchanging information, discussing together and learning from one another for a better future: this was the theme of Oerlikon Balzers' invitation to the first Asia Press-Shop Meeting (APM), which was held October 30–31, 2018 in its customer center in Suzhou (China). Through numerous lectures as well as in a roundtable forum, more than 120 leading OEMs and Tier 1 suppliers shared their knowledge and experience in the field of punching and forming technology. Their focus was on current issues: What opportunities and challenges for the punching industry do vehicles with alternative drives present? What challenges are found in a full-aluminum vehicle body? What does the term automotive punching industry 4.0 mean? Representatives from Beijing Benz, BMW Brilliance, Dongfeng Nissan, Ford Motor, Honda Motor, SAIC and many others provided insights into advanced concepts for materials, tools and manufacturing processes. For the stamping industry, this means higher productivity and more rapid model changes. In the automotive industry, this allows the manufacture of vehicles with lower weight and energy consumption. Surface treatments and new coating solutions for stamping and machine tools were also important topics in discussions about how to achieve further increases in stamping productivity while lowering production costs.



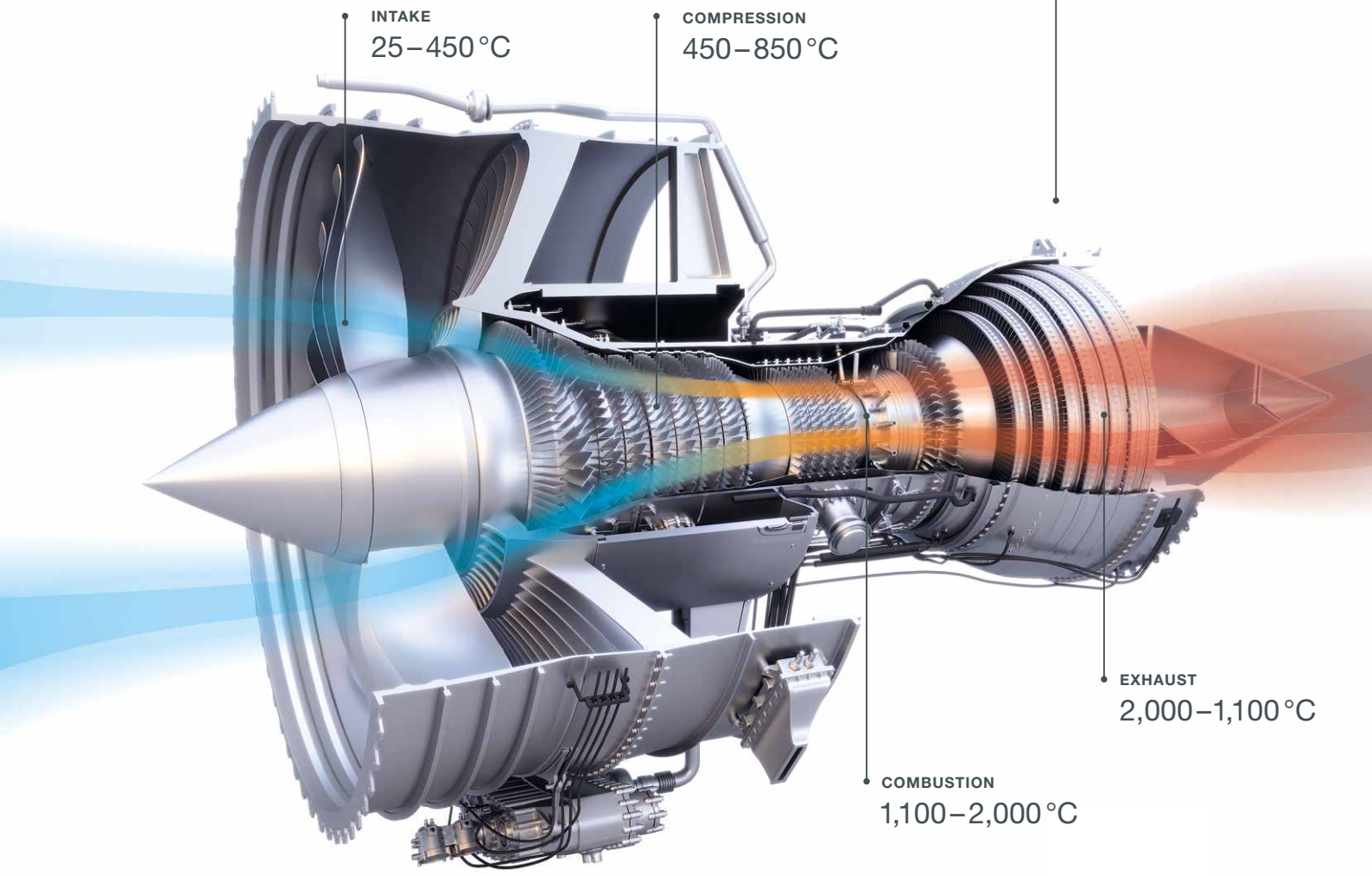
BALINIT C coatings on copper alloys

OERLIKON BALZERS IS "QUALIFIED SUPPLIER" FOR AIRBUS

Airbus has given the status of "Qualified Supplier" to the Oerlikon Balzers customer centers in the United Kingdom and France for their BALINIT C coatings on copper alloys. This coating reduces surface fatigue when applied to aircraft components so that they are more resistant to the wear and high loading they experience. At the same time, they are light and less susceptible to friction. Moreover, BALINIT C is known as a non-hazardous and REACH-compliant alternative to hard chrome plating. The sites in France and the United Kingdom have already been certified by Airbus for the coating of steel, titanium and Inconel. In addition to the sites in Canada and Luxembourg, they are also NADCAP-certified (National Aerospace and Defense Contractors Accreditation Program) and offer first-class coating solutions and services for the aerospace industry.

Hot figures for a booming market

Aerospace is one of the fastest growing markets worldwide. Since 2016, passenger volume has almost doubled – a pace far faster than the International Air Transport Association's (IATA) estimate. In 2018, a record 4.1 billion passengers flew by plane. That's the equivalent of over half the earth's population. And still, demand accelerates. In response, aerospace companies are developing next-generation airplanes. At the same time, they need to increase efficiency and sustainability.



Aerospace industry challenges of today

The aerospace industry is marked by ever shorter development and manufacturing cycles, enormous quality and safety demands and increasing environmental protection requirements.

Aircraft producers and parts suppliers are expected to eliminate expensive tooling, shorten production lead times, reduce weight, eliminate waste, customize parts and integrate designs to reduce the number of parts that require assembly.

Oerlikon aerospace solutions help them to produce and operate efficiently, environmentally friendly, and safely.

INCREASED COMPONENT LIFETIME

Oerlikon Balzers' aerospace solutions offer environmentally friendly coating technologies that reduce operating costs by increasing fuel efficiency, extending service intervals and protecting valuable components from all types of wear.

oerlikon balzers

BENEFITS

+ wear resistance
+ low frictional coefficient
+ corrosion resistance
+ erosion resistance

MAXIMUM PROTECTION FOR HOT PARTS

Oerlikon Metco's next-generation solutions are designed to protect key aerospace components from wear, corrosion, oxidation and thermal attack. Our materials, functional coatings and turbine components are essential to jet engine operational efficiency, performance and safety.

oerlikon metco

BENEFITS

+ thermal protection
+ wear and corrosion protection
+ clearance, sealing and cooling control
+ increased engine efficiency and safety

CUSTOMIZED DESIGN SOLUTION

Additive manufacturing (AM) is a technology that has the potential to disrupt aviation supply chains and change the future of aircraft design, manufacture and repair. AM enables lower part weight, new design possibilities and the integration of multiple parts into one. Equally important, it can be used to produce more complex parts than are possible through traditional manufacturing techniques.

oerlikon am

BENEFITS

+ lower weight
+ improved stability
+ parts reduction
+ impact protection

Compressor Blades

USE CASE

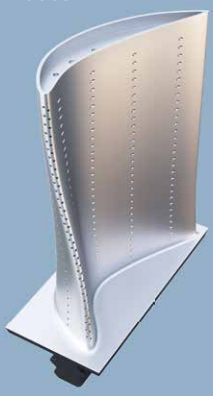
Coatings to protect blades

The high hardness and fatigue resistance of BALINIT TURBINE PRO protects against abrasive wear, solid particle erosion and liquid droplet erosion. This makes this PVD coating ideal for highly stressed precision components such as compressor blades, even under high thermal conditions.

40×
MORE EROSION RESISTANT THAN STEEL

5×
MORE EROSION RESISTANT THAN OTHER PVD COATING SOLUTIONS

Turbine Blades



USE CASE

Coatings to boost engine performance

Thermal Barrier Coatings (TBCs), including environmental barrier coatings, are used in the hot sections of engines. They provide outstanding thermal protection and enable higher combustion temperatures. This results in better fuel and engine efficiency, and – by burning more carbon dioxide – reduces the impact on the environment.

+2,000 °C
OPERATING TEMPERATURE

5%
EFFICIENCY BOOST

1–3%
FUEL EFFICIENCY GAINS

Antenna Bracket

USE CASE

3D printed parts to reduce weight

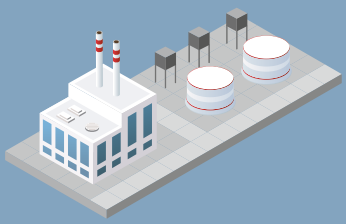
Oerlikon and RUAG Space worked together on the qualification of a sentinel satellite antenna bracket for a payload fairing. A new optimized design made possible through additive manufacturing (3D printing) reduces costs, decreases weight and doubles the stiffness of the bracket.

25%
LESS COST

50%
LESS WEIGHT

2×
STIFFER

5 things you probably didn't know about aircraft jet engines

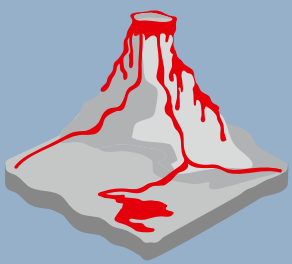


USE IN POWERPLANTS

GE is taking the world's largest jet engine (GE90-115B) and turning it into a power plant. The new electricity generator (LM9000) will be able to generate a whopping 65 megawatts, enough to supply 6,500 homes.

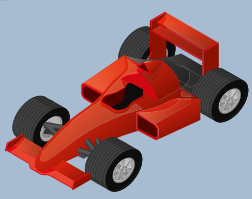
THE SIZE OF AN ELEPHANT

The current biggest and most powerful passenger plane jet engine weights around 8.28 tons, measures 3.43 m in diameter and is 7.29 m long. Even more than a grown up African elephant.



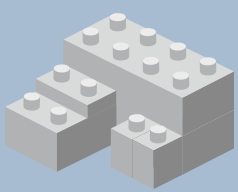
HOTTER THAN LAVA

With temperatures of over 2,000 °C inside the combustion chamber, a jet engine has to withstand temperatures hotter than lava.



FORMULA 1 POWER

A Trent 1000 jet engine from Rolls Royce has a turbine that generates 50,000 horsepower. This is equivalent to 68 Formula 1 racing cars.



40,000 PARTS

Engines are fully disassembled when they're overhauled. Depending on type, a jet engine can consist of up to 40,000 parts, which means this process can take up to 60 days.

Sources: KLM.com, GE.com, generationaerospace.com

TRACKING THE AEROSPACE TREND TRAJECTORY

The global volume of airline passengers has increased dramatically in recent years: More than one third more people boarded an aircraft in 2018 than did just five years ago. Demands for operational efficiency and sustainability are equally in focus, both for aircraft manufacturers and airlines. **Donough Tierney, Vice President Canada & Europe at Airbus Industries** relates what factors will influence the sector in the years to come.

What does the aerospace industry mean for you personally? What fascinates you the most?
Aerospace is one of the most interesting industries I have worked in. The technology and various business models across the industry have a major effect and impact on three levels. At Level 1, aircraft development creates valuable and sustainable high-tech jobs. At Level 2, the spin-off from aircraft manufacturing has a major direct and indirect impact on the supply chain that can stretch over many countries. At Level 3, the aircraft produced and sold to airlines in recent years have led to a huge increase in air travel that has changed our ability to move across countries and continents at a reasonable price and at the same time has sparked the growth of aerospace hubs.

What major trends currently drive the aerospace industry?
There is a range of trends, passenger experience for example, through various innovations, including increased space, comfort and environment. On the operational side, we're discovering how to maximize fleet performance and reduce operational expenditure. In these areas, data analytics can play a major role. Airlines are looking for ideas that can have a positive effect on fuel consumption, which is a major airline cost, and aircraft maintenance. When aircraft are not flying, they are not making money for airlines – hence the need to make sure that maintenance is performed off-peak or through scheduled checks. Environmental impact is now being heavily considered, and new solutions including hybrid and electric aircraft are developing and will be introduced in the future. Battery technology will have a major impact on the pace of this development.

Given the emergence of major urban transport hubs, airport development is looking to cater to increased traffic while managing customer expectations. Technology is playing a major role in design and personalization, leading to higher retail expenditure, and to maximizing operational improvements on both land and airside.

Can you describe one or two examples of digital transformation's impact on your business and how Airbus manages them?
Airbus has launched a new aviation data platform in collaboration with Palantir Technologies – pioneers in big-data integration and advanced analytics. Skywise aims to become the single platform of reference used by all major aviation players to improve their operational performance and business results and to support their own digital transformation. Skywise is already improving industrial operations performance throughout Airbus' industrial footprint, and it is now possible to deliver enhanced aircraft and equipment designs, better service and support offerings based on deeper in-service data insights.

Servitization is an area where Airbus is growing rapidly, and digital transformation allows for better customer offerings. A good example of this is the Flight Hour Service (FHS) business, which allows for increased operational reliability. Airbus FHS provides fully integrated component services, including spare pool access, onsite stock replenishment at the main base and components repair. Through FHS, Airbus offers airlines its extensive and proven expertise in fully integrated maintenance services, and the advantage of its OEM expertise as well as one single interface to manage their whole fleets and associated component support operations. →

Airbus is working on solutions for future air mobility in cities. What do these solutions look like, and when will they come into operation?

Growing urbanization and the associated need for mobility are key megatrends in our century: by 2030, 5 billion people, 60 percent of the population, will live in cities. This leads to ever-growing congestion problems and associated costs, both of which reduce the living conditions of the citizens. Within the future smart city, there is a strong opportunity to overcome the constraints of ground transport by using Airbus territory: the third dimension. Within this framework, Urban Aircrafts are potential solutions for on-demand and shared air mobility. CityAirbus has been tailored to the needs of urban environments. It features a fully electric “multicopter” design combined with a radically simplified architecture. Autonomy features will reduce pilot workload and increase safety. In addition, new production technologies and industrialization for mass production will reduce costs significantly. Key enabling drivers are safety, cost and noise to ensure techno-economic feasibility and public acceptance.

What role do partnerships play in designing our future air travel solutions?

The collaboration economy will reach new heights in the coming years, as many solutions will be introduced to improve the overall travel experience. As air travel continues to grow, so too will the partnerships with existing and new technological partners.

Donough Tierney,
Vice President Canada & Europe at Airbus

In the 15 years Donough Tierney has worked with Airbus, his primary area of focus has been International Development. The scope of this work encompasses devising and implementing country and region strategies and working on International Cooperation for large and strategic campaigns, which may include responsibility for roadmaps, industrial projects and aligning resources with objectives. In addition, his hands-on role in regional approaches and business development draws on his expertise in political affairs, strategy, industrial development and sales and gives him impact in areas as diverse as the United Nations, Multinational Organizations and the Arctic.

More flexibility and better service quality

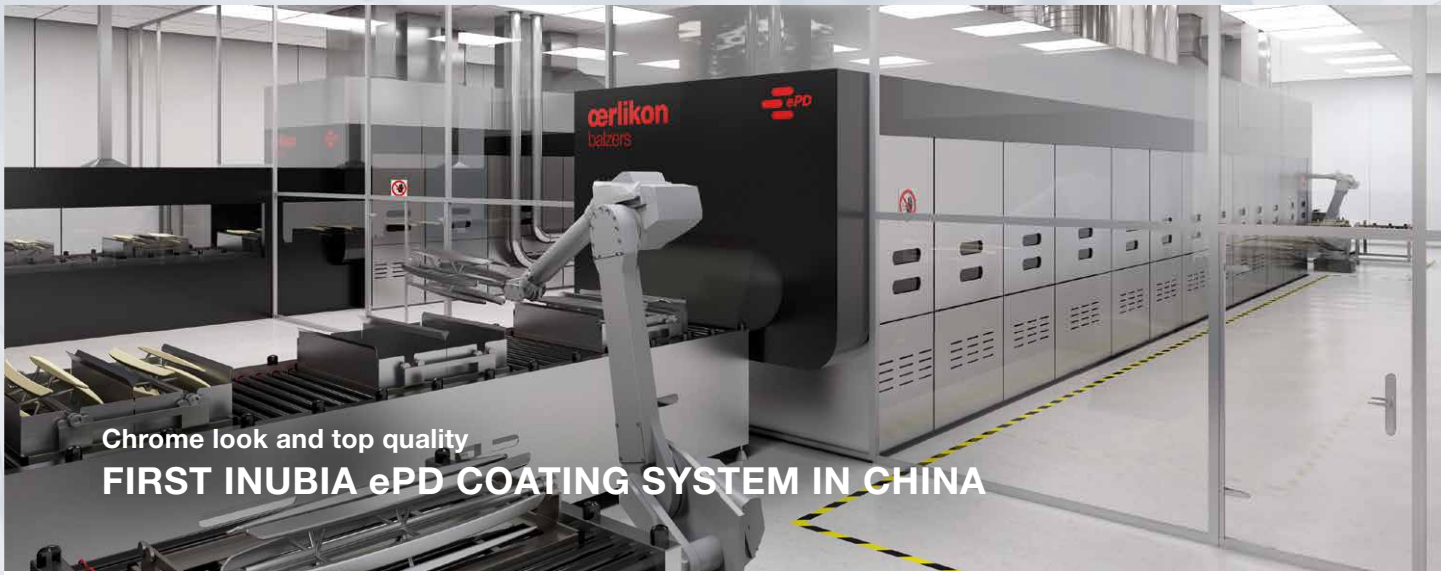
NEW COATING SYSTEM IN SWITZERLAND

The INGENIA family's new PVD coating system was formally inaugurated at the Oerlikon Balzers coating center in Brügg (Switzerland) in November 2018. The new investment significantly increases production capacity and, most notably, the flexibility and quality of service. "The INGENIA's smaller coating chamber allows us to reach a full batch load more quickly, even for coatings that we previously were able to offer only at longer intervals. As a result, we can now guarantee shorter delivery times to meet specific customer requirements," explains Andrea Hürlimann, manager of the customer centers in Switzerland and Liechtenstein.

Acquisition of TeroLab Surface GmbH

A BROADER RANGE OF SURFACE COATINGS

With the acquisition of TeroLab Surface GmbH in Langenfeld (Germany), Oerlikon Metco has expanded its range of coating solutions with additional market applications, especially in the agriculture, printing, steel, automotive and mechanical engineering sectors. "We are now able to offer our customers a more comprehensive range of surface coatings to improve the reliability and durability of components and parts," says Dr. Wolfgang Konrad, Head of Business Unit Metco Aero & Energy. This acquisition strengthens Oerlikon's market position for coating services and brings the business yet another step closer to its customers. In the future, TeroLab Surface GmbH will be active as Oerlikon Metco Coating Services GmbH in the Oerlikon Metco Aero & Energy business unit.



Chrome look and top quality

FIRST INUBIA ePD COATING SYSTEM IN CHINA

Automobile company Shanghai Dafangwuyu (DFWY) signed a purchase agreement for the first INUBIA I6, a fully integrated and automated coating system, in China. The system uses the ePD technology developed by Oerlikon Balzers to produce metalized plastics with a chrome look and represents a clean alternative to conventional galvanizing. The abbreviation for "embedded PVD for design parts", ePD is an environmentally friendly coating process that uses no harmful chemicals whatsoever. The system enables mass production in accordance with the automotive industry's requirements. DFWY, a Tier 1 or Tier 2 supplier for national and international OEMs, was recently awarded a contract for the mass production of ePD coatings for a wide array of decorative exterior parts. The INUBIA I6 makes it possible for DFWY to serve its customers in the automotive industry with chrome-look components of top-flight quality. "The ePD technology is a promising, environmentally friendly coating solution that meets the high protection requirements of our automotive customers," says Chairman Anthony Huang.

Sven Götti,
CEO and founder,
Götti Switzerland

EYEGLASSES

= TEMPLES + RIMS (OR EVEN LESS)

Eyeglasses consist of two temples, a bridge, the rims and a few more small parts. You might think that provides limited options. Far from it: **This drives designer Sven Götti to new heights of creativity.** And with his “Götti Perspective” collection, he has gone one step further by redefining rimless eyewear. The new concept also employs **BALINIT C from Oerlikon Balzers.** →

by Agnes Zeiner

«Using AM makes us enormously flexible, so we can not only **offer a widely diversified model range** in our ‹Dimension› collection, but can also **produce ‹on demand›.**»

Even after 25 years as a designer, optician Sven Götti is still fascinated by eyewear: “Yes, it’s true – we’re still dealing with the same product. But it’s even more exciting now, and the combination of fashion accessory and precision mechanics embodied by glasses is totally unique and challenges me every day.”

Perhaps that is the essence of the fascination Götti eyeglasses engender. They are not merely about an attractive design, top fashion or a certain “look”. Sven Götti’s team consists of 30-odd opticians, industrial designers and design engineers. And at headquarters in the town of Wädenswil on Lake Zurich, there is a separate development department.

Small and clever

Why does an eyewear brand need design engineers and its own development department? “We started this about three years ago when we wanted to design a pair of glasses that didn’t require any soldering, screws or glue,” explains Götti. The result is the “Perspective” collection – minimalist, rimless, aesthetic. Not a single screw is anywhere to be found.

On a tour through the small production facility, the designer’s passion – and that of his staff – is palpable: “We make the individual parts out of Sandvik stainless steel, which makes the glasses ultralight and flexible. The decisive connecting piece for the eyeglass lenses is manufactured with 3D printing. All of the parts are fabricated here in Wädenswil as well as in three foundations in Switzerland where people with disabilities carry out repetitive production tasks for us. The tools that local opticians require to connect the components with the lenses are also the result of our own development work.”

It all comes down to the coating

The rimless “Perspective” models are available in eight colors. For black, Götti brought a partner on board who is also known for Swiss precision, because only the BALINIT C coating from Oerlikon Balzers, normally used for high-tech tooling, was able to satisfy the designer’s demanding requirements. “I was looking for a partner that stands for ‘made in Switzerland’, as we do as well,” he explains. But it wasn’t just the color that convinced him: The coating also makes the eyeglass components scratch- and abrasion-resistant as well as impervious to environmental influences.

Printed glasses

And what about 3D printing – did we hear that correctly? Yes, in Götti’s production department there is also a printer that uses white polyamide powder and a finely tuned color mixture that prints not only tiny connecting parts, but also entire glasses. Götti has employed his own CAD designers for this purpose. “This makes us enormously flexible, so we can not only offer a widely diversified model range in our ‘Dimension’ collection, but can also produce ‘on demand’. Peak periods are buffered by an external partner.”

And what’s coming next? The designer smiles: “My vision is the question: How far can we take this? Innovation is the lifeblood with which we seek new solutions – and create an endless array of shapes from the same parts.”

Eyeglasses consist of two temples, a bridge, the rims and a few more small parts. After a visit to the Götti Switzerland facility with Sven Götti, however, it is clear that there is more. Much more.

Or, perhaps, less.

BALINIT C

BALINIT C is a WC/C based coating, meaning it is a mixture of metal (WC stands for tungsten carbide in German) and diamond-like carbon (C). The coating reduces surface fatigue and tribo-oxidation. BALINIT C is typically employed for gear wheels and ball bearings subject to high surface pressure and heavily loaded precision components in internal combustion engines. Further applications include punching and forming tools, but also the pharmaceutical and food-processing industries.

www.oerlikon.com/balzers/balinit-c

Color design and functionality

Highly decorative and wear resistant at the same time – the coatings in the Oerlikon Balzers “Design Line” deliver high-quality, colorful surface coatings that provide even more creative flexibility in product design. The coatings are extremely thin, which enables the existing structures to be replicated with precision. Matte or gloss effects are applied prior to coating by blasting, brushing or polishing. Application areas include the plumbing sector, automotive interiors, parts for clocks and watches, writing implements, eyewear or electronics components.

www.oerlikon.com/balzers/designline

ARTIFICIAL INTELLIGENCE MEETS POWER

A start-up in Magdeburg, Germany, has developed a measuring instrument **that helps athletes attain optimal results from strength training.** The polymer housing is from Oerlikon AM in Barleben.

by Gerhard Waldherr

It has the same size and appearance as a rubber eraser: A black housing with a lightly roughened surface in which a small orange V is embossed. The Vmaxpro has a sleek exterior. What actually makes this small device exceptional, however, are its inner workings, which could soon take the arena of popular sports by storm. The fact that it also has a story to tell about additive manufacturing makes it just that much more intriguing.

Location: Magdeburg, Lorenzweg 43. The office of Blaumann & Meyer – Sports Technology UG can be found on the second floor of a yellow Art Nouveau villa. Marcel Blaumann, an athletic young man who talks about his product with enthusiasm, is waiting. From the electronics to the design and even the associated app, everything is the result of his own development work, he says. And, naturally, he wants to provide his visitor with a demonstration of how it works.

Blaumann fetches a barbell and places it on the floor. The Vmaxpro sticks to the bar magnetically. Blaumann starts the app on his smartphone. He selects the category of "muscle building" and "deadlift" as the exercise.

The app, your friend and trainer

What happens next is fascinating. Artificial intelligence meets power. The app says: 55 kg, three repetitions to warm up. Blaumann lifts the barbell three times. The system reports the speed of motion in seconds per meter. The smartphone instantly displays the maximum weight in dependence on your personal day's form (196 kg) as well as the optimal weight (142 kg) for the training session. The next instructions: five to six repetitions at 142 kg. In addition, a graphic shows the primary stimulus that will be applied to the muscles.

"The system," explains Blaumann, "interprets all the available data: the lifting speed, previous training performance, general sports science findings as well as my personal form today. It uses this to calculate the optimal strength training session for my individual training objective."

Marcel Blaumann
CEO, Blaumann & Meyer – Sports Technology UG

He studied mechatronics in Mannheim and subsequently worked for ABB, an energy and technology firm with headquarters in Zurich. In his free time, he engages in mixed martial arts, which also entails strength training. "The danger in strength training," says Blaumann, "is overdoing it, which leads to injury. Doing an exercise with too much weight increases the risk of injury. Using too little weight doesn't bring results. The question of how to optimize strength training has always been on my mind."

Algorithms to make you strong

That question was also a factor in his second course of studies, Sports and Technology, in Magdeburg. Blaumann knows: "Speed is the key. In weight lifting, for example, an athlete knows that if he can achieve a certain speed, he'll manage the weight." There are devices available that measure speed during strength training, but they are extremely expensive and are therefore used only in professional sports. They also record and analyze the motion of the barbell. "Eighty percent of what an athlete does right or wrong can be recognized based on the motion of the barbell."

Blaumann is convinced that everyone who engages in strength training needs that →

information. “There are huge numbers of ambitious recreational athletes who go to the gym and lift weights but are ultimately frustrated when they don’t reach their goals.” Because they are training wrong. Because they aren’t being instructed or monitored and hardly anyone can afford a personal trainer. And that is where the idea for the Vmaxpro was conceived. During an internship at the Olympic Training Center in Magdeburg, he met the sports medicine scientist Dr. Guido Meyer, who was immediately fascinated. The idea of starting a company was proposed.

This is the point at which Oerlikon came into play. Blaumann had put together the electronics and developed the software; there was even a design for the housing already. But he had no idea how to get it made. An injection mold costs considerably more than 10,000 Euros. Too expensive. Initial trials with a 3D printer found via the Internet proved unsatisfactory. The electronics package was still too large. The shape didn’t fit. The usual problems a start-up faces. Blaumann needed professional support, so he consulted with professors and fellow students. Ultimately, one said: “Why don’t you go to citim?”

Located in Barleben near Magdeburg, citim was established in 1996 as a spin-off of the University of Magdeburg and is one of Europe’s additive manufacturing protagonists. The first laser sintering system (plastics) was installed in 2004 and the first laser beam melting system (metal) in 2009. Currently, the company has more than 20 printers for metal and ten for plastics. Since 2017, citim has been part of the Oerlikon Group.

«Eighty percent of what an athlete does right or wrong **can be recognized based on the motion of the barbell.»**

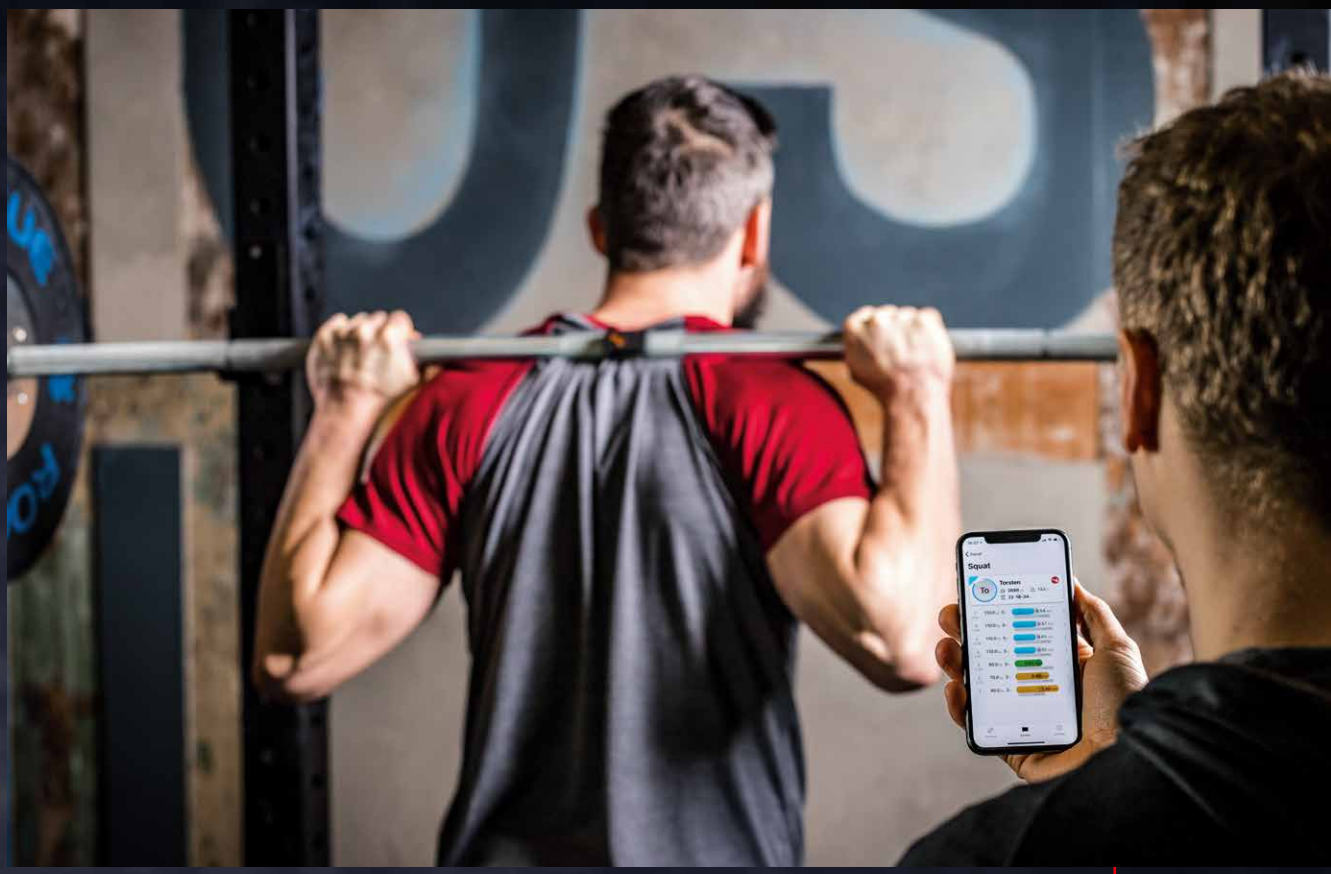
Win-win for Oerlikon and customer

“We are always happy to get inquiries like the one from Blaumann & Meyer,” says Nils Raschke, Project Manager AM Polymers at Oerlikon. Especially because the challenge with the Vmaxpro did not involve metal powder, but rather polymers and the requirement of achieving a surface quality that was suitable for series production. “With projects like this,” says Raschke, “we can improve our ‘out of the box’ production skills. All our customers benefit from this learning effect.” What’s more, Oerlikon AM is naturally interested in promoting the theme of additive manufacturing, especially in Magdeburg as a center of technology.

A little later, the scene has changed to the Oerlikon AM production shop. There is humming and whistling and hissing, as 3D printers, CNC machines and printed parts are everywhere. Raschke opens the door to a separate area with glass walls. There stands the M2 from the California company Carbon, with which the Vmaxpro is printed. It is a futuristic looking white cylinder. At the top is a semi-circular pane with a golden shimmer. The Continuous Liquid Interface Production (CLIP) process used for printing here was developed by Carbon. With it, objects are fabricated from a liquid synthetic resin using UV light.

A glance through the pane reveals a product taking shape not layer by layer, but slowly as a single piece. It looks as if an object were being pulled out of a thick, black soup. The part is subsequently cleaned in what is known as a washer. Afterward, it is hardened in an oven at from 120 to 210 degrees Celsius for eight to twelve hours, depending on the plastic used. In contrast to laser sintering, the end product has a fine surface texture that looks as if it were the result of injection molding.

And the best part: A housing for the Vmaxpro, which consists of three parts, costs Blaumann & Meyer significantly less for a series of 1,000 pieces than it would using injection molding. It’s also possible to incorporate modifications later on quickly and cost effectively.



The system interprets all the available data and calculates the optimal strength training session for the individual training objective.

Headlines worldwide

Carbon and its CLIP technology recently attracted international attention as Adidas presented its first polymer soles fabricated by means of 3D printing. They are the foundation for a custom sports shoe adapted perfectly to the foot of any athlete. In addition, Ridell, a manufacturer of helmets for football players, is now working with this 3D process for padding. Experts are already talking about a new trend in the sporting goods industry that will permit more creativity and change not only what, but also how, products are manufactured in the future.

One could say that also holds true for Blaumann and his Vmaxpro, which is already in use at almost all Olympic Training Centers in Germany for all Olympic disciplines and all team sports. “The feedback is thoroughly positive.” Blaumann’s real objective, though, goes beyond professionals and Olympic athletes. He wants to conquer the whole range of popular sports. He recently sold 250 of his measuring instruments by means of crowd funding. That has secured the continuation of the business for the time being. But to market his product on a large scale, he needs an investor. Blaumann says: “Then we could really get moving.” The 3D printers at Oerlikon AM in Barleben are ready to go in any case.

www.vmaxpro.de
www.oerlikon.com/am

1 | Plymouth

AT YOUR SIDE

Even closer to our customers

2 | Manesar

1

AT THE FOREFRONT

Super alloys and titanium materials from Plymouth

Oerlikon's state-of-the-art powder metals manufacturing facility is located in Plymouth (Michigan, USA). In operation since summer of last year, the factory produces super alloy and titanium materials for additive manufacturing and coating processes. The powdered metals are used mainly for aerospace, energy, medical and automotive applications.

The Plymouth facility features latest gas atomization and spheroidization equipment and has full capacity to produce, for example, high-purity titanium powders (read more from page 34 about this chemical element, which is used to produce strong and lightweight alloys for aerospace, biomedical and other industries). The installed processes deliver highly spherical and fully dense metal powders with significantly reduced surface contamination, which is important for titanium implants in the biomedical industry.

Plymouth is another step in Oerlikon's efforts to save valuable resources: All installations have been built with a focus on minimizing loss of process energy and raw materials.

Oerlikon's Plymouth operation: at the forefront in the production of super alloy and titanium materials.

2

INDIA'S LARGEST CUSTOMER CENTER INAUGURATED

Oerlikon Balzers India inaugurated its largest production center in Manesar (India) in October 2018. The guests of honor in attendance included H.S.H. Hereditary Prince Alois of Liechtenstein and Dr. Doris Frick, Liechtenstein's ambassador to Switzerland. The new customer center not only enlarges the production floor space, but also provides a widely diversified range of services offered throughout India. Customers can now have even large-scale forming tools coated. There are additional capacities available for cutting tools as well, and all delivery times have been shortened considerably. "We want to offer our customers the best possible service. That's because it's our technologies and services that make the difference in the hotly contested and booming Indian market," comments Marc Desrayaud, Head of Oerlikon Balzers.

"GREEN THINKING" AT OERLIKON BALZERS

Climate neutral and easy on resources

Conserving resources as well as protecting the environment and health: Oerlikon Balzers pursues this goal not only for its customers, but also in its own right. Thanks to a climate-neutral energy supply and waste management system, the company is not required to pay a CO_2 levy at the Balzers (Liechtenstein) site. The electricity required comes from hydroelectric and solar power, while heat is supplied from a wood-fired heating plant. Even the waste management system has been optimized: Use of a vacuum evaporator reduces the annual amount of special waste by 26 percent, or about 23 metric tons annually. "We follow the current trends in climate and environmental protection continuously and evaluate which new technologies could contribute to climate-neutral site development. Sustainable management is important to us," explains Marc Desrayaud, Head of Oerlikon Balzers.

TITANIUM
AS ONE OF THE METALS

Atomic number: 22
Chemical symbol: Ti
Relative atomic mass: 47.867
Series: transition metals

In our new Plymouth facility, we work intensively with Titanium. Therefore, we had a closer look at the element.

Special properties
Named after the Titans, the gods of Greek mythology, titanium is the heaviest light metal at 4.5–4.8 g/cm^3 (by comparison: aluminum is 2.7 g/cm^3, and steel is 7.5–7.8 g/cm^3). And its properties are impressive: It is corrosion resistant, especially tough and durable. Even in a concentration of only 0.01–0.1 percent by weight, it gives steel exceptional toughness, strength and ductility.

Where is titanium used?
Titanium is frequently used in medical and dental technology as a biomaterial for implants and other medical products. It seldom causes rejection reactions and allows bone ongrowth. But there are other uses, as well: For tools or components that require protection from corrosion or in aircraft construction. Here, it is used for parts subject to especially heavy stress that must nonetheless be light (such as turbine blades). Many other products employ titanium, as well, from protective clothing to sports equipment and jewelry and even cosmetics.

Where can it be found?
Titanium is found in the earth's crust and, apart from a few exceptions, only in combination with oxygen as an oxide. It is by no means scarce. With a content of 0.565 percent, it is the ninth most common element in the continental crust. Usually, however, it is found only in a low

Hip joint prosthesis with socket and head

High-purity titanium (99.999%) with a visible crystalline structure
Photo: Alexander C. Wimmer

concentration. The principle conditions that allow extraction of larger amounts are found in Australia, Scandinavia, North America, the Urals, Malaysia and Paraguay.

Is titanium expensive?

Titanium is about 35 times more expensive than common steel alloys and about 200 times more expensive than crude steel. In the traditional process, known as the Kroll process, ilmenite (titanium iron ore, $FeTiO_3$) or rutile (TiO_2) are treated at temperatures of greater than 1,000 °C with chlorine gas, other volatile chlorides and liquid magnesium. This causes the formation of blocks of pure, solid titanium. The process is extremely complex, requires a great deal of energy and is about 10,000 times less efficient than that used for making iron.

Progress is expected with a new process developed in 2015 by the Stanford Research Institute at Stanford University in Menlo Park (USA): The energy of a plasma arc is used to split the titanium-chlorine bonds in titanium chloride obtained from titanium ore. The result here is titanium vapor, which quickly solidifies and forms titanium powder. The significantly lower amount of time and resources consumed provides a noticeable reduction in manufacturing costs.

Ilmenite is one of the most important sources of titanium oxide.

Quartz with rutile inclusions:
Rutile is a commonly occurring mineral from the class of “Oxides and Hydroxides” with the chemical formula TiO_2, and it is called titanium dioxide in chemical terms.

FIVE MINUTES FOR A TRULY HOT TOPIC

"My research and I – that's a little bit like neutral Switzerland between academia and industry," says **Edward Jonas Gildersleeve V, winner of the Oerlikon Metco Young Professional Award 2018,** as we meet with him for an interview. The trip to Switzerland and Oerlikon Metco in Wohlen was the young New Yorker's first journey abroad, as well as a further highlight of the OMYPA.

by Agnes Zeiner

The late-winter weather in Switzerland stood in stark contrast to the warmth and sunshine of Orlando, Florida, home to the first OMYPA. Ed Gildersleeve, who is writing his dissertation at the Center for Thermal Spray Research of the Department of Materials Science and Engineering at Stony Brook University in New York, recalls: "In May 2018, I presented my work at the ITSC, or International Thermal Spray Conference and Exposition, in Orlando, Florida. They gave me exactly five minutes!" Gildersleeve mastered the challenge and won the Oerlikon Metco Young Professional Award.

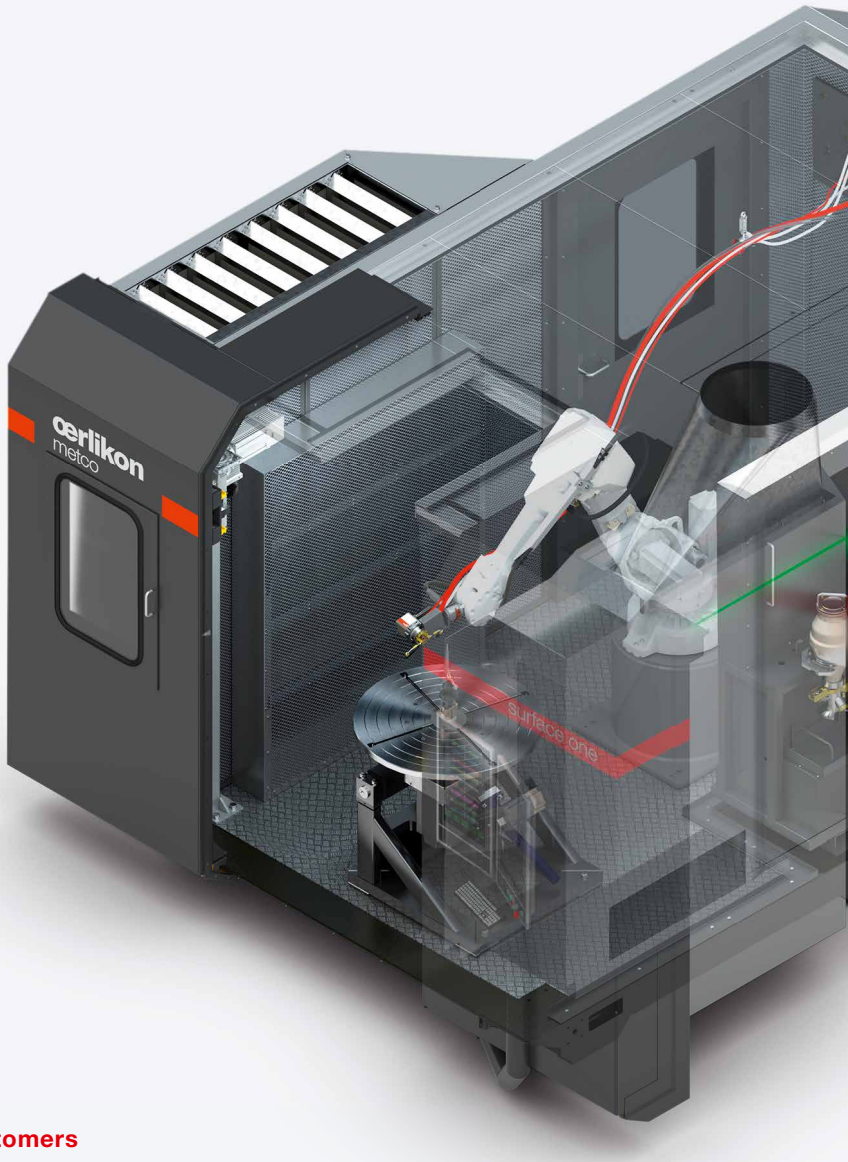
"At the Center for Thermal Spray Research, we have constructed a gas combustion burner rig on which we can simulate the effects that takeoffs and landings have on jet engines. Among other things, we are also using it to test thermal barrier coatings (TBC), which are a focus of my research. For my presentation at the ITSC, I concentrated on only one aspect and chose the topic of CMAS." (CMAS stands for debris containing primarily calcium, magnesium, aluminum, and silicon.) "Briefly, this deals with the question of what changes contaminants in the combustion gas and the ambient air cause in the TBC coatings over a certain operating period and temperature. The reason is that the turbines heat up to as much as 1,200 °C, which causes contaminants like these to melt and affect the coatings. My research examines how certain combinations of materials behave under operating conditions over a specific period of time."

That behavior, of course, is what most interests the young materials scientist. He is concerned not with finding the perfect material for an application, but rather with understanding how a material reacts under certain conditions and over a given period of time so as to draw conclusions for the process (failure mechanisms). "For me, what I do is almost intuitive – nonetheless, I am moving in directions that no one else has yet thoroughly pursued. This is an aid to other people in their work, whether it be research or in industry, because what we publish is utilized by both sides. It's both exciting and very enriching at the same time," relates Gildersleeve. Does he personally feel more drawn toward industry in the final analysis, or will he remain true to his roots in research? That is something the OMYPA winner does not yet know: "What I need to do now is get my doctoral work finished. Then we'll see. I find both options appealing!"

Oerlikon Metco Young Professional Award (OMYPA)
The OMYPA was launched by Prof. Dr.-Ing. Kirsten Bobzin of the University of Aachen. It is funded by Oerlikon Metco and organized by the German Welding Society (DVS) and ASM International. It aims to acknowledge students, doctoral candidates and scientists from all over the world, and to encourage new talent to engage in the advancement of surface engineering. Award contestants are students who are currently in their graduate year of university and have prepared an abstract on their thermal spray research. The submitted abstracts are evaluated by an international team of thermal spray professionals from both academia and industry. The abstracts selected are presented by the finalists at the ITSC, where they are evaluated and scored for originality, experimental and research results and presentation style.

A COMPACT FUTURE

When Oerlikon puts a new product or technology on the market, it is not thanks to a few clever inventors ensconced in a small room somewhere. Quite the contrary: **they keep an eye out for customers' experiences, which form the basis for innovation.**



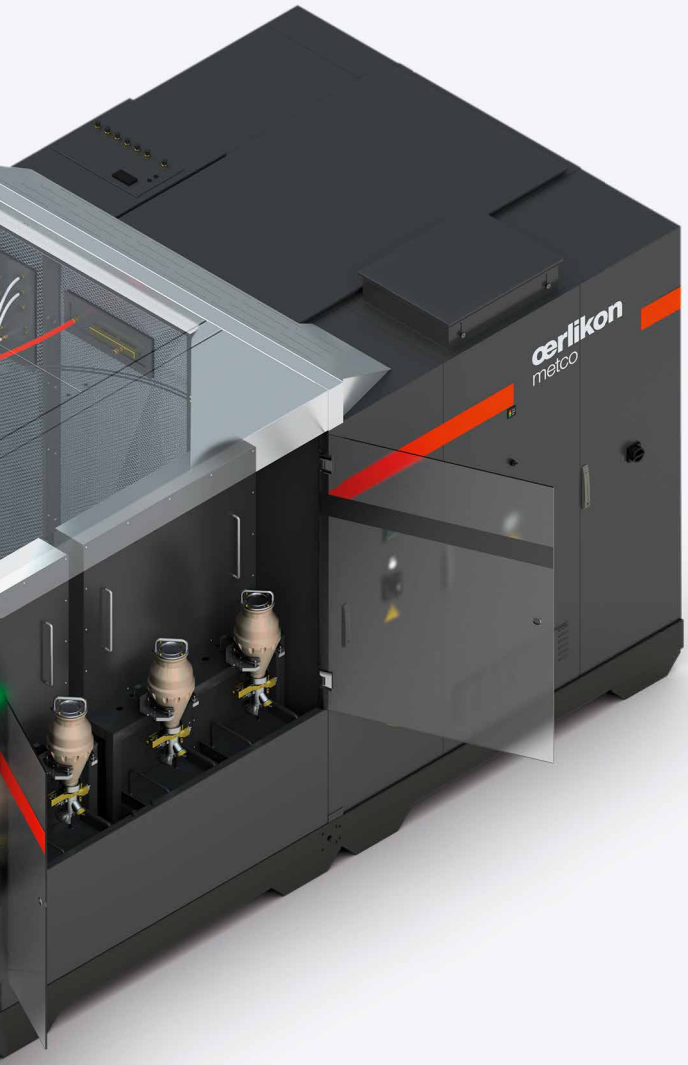
This was the case as well with the recent development from Oerlikon Metco: a totally new type of machine for thermal coatings. In an effort to gain a better understanding of requirements, a meticulous process was employed to survey more than 45 customers. They shared their vision for the future of thermal spray coatings with the developers, explained their challenges and talked about their needs.

Based on this invaluable input, Oerlikon Metco developed an unprecedented system: Surface One.

Delighted customers

This first machine for thermal spray coatings integrates three spray processes, a spray gun and part handling system, and powder feeders into one compact unit. The Surface One has generated excitement on the market accordingly. Nicholas Lindroos from TKM TTT Finland OY, one of the first people to experience a machine like this live, remarks: "For us, the best Surface One possibility is that we can change very fast to different applications and different powders." And Joe Martin from Chromalloy in New York expressed that he is "very impressed that it was actually put together in a one-pickup unit."

Ansar Syed-Asif from the German Aerospace Center puts it succinctly: "Oerlikon Metco is the leading company in this area and a good partner, and together with them, we would like to bring the whole technology into the future."



A persuasive solution

Oerlikon Metco's "intelligent factory of the future" has persuaded not only customers, but also the Red Dot Design Awards jury and the International Design Excellence Awards (IDEA), who have given the new system accolades for its product design.

Its success is also confirmed by the fact that since the market launch just shy of one year ago, more than ten machines have already been sold. In fact, due to the high demand, Oerlikon Metco has invested in a new production facility specifically for the Surface One.

SURFACE ONE …

is so compact that it even fits in a transport container. It takes up much less space on the production floor and can easily be relocated to a different site.

scores high marks with a standardized, modular and configurable design. This speeds up delivery by 30% and installation by 80%, which dramatically reduces the duration of interruptions in production.

enables accelerated production planning because now, coating recipes and operating configurations can be transferred from one machine to another worldwide. This ensures reliable and reproducible coatings everywhere throughout a corporation.

enables intuitive and configurable handling with its Clarity user interface and guides operators through the process. These aspects simplify production, avoid errors and provide greater efficiency in operation.

is matched to the requirements of Industry 4.0 and the IIoT[1] and can be integrated with ease into any production environment in order to provide even better production process control.

can easily be adapted to various requirements, which minimizes production interruptions.

Find the video and more information at
www.oerlikon.com/pages/surface-one

[1] Industry 4.0 is a term that was introduced by the German government to refer to the trend to automation and data exchange in the context of production technologies that enable what is know as a "smart factory". The "Industrial Internet of Things" (IIoT) is part of Industry 4.0, in which cyber-physical systems and devices communicate and work together with one another as well as with humans in real time.

2019 Trade show dates

In the upcoming months, Oerlikon will again be represented at important trade fairs dealing with surface solutions and additive manufacturing. We look forward to your visit to our booth!

Europe

June 17–23	**International Paris Air Show**	Paris, France
June 18–21	**EPHJ-EPMT-SMT**	Geneva, Switzerland
June 25–27	**Rapid.Tech**	Erfurt, Germany
Sept 3–6	**SPE Offshore Europe**	Aberdeen, UK
Sept 9–13	**EUROCORR**	Seville, Spain
Sept 16–21	**EMO Hannover**	Hannover, Germany
Sept 24–26	**Alihankinta Subcontracting**	Tampere, Finland
Oct 7–9	**Aachen Colloquium** Automobile and Engine Technology	Aachen, Germany
Oct 16–23	**K-Messe**	Düsseldorf, Germany
Nov 5–8	**Blechexpo**	Stuttgart, Germany
Nov 12–15	**Elmia Subcontractor**	Jönkoping, Sweden
Nov 13–14	**Metalmadrid 2019**	Madrid, Spain
Nov 19–22	**FormNext**	Frankfurt, Germany
Nov 21	**Swiss Innovation Forum**	Basel, Switzerland

Asia

June 19–22	**INTERMOLD Nagoya 2019**	Nagoya, Japan
July 2–5	**MTA Vietnam 2019**	HCMC, Vietnam
Nov 20–23	**Metalex 2019**	Bangkok, Thailand

Americas

June 11–13	**OMTEC**	Chicago (IL), USA
Sept 25–28	**NASS**	Chicago (IL), USA
Sept 30 – Oct 3	**CMTS**	Toronto (ON), Canada
Oct 1–3	**NADCA**	Cleveland (OH), USA
Oct 22–24	**Southtec**	Greenville (SC), USA
Nov 11–14	**Fabtech**	Chicago (IL), USA
Dec 12–14	**PRI**	Indianapolis (IN), USA
Dec 19–21	**PowerGen**	New Orleans (LA), USA

3rd munich
technology conference on
additive manufacturing

MTC³

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October 10
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