

BEYOND SURFACES

SUSTAIN- ABILITY

Achieving more with less: Green innovations, communicated transparently

Achieving more together: EcoGear and NADEA international research projects

Pushing boundaries: Advanced Manufacturing Technology Conference

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IMPRINT

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PROACTIVE AND TRANSPARENT COMMUNICATION

by Agnes Zeiner



“Sustainability is nothing new for Oerlikon – **what’s new is that we are talking about it so transparently,**” says Georg Stausberg, Chief Sustainability Officer at Oerlikon. In 2021, Oerlikon published its first sustainability report. We talked with Georg Stausberg and Dr. Sven Hicken, Chief Technology Officer of the Surface Solutions Division.

Mr. Stausberg, has Oerlikon jumped on a trend with its sustainability report?

Georg Stausberg: Sustainability is not a new topic for us. All of our large sites have energy management systems, and many use solar energy and employ waste recycling at a very high level. In addition, sustainability means more than “just” environmental protection for us: We pay special attention to the health of our employees and have been able to significantly reduce the number accidents over the last ten years through our “Health, Safety & Environment” program. What’s more, we foster the development of our employees — especially women — through other special programs. This puts us in a good position in comparison to competitors.

So why wasn’t a sustainability report issued before now?

GS: We realized that, while we are at a good place in this context, many



Georg Stausberg,
Chief Sustainability Officer,
Oerlikon



Dr. Sven Hicken,
Chief Technology Officer of
the Oerlikon Surface
Solutions Division

times our customers, investors, and in part, even our own employees, have not perceived that to be the case. With the report, which we will be publishing annually, we are communicating transparently and answering many questions before they even arise. As of 2024, in fact, reporting on non-financial key figures will become mandatory EU wide.

Mr. Hicken, what do Oerlikon’s sustainability objectives mean for the area of research and development?

Sven Hicken: Let me explain using an example. When we are working on a new coating, it has to fulfill certain criteria. Our developers use a check list to see that these are met. In that check list, sustainability criteria are now better represented, both in terms of clarity and quantity. This means our approximately 1,000 employees in R&D are now placing a greater focus on this topic. And not only that: We have even stopped projects that were

already at quite an advanced stage because they did not meet these criteria, and we are now looking for alternatives. For me as a manager and as Chief Technology Officer, that is not always so easy from a strictly business perspective. But as a person who thinks and acts holistically, I find it to be the right thing because it shows that Oerlikon takes this issue very seriously.

Where is Oerlikon setting priorities to meet the 2030 sustainability objectives?

GS: All Oerlikon sites that account for 50% of our total energy consumption already have an energy

management system according to the Oerlikon standard or to ISO 50001; all the others will follow successively by 2030. This is a very important measure for achieving our goal. On the other hand, we want the growth of our enterprise to continue at the same time. But more production also means more energy consumption. That means we need targeted measures to reduce it: Eliminating waste, renewing →

machines, and utilizing sustainable energy sources, such as photovoltaic and green electricity.

SH: I can address that based on the previous example because our efforts extend even to our equipment manufacturing. With respect to energy consumption, or energy efficiency, the question of how long the coating process takes and how many resources are consumed is very significant, including for the issue of costs. As a provider of coating services, this is just as important for us as for our customers who use our machines themselves.

How does Oerlikon measure its ecological footprint?

GS: Actually, it is hardly possible for us as a service provider and equipment manufacturer to say how much turnover we generate with sustainable solutions. There are still no industrial standards for this. That means we have had to define standards for ourselves, and that keeps an entire project team busy internally. In the meantime, this is the reason we are only reporting what we can actually measure.

Principally speaking, coatings make a significant contribution to sustainability because they either extend the service life of components

or reduce their weight. Beyond this, the efficiency of our equipment, (for example, in terms of energy and water consumption as well as emissions) also contributes to sustainability. We have good comparison values for these two aspects and can also quantify the advantages.

With lightweight-construction components for aircraft and cars, however, measurability becomes more difficult. For example, a coating from Oerlikon means that the fuel in an aircraft turbine can be burned at higher temperatures, thereby improving combustion and reducing kerosene consumption. Our customer, however, the manufacturer of the turbine blade, doesn't benefit from this directly. The effect can only be discerned in the second, or even the third, stage in the supply chain.

What contribution is Oerlikon's R&D making to the sustainability objectives?

SH: For one thing, this deals with the usual topics: How can we reduce the energy consumption of an aircraft? What influence do alternative fuels such as hydrogen have on engine components, and what properties do coatings require for this? Or: What coatings can be employed to make consumables such as lubricants or coolants unnecessary?

In addition, we are engaging with the topic of e-mobility quite intensely. We have a strong tradition dealing with coatings for the components of internal combustion engines, but now our customers are increasingly needing solutions for alternative drives. Here as well, coatings can not only protect components, but also even replace other materials, such as insulation.

What is the long-term focus of Oerlikon's R&D, specifically with reference to 2030?

SH: For us as researchers, the topic of sustainability opens up new, very exciting areas of activity. For example, that of energy generation: In stationary and mobile fuel cells, energy is generated from hydrogen by means of a chemical process, and coatings play an important role here. We are also looking at solid-state batteries because the Achilles' heel of e-mobility today is still the battery. Using solid-state batteries would enable a significant increase in the amount of energy stored per volume. One possibility would be using powders in the future instead of today's liquids. For us as a manufacturer of metal powders, that is, of course, a highly interesting field of research!

Many thanks for the interview!

Oerlikon's sustainability targets 2030

Oerlikon's goal is to ensure that it is recognized equally for its innovation and its integrity — and for the extent to which its work supports countries' progress toward achieving the United Nations SDGs. To that end, Oerlikon focuses in particular on the areas in which the company can make the greatest impact through products, services and operations.



HOW WE HELP OUR CUSTOMERS MEET THEIR SUSTAINABILITY GOALS



Reducing fine dust emissions

On average, **31% of passenger-vehicle-related emissions are caused by brake wear.** This results in more than 90,000 metric tons of fine dust per year in the OECD countries alone. Oerlikon's DiscCover solutions significantly reduce fine dust from brake discs.



Reducing CO₂ emissions in aerospace

Our solutions help **save up to 5 million liters of fuel**, the volume of two Olympic size swimming pools, every day for a fleet the size of the A320 family. This reduces CO₂ emissions by 11,600 tons.

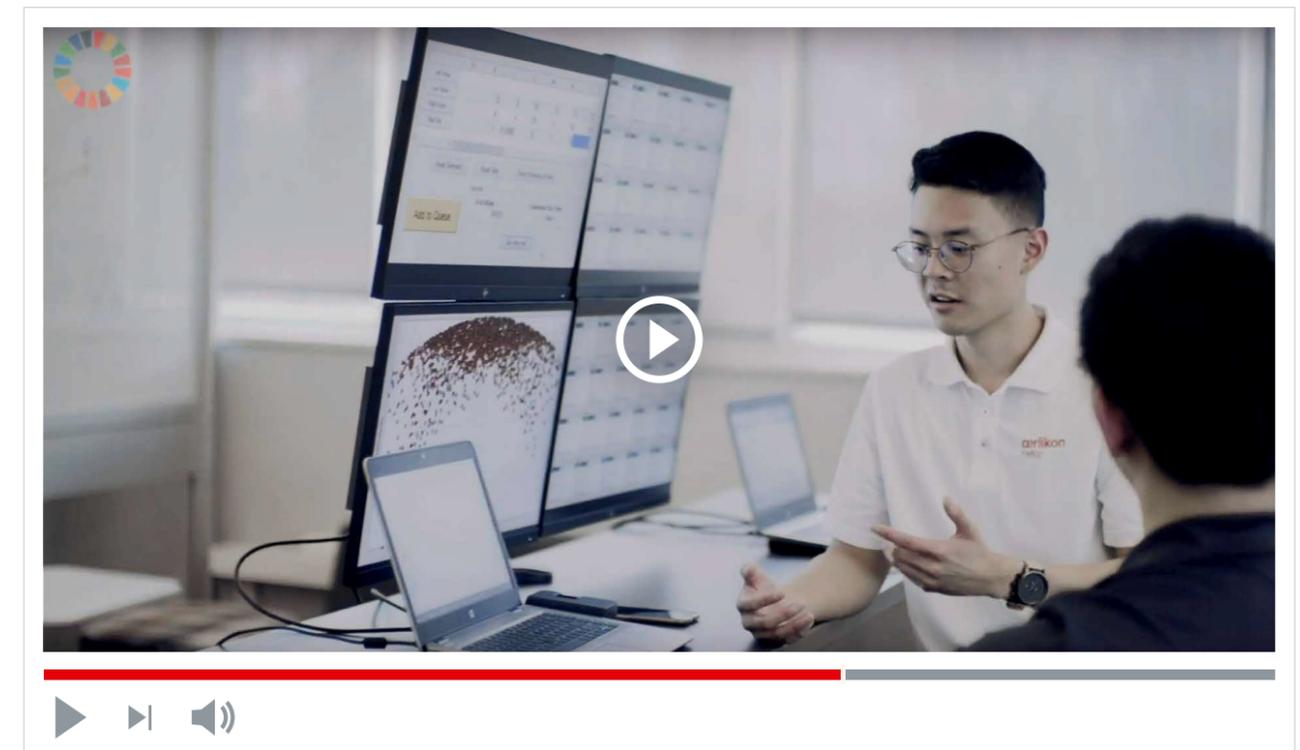
Achieving more with less.

This is our ambition and promise to our customers. As one of the "50 Sustainability & Climate Leaders", a project of companies to combat climate change, our climate action takes center stage in this video.



Video "Oerlikon is a global Sustainability & Climate Leader. Enabling YOU to achieve more with less": youtu.be/tFMPgR6ohMc

www.50climateleaders.com



SUSTAINABILITY INITIATIVES

OERLIKON'S EMPLOYEES IMPLEMENT GREEN INNOVATIONS WORLDWIDE

Great change also evolves out of smaller innovations that reflect a creative mindset and a commitment to making sustainable contributions to the health and well-being of our planet. With Oerlikon's history of creating sustainability solutions for its clients, green thinking is already integral to Oerlikon's mission. Teams all around the world are intensifying their efforts to bring this perspective to their own workplace, operations and personal conduct.



Aurangabad, India

CATCH AND RELEASE SNAKES

For the Oerlikon team in Aurangabad, India, green thinking translated to supporting nature and wildlife conservation in the forests and hills surrounding the facility. Snakes play an important role in the local ecosystem by controlling invasive species and preventing

overpopulation of rodents and poisonous snakes. In collaboration with forest officials and licensed trainers, team members learned to catch snakes that ventured onto the property and release them back into their natural habitat.

Vadodara, India

SOLAR INITIATIVE

Oerlikon's site in Vadodara, India, installed a grid-connected rooftop solar photovoltaic power generating system at the facility in 2018. The panels produced about 40% of the electricity used at the facility in 2019, and that rose to 50% in 2020.





Suzhou, China

ENERGY EFFICIENCY IMPROVEMENTS, ZERO WASTEWATER AND REUSE OF PACKAGING MATERIAL

Sustainable systems and processes have also been an area of focus in Suzhou, China, where the Oerlikon team identified energy reduction, water cleaning and reuse of packaging as areas in which it could have the greatest impact.

Equipment updates led to efficiency improvements there that lowered electricity consumption by 430,000 kWh, which translates to 302 tons of reduced CO₂ emissions annually. In addition, the Zero Wastewater Project

updated the water cleaning system from ultrasound to plasma, which lives up to the target of producing zero wastewater, down from 30 tons per year.

At the same time, a packaging redesign is reducing the use of wood materials by up to 500 m³ annually on initial use — and because the packaging material can be reused up to five times, an additional annual saving of up to 3,500 m³ in wood and an additional 38 tons in metal can be achieved.

Remscheid, Germany

45% DROP IN CO₂ EMISSIONS THANKS TO A COMBINED HEAT AND POWER PLANT

At the Oerlikon facility in Remscheid, Germany, energy consumption provided another context for sustainable innovation. The facility implemented a combined heat and power plant that redirects waste heat produced during the process and uses it in the heating system.

The initial system went live in 2016 and was so successful that a second was built in 2019. Today, these systems are achieving a 45% reduction in CO₂ emissions compared with traditional power generators.



Balzers, Liechtenstein

FULLY CO₂-NEUTRAL

Oerlikon Balzers' headquarter site in Liechtenstein provides an example to follow not just in greening operations, but in fully achieving CO₂-neutrality, although a lot of electricity is needed to operate the coating systems. Heat is provided by the local wood-fired heating plant in Balzers since 2014, and electricity is supplied exclusively from renewable sources (water, wind, solar). In addition, two photovoltaic systems that Oerlikon Balzers invested in as early as 2013 produce around 83,000 kWh per year. There are also several charging stations for electric vehicles installed at the site.

We drive innovation!



The company has had its own mobility concept for employees for several years, including public transport tickets and a platform for carpooling. As part of the PET recycling program, over 1.1 tons of PET bottles were collected in 2019 — equivalent to savings of around 3,429 kg of greenhouse gases and around 1,086 liters of petroleum.



GEARING UP FOR SUSTAINABILITY

EcoGear, a joint R&D project between Oerlikon, industry partners and academia, focuses on a manufacturing process improvement that **reduces waste, uses less energy and has a smaller carbon footprint.**

by Randy B. Hecht

Waste reduction is one of the most pressing challenges in sustainable innovation. What does it take to manufacture products and components that generate substantially less waste without compromising their utility or performance? Devising answers to that question often requires the input of a multidisciplinary team, and it is just such a collaborative approach that sets the stage for

development of a radically new way to produce bevel gears.

From traditional to transformational

Traditionally, bevel gears are produced as blanks from which the teeth shape is cut. This generates a great deal of material waste. The EcoGear project, a joint R&D venture of Oerlikon Balzers, Stockholm's KTH

Royal Institute of Technology, and industry partners Scania, Georg Fischer and Buderus Steel, was launched in 2020 to develop an alternative to replace the traditional manufacturing process.

"The goal of the EcoGear project is to develop a pre-forged blank at the beginning of the process chain with a near net shape geometry of the teeth," says Tony Ulander,

Oerlikon Balzers' Sales Manager for Scandinavia. "This dramatically reduces the machining effort to achieve the desired shape and the material waste; it also increases tool lifetime."

However, this new approach raises challenges for the entire process chain, including the tools and coatings. Oerlikon's role in the project includes establishing the parameters for the cutting data and the criteria for running operations. "By utilizing primeGear, we can optimize surfaces and edges with pre- and post-treatments together with coating. This makes it possible to increase tool life by up to 80%," says Kristofer Malmberg, Oerlikon Balzers' Tribology Specialist. "Cutting data collected over the course of the project gives us the documentation needed understand tool wear and to optimize the tool surface and edges."

The team found that the EcoGear solution reduced not only material waste, but also the volume of energy and resources needed for production, machining, transport and recycling. Results of a pre-study announced by the team notes: "The potential material savings are estimated to be up to 20% of total weight of the workpiece. If the workpiece weighs 37.8 kg and 80,000 bevel gears are produced per year, this would lead to material savings of approximately 600 t steel per year. The volume of chips generated in gear milling in a year would be reduced from approximately 700 t to 100 t."

Reduced waste, increased opportunity

For Ulander, these results speak for themselves, and the project also affirms the benefits of Oerlikon Balzers' tool coatings and their contribution to the reduction of wear and tear on tools. But he takes an additional lesson away from the project about the power of interdisciplinary partnership.

"We see that through collaboration between Oerlikon, tool makers and the end users, we can come up with a finished product that delivers real benefits," Ulander says. "For us, it has been a good experience to collaborate in depth with the tool manufacturers on this green project and to gain better understanding of the end users and their processes. This enables us to really support them in going for greener solutions when it comes to tools and tool usage." He and the team look forward to having more opportunities to explore sustainable solutions in partnership with Oerlikon customers.

Project partners

- > KTH Royal Institute of Technology – PMH Application Lab
- > KTH Royal Institute of Technology – Department of Production Engineering (IIP)
- > Swerim
- > Laboratory for Machine Tools and Production Engineering (WZL) of RWTH Aachen University
- > Scania
- > Buderus
- > GF System 3R
- > Oerlikon Balzers

A CONSERVATION COMPONENT

Oerlikon Balzers' primeGear service reduces manufacturing costs for gear components and preserves natural resources by reconditioning high-quality cutting tools. The service, which is available at many customer centers worldwide, emerged from years of R&D collaboration with commercial partners.

In 2020, Oerlikon Balzers opened a new application support center in Uppsala, Sweden, for the pre- and post-treatment of cutting tools for the automotive industry. It serves as a global competence center, where the tailored surface pre- and post-treatment service will be further developed and optimized, as an information and consulting center for customers and as a training center where Oerlikon Balzers staff can keep up-to-date with the latest pre- and post-treatment solutions.

NAVIGATING THE COBALT MATRIX

From turbine blades to e-vehicle batteries, cobalt is essential. But sourcing and handling it responsibly is an equal imperative.

by Randy B. Hecht

The word cobalt has its roots in a succession of Middle High German and Modern German names given to elves who could be helpful or commit pranks, depending on their mood. “Kobolt” first acquired an extractives context in the 16th century, when miners used it to describe ores that they regarded as worthless — the remnants of silver ores that had been ruined by mountain goblins. A century later, *cobaltum* entered the science lexicon and cobalt’s material value was first recognized.

Today, cobalt is an integral component of Metal Matrix Composites (MMCs), for example tungsten carbide in a cobalt-chromium alloy, as well as the main alloying component of cobalt-chromium-molybdenum. Oerlikon’s cobalt-based powders are used in such applications as thermal spray and PTA. These materials form coatings that are appropriate for wear and corrosion resistance in relatively high-temperature service conditions.

Better performance in extreme conditions

Cobalt alloys deliver excellent resistance against high temperatures and high hardness, which translates to increased protection against wear and corrosion in extreme conditions. In the aerospace industry, for example, alloys that include cobalt are used in thermal coatings for turbine blades.

What qualities does it strengthen in alloys? “Cobalt offers two advantages in combination with tungsten carbide,” says Guido Reisel, Head of Global Competence Team Wear & Erosion/Hardfacing Materials. “One is that tungsten carbide has good wettability with cobalt, which means it’s very well bonded into the metal matrix. The other is that tungsten carbide has a tendency to dissolve very fast at high temperatures in combination with metal, so that carbon diffuses into the metal matrix and forms unwanted brittle and hard so-called *ata*-phases. With cobalt, this tendency is reduced compared to a nickel or iron alloy. It’s the best metal matrix for tungsten carbide. Without it, you would see a decrease in the wear resistance, the ductility and the toughness of the coatings.”

Driving e-mobility — and conflict

But like those medieval elves who had the capacity to be destructive as well as helpful, cobalt also presents complications in materials engineering.

There are health and safety considerations in its use, and Oerlikon observes strict precautions in cobalt R&D and production to protect employees. Equally important, the company publishes Safety Data Sheets with versions that are localized for each country in which the material will be used to optimize the well-being of customers and end users.

The main cobalt ores are cobaltite, erythrite, skutterudite and glaucodot (from left to right). However, it is mostly extracted as a by-product of nickel and copper mining and smelting.



Sourcing is another challenge — one that has put cobalt into headlines because it’s an essential element in batteries for electric vehicles and helps them to maximize mileage with each charge. As the market for mobility that runs on renewable energy grows, demand for cobalt is escalating. That’s giving the Democratic Republic of Congo new prominence in global markets as the source of most of the world’s supply of cobalt, despite the fact that the country and its mining industry have long faced charges of human rights abuses.

Oerlikon makes it a priority to source cobalt from other countries, which can create competitive and pricing pressures. But the company pursues its responsible sourcing objectives by making an ongoing investment in strong supplier partnerships that support Oerlikon’s environmental and human rights standards. This is the company’s formula for meeting its obligations to customers and society alike.

Oerlikon’s tungsten carbide–12 cobalt materials are among the best-known thermal spray powders for use in wear applications at service temperatures below 500 °C (930 °F) in non-corrosive media.

Oerlikon’s cobalt-chromium alloy powders are suitable for additive manufacturing and coating processes, and are used in a variety of applications, from aerospace (for example, gas turbine parts) to medical (orthopedic implants) and general industry.

Electrolytically refined pure cobalt (99.99%)



A EUROPEAN PROJECT TO SOLVE A MATERIAL CHALLENGE

Components designed for **high strength applications in corrosive environments** are mostly made of duplex steels. This is true today across such industries as oil and gas, mining, offshore and chemicals. **High-entropy alloys** could be even more suitable for these applications, but there is little experience so far with this relatively new class of materials, and the price is significantly higher than for duplex steels. A European research project with strong participation from Oerlikon embarked on the search for a solution.

by Agnes Zeiner

Duplex steels are better suited for corrosive environments and provide higher strength than conventional austenitic stainless steels. However, for specific applications such as impellers, a new class of materials could outperform them: High Entropy Alloys (HEAs), which are usually composed of five or more elements.

Parts made from certain HEAs are characterized by particularly good strength-to-weight ratios and improved fracture and/or corrosion and oxidation resistance. But relatively expensive elements such as nickel and/or cobalt lead to increased costs. "This represents an obstacle for the industrialization of these alloys and their application in new areas," explains Dr. Alper Evirgen, Senior Materials Scientist at Oerlikon AM.

A high-entropy alloy without cobalt: is that possible?

About four years ago, the independent German research institute Access e.V. invited Oerlikon to participate in a funded, Europe-wide research project initiated by the German Federal Ministry of Education and Research. The project, NADEA — Nano-scale Duplex High Entropy Alloys Produced by Additive Manufacturing — aimed to develop a cobalt-free HEA (based on an Al-Cr-Fe-Ni alloy). It was prototyped

for applications in highly demanding industries, to optimize its additive manufacturing process, and to characterize it against duplex steels.

"Together with the colleagues from Oerlikon Metco, we cover the entire process chain, from powder atomization to process development and even designing and printing the impellers," says Dr. Evirgen, who led the NADEA

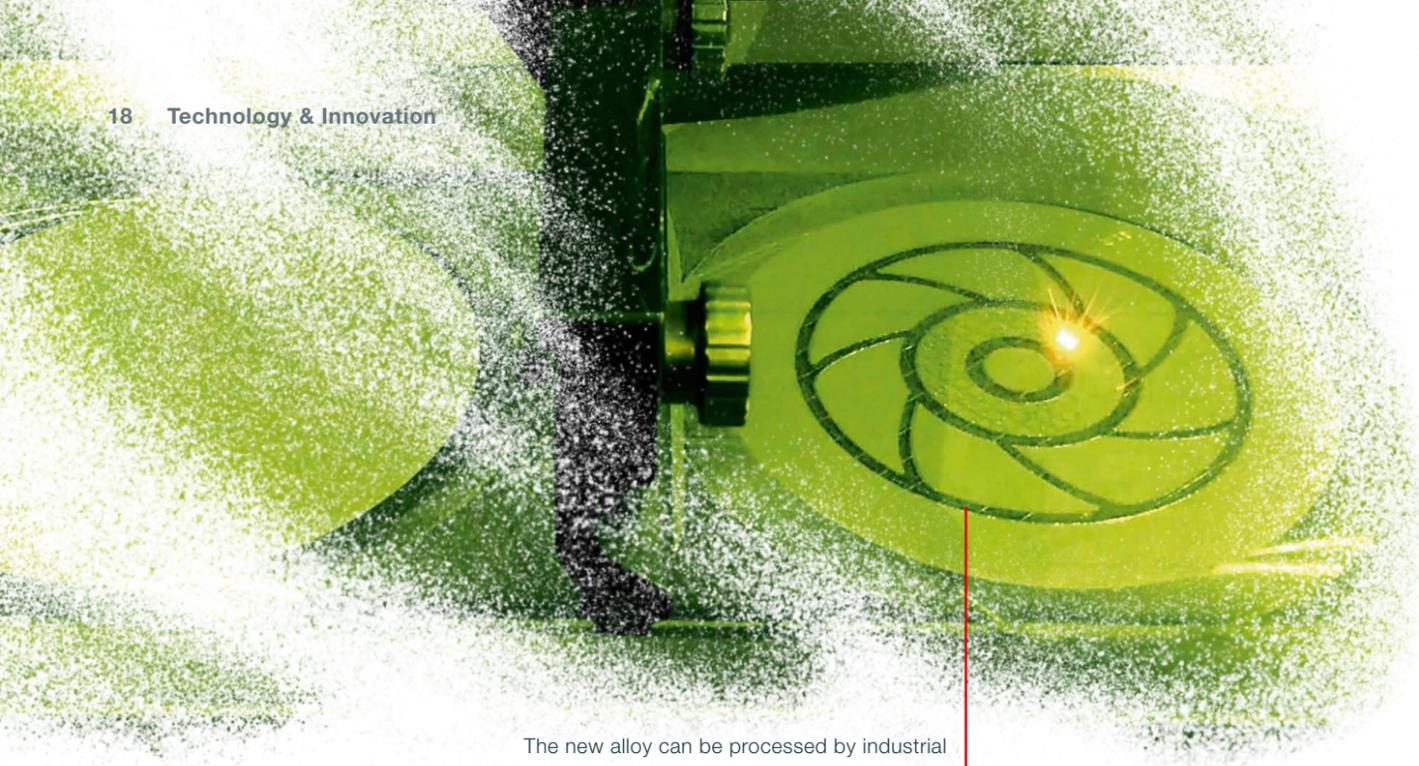
project at Oerlikon AM. For the alloy development, Oerlikon's scientists fine-tuned the material composition to optimize the processability of the material microstructure design. The second step encompassed the development of the process parameters and research on the optimal material response, which is dependent on the relationship between the materials microstructure and the properties. →

"Together with the colleagues from Oerlikon Metco, we cover the entire process chain, from powder atomization to process development and even designing and printing the impellers."

Dr. Alper Evirgen,
Senior Materials Scientist, Oerlikon AM

The new metal powder enables additive manufacturing of impellers, for example.





The new alloy can be processed by industrial printers without preheating the base plate.

Chemistry simulation with Scoperta Rapid Alloy Development process

After initial research, the Oerlikon team focused on optimizing processability of the novel alloy through metallurgical design of the baseline alloy. “We used Oerlikon’s proprietary Scoperta™ Rapid Alloy Development tool to simulate the effect of chemistry on solidification. Based on the results, we modified the baseline alloy composition. The approach was validated first via printing trials using blended powder with selected compositions and afterward using prealloyed powder atomized by Oerlikon Metco. Mechanical test coupons were successfully manufactured and the test results showed that the newly developed alloy exhibited improved properties as compared to conventional duplex steels,” says Dimitrios Vogiatzief, who is writing his doctoral thesis at Oerlikon AM as part of this project.

Combining the advantages of materials know-how and AM

Project leader Dr. Alper Evirgen is very pleased with the findings during the project, which was completed in July: “We developed a novel HEA material with ultrafine nanoscale duplex microstructure and improved mechanical properties that can be tailored via heat treatments. The alloy is processable using industrial printers without the need of baseplate heating. We developed the know-how and the technology to atomize such powder together with the colleagues from Oerlikon Metco and optimized the parameter window to process such alloys with high density.”

As a result, the team designed and successfully printed demonstrator components via Laser Powder Bed Fusion (LPBF). “The possibilities of the additive manufacturing process allowed us to redesign the demonstrator impeller. This saved

even more weight — on top to the savings achieved through the new material. To sum it up, we combined Oerlikon’s know-how as a materials specialist with the advantages of additive manufacturing, which is the biggest success in this project,” says Dimitrios Vogiatzief.

NADEA Project Partners

- › Access e. V.
- › Fraunhofer ILT
- › Oerlikon AM Europe GmbH
- › Otto Junker GmbH
- › AGH University of Science and Technology, Krakow
- › Technion Israel Institute of Technology
- › KU Leuven

EXPANSION INTO THE LUXURY GOODS MARKET: OERLIKON ACQUIRED COEURDOR

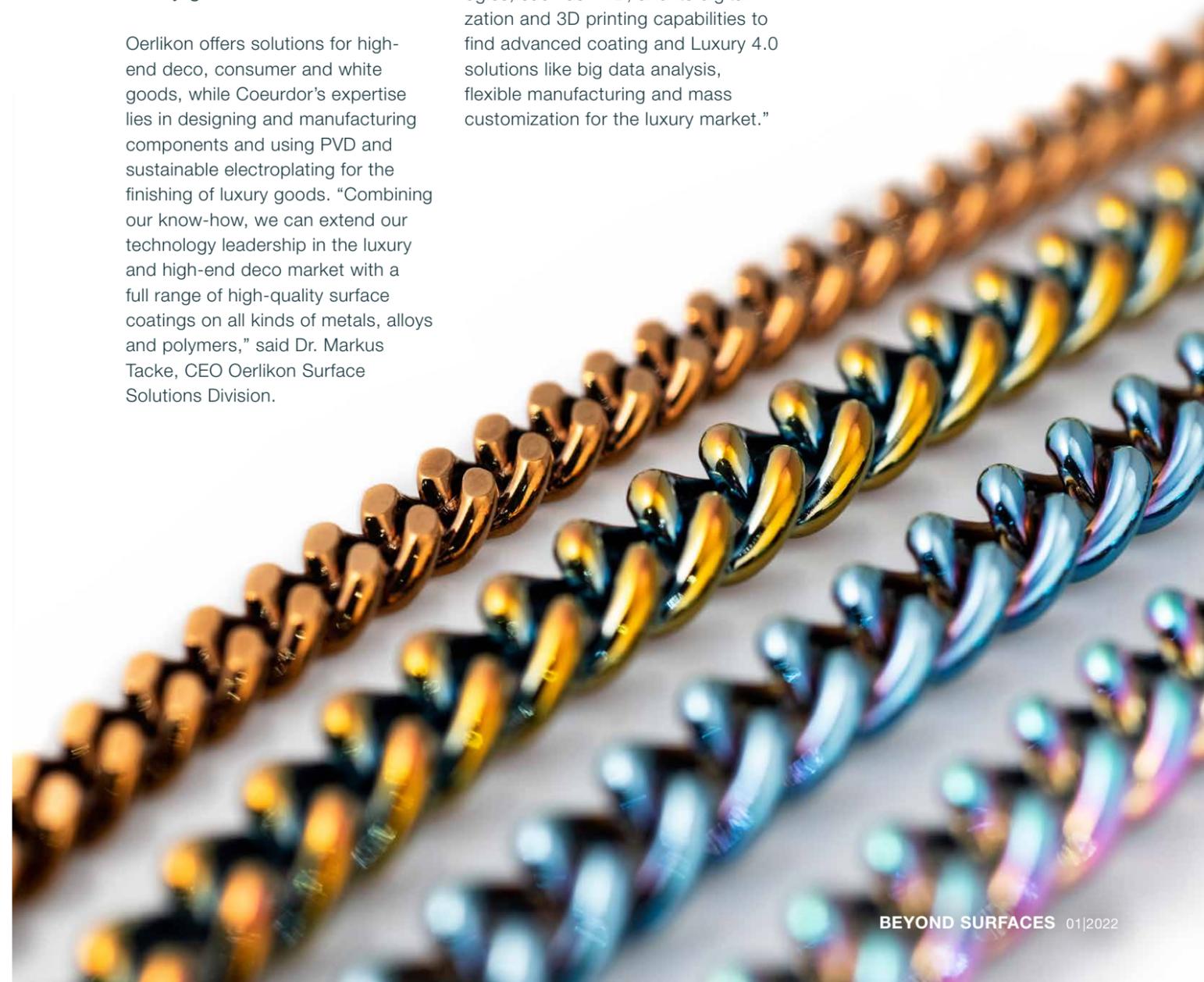
In June 2021, Oerlikon acquired Coeurdor, a **full-service provider for the design, manufacture and coating of metallic components to world-leading luxury brands**. Coeurdor’s accessories form parts of leather bags, belts, watches, and other luxury goods.

Oerlikon offers solutions for high-end deco, consumer and white goods, while Coeurdor’s expertise lies in designing and manufacturing components and using PVD and sustainable electroplating for the finishing of luxury goods. “Combining our know-how, we can extend our technology leadership in the luxury and high-end deco market with a full range of high-quality surface coatings on all kinds of metals, alloys and polymers,” said Dr. Markus Tacke, CEO Oerlikon Surface Solutions Division.

“As a family business built on a strong tradition of fine craftsmanship, meticulous work and rigorous quality assurance, this is an excellent next step for Coeurdor to expand globally,” said Robert Jeambrun, General Manager of Coeurdor. “As an Oerlikon company, we can gain access to other segments of the luxury goods market worldwide. We also see huge potential in using Oerlikon’s leading surface technologies, such as PVD, and its digitalization and 3D printing capabilities to find advanced coating and Luxury 4.0 solutions like big data analysis, flexible manufacturing and mass customization for the luxury market.”

Coeurdor is headquartered in France and has production facilities in Italy and Portugal, employing a skilled workforce of more than 220 employees.

More information:
www.coeurdor.com



ECOSYSTEM, COOPERATION, DATA

Additive Manufacturing's role in industrial production continues to evolve and to attract more advocates. In October, more than 3,000 participants gathered on-site and online to take part in the 3-day Advanced Manufacturing Technology Conference in Aachen.

C-level executives and experts from various industrial sectors

and research/education institutes concurred that AM's ability to transform manufacturing is no longer theoretical. The focus now is on how to scale up in ways that ensure quality, repeatability and traceability. Ecosystem, cooperation, data and value were terms discussed frequently, and while players in today's AM world seek ways to scale up and define value, researchers

continue to push the bounds of what is possible.

The Conference was organized by Oerlikon, co-hosted by the RWTH Aachen University and the TUM Technical University of Munich, and co-sponsored by 32 partners.

Read the full article and learn more about the AMTC on www.amtc.community

"Has Covid-19 killed off industry interest in AM? Absolutely not! We've seen a slowdown in the last 2 years, but you can see very clearly from the panel discussions and sessions that companies remain committed to investing to accelerate AM adoption and innovation."

Cindy Koh,
Singapore Economic
Development Board

"I think we are about to enter a new stage in the industrialization of AM. A conference like this, driven by the industry, shows the true commitment among leading companies. They are serious about using AM for industrial production, and that requires industrializing this technology fully and on a wide scale."

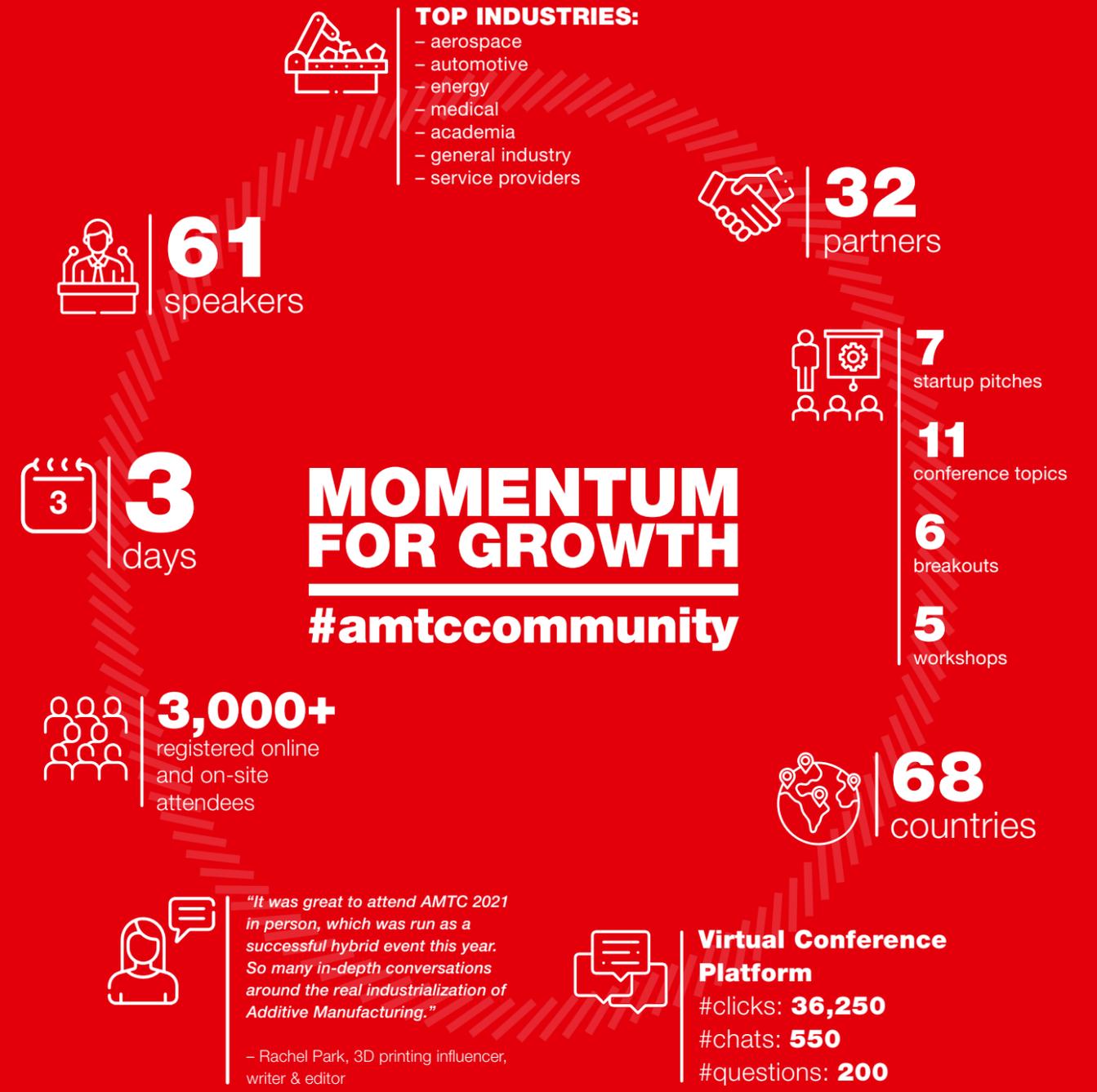
Klas Boivie,
SINTEF Manufacturing

"Digitization and data hold great potential for the AM industry. I see two areas in particular: On the one hand, companies could and should use data to plan their production. On the other hand, it's about using data during production, for example, to understand exactly what's happening during the process, why one part turns out well but another doesn't. Business intelligence and manufacturing intelligence: these are the two areas where I see great potential."

Caroline Albert,
nebumind

The most influential C-level event on Additive Manufacturing

Advanced Manufacturing
Technology Conference
Hybrid event - Virtual // Aachen, Germany
October 12-14, 2021



MOMENTUM FOR GROWTH

In advance of the AMTC in Aachen, **Prof. Dr. Michael Süß**, Chairman of the Board of Directors, Oerlikon, and **Dr. Sven Hicken**, Head of Additive Manufacturing and CTO of the Surface Solutions Division at Oerlikon, published a paper on the **six elements that the AM industry will need to address** to leverage its growth momentum. Oerlikon and its partners have been particularly focused on this thesis topic from the very start. In several discussion rounds, experts commented on each thesis covered in the paper.

Download the ATMC 2021 Thesis Paper and watch the videos here:
www.amtc.community/amtc/en

SIX THESES THAT THE AM INDUSTRY NEEDS TO ADDRESS



Involve experienced AM specialists in the product development process as early as possible.



Adjust university curricula to better educate engineers on the potential of AM.



Further develop today's versions of the 3D printer.



Accelerate the industrialization by defining mandatory standards.



Establish a dedicated AM association to represent the interests of all members of the AM community.



Engage in comprehensive interdisciplinary collaboration with end-to-end consideration of all workflows in the AM process.

“We are implementing different courses in mechanical engineering on sustainability in production engineering and how to build up sustainable production lines. **To bring together AM and sustainability could be one key for ‘greener’ production processes.**”

Prof. Katrin Wudy, TU Munich



“What we look for is making sure that what we do adds value. Getting our teams incorporated into the product development teams, so that we can find those situations where additive manufacturing will add value. **We’re not just looking to optimize parts, but we’re searching for opportunities where AM can be used to optimize the whole product** — in our case, for Boeing vehicles. So it’s not about making parts, it’s about using AM to create a differentiating vehicle.”

Dr. Melissa Orme, Boeing

“When we talk about interdisciplinary collaboration, I think we need three things to accelerate the industrialization of AM: **a democratization of IP, so that we can work together and innovate freely; sharing of knowledge and empirical data; and connectivity.**”

Dr. Vino Suntharakumaran, DMG MORI Additive



Watch the videos here:



Prof. Katrin Wudy
youtu.be/Dua6F0MfzVA



Dr. Melissa Orme
youtu.be/RQfM1vzertU



Dr. Vino Suntharakumaran
youtu.be/XoVDxqEMKPI



Dr. Ali Forsyth,
Co-founder and CEO of
Alloy Enterprises, pitches
on the ATMC stage to
industry executives.

Oerlikon AM Start-up Night

Together with the venture capital companies Freigeist Capital and AM Ventures as well as the two start-up centers – UnternehmerTUM and RWTH Innovations – **Oerlikon hosted the 2nd AM Start-up Night in Aachen as part of the AMTC.**

“The Start-up Night opens up access to new ideas for founders and investors. The exchange about trends and solutions is vital in this dynamic and innovative industry. And it’s all about business matchmaking: start-ups pitch to

potential investors on stage and as part of a ‘speed dating’ event, at the highest C-level and expert level. That’s unique,” says Christian Häcker, Head of Technology and Operations and Managing Director of Oerlikon AM Europe.



Amnovis, Belgium: High-end products for regulated and high-tech industries

“The timing of the event is perfect for us after our founding in June last year, right at the beginning of the pandemic in Europe. We want to innovate as a contract manufacturer and bridge the gap between innovative new AM technology and the products for quality critical applications, e. g. in the medical sector.”

Dr. Ruben Wauthle
www.amnovis.com



Sintratec, Switzerland: SLS 3D printing systems for prototyping, production and research

“We got in touch with companies and people we might not have had access to otherwise, or not so easily, and gained some valuable contacts who were interested in our machines and solutions.”

Dominik Solenicki
www.sintratec.com



Graphmatech, Sweden: inventing, developing and selling graphene-based materials

“The event is a great opportunity to learn about the latest trends, challenges, and competitive solutions and to expand our network. Our goal for next year: to present Graphmatech to the audience as a pitch on stage!”

Bernhard Münzing
www.graphmatech.com



DyeMansion, Germany: Industrial finishing solutions for additive manufactured polymer parts

“You won’t find such a high-quality audience at any other AM event in this concentration: of all the conversations I had, just one would have been worth coming here!”

Felix Ewald
www.dyemansion.com

SEARCHING FOR THE FUTURE WORLD MARKET LEADER

Frank Thelen is a serial entrepreneur, technology investor, TV personality and author, and he is convinced that **additive manufacturing** is going to fundamentally change the world of industry: “The question is only exactly when that will take place.” In the meantime, he is searching for AM start-ups — and is quite choosy. In fact, he’s looking for nothing less than the next (first?) European AM unicorn*.

by Agnes Zeiner

Frank, what’s your connection to additive manufacturing?

At Freigeist, we want to help develop outstanding companies that have their roots in Europe. We’ve defined a “construction kit for the future” to assist in this and want to bring bright minds and their ideas together with the necessary capital. We’re convinced that AM represents a revolution that, while it may be just starting now, will totally change industry in ten years. It’s similar to the Internet where you knew: This is going to change our world — but no one could predict just exactly how.

Where does Freigeist find its investments?

We have experts for all of the areas we have defined in our “construction kit for the future” and we cooperate closely with universities. This means we can identify relevant topics and start-ups very early on.

Do you already have AM start-ups in the Freigeist portfolio?

We invest in start-ups that are still in the early phase, so this would be the venture capital area. A second focus is our equity fund 10xDNA with which we invest in up-and-coming companies that are already listed on the stock

exchange. Unfortunately, we haven’t found the right investment yet in the area of AM for either category.

Why not?

In spite of several meetings with European start-ups, we haven’t found a good match yet. We have high expectations. For an investment, both the team and the phase through which the start-up is currently moving need to be just right. The technology also needs to be scalable so that a multi-billion euro company can result from it.

What advantages do tech start-ups have over established (industrial) enterprises?

When an industrial sector is radically changed by a technology, companies must react with agility. Large, established companies often find this difficult: They are unable to part with their core business and consequently do not invest enough in the paradigm shift. A good example is the automotive sector and electromobility.

Young, new players, on the other hand, are able to fully concentrate on the new technology with no regard for legacy “dead wood”. They also have a different mindset. For them it’s: “Do or die” — they have no alternative other

than to take the initiative and go all in with innovation.

How can start-ups and industrial companies get together and how can established enterprises foster start-ups?

There is no other way: start-ups and industrial companies must get together! As far as the acquisition of start-ups by established companies is concerned, China and the USA are ahead of us. Here in Europe, and especially in the DACH region, companies often suffer from the “not-invented-here” syndrome — they try too hard to be innovative themselves instead of taking over promising start-ups.

If a takeover occurs or a cooperation is established, the partners must each be able to act on an equal footing. That also means accepting that the start-up is better at its business than the concern that seeks to foster or acquire it. And: The DNA of a start-up must not be destroyed through the integration process, because if the leading thinkers become frustrated and leave the company, both sides lose.

Thank you for your time.

Personal details:

Frank Thelen started his first (of seven to date) company in 1994. Today, with his venture capital firm Freigeist, he invests in European tech start-ups. He is known to a broader audience as one of the judges and investors in the German television show “Die Höhle der Löwen” (“The Lions’ Den”) 2014 to 2020.

Official websites:

frank.io

freigeist.com

10xdna.com

* A unicorn refers to a start-up company that is valued at more than 1 billion US dollars. One of the unicorns with the highest valuation is Elon Musk’s SpaceX.



SIX-FOLD INCREASE IN PRODUCTIVITY

Tier 1 supplier UNIPRES presses sheet metal for automotive manufacturers and specializes in high-strength steel pressing, tailored blank welding and hot pressing technology to make components lighter and safer. With **BALINIT FORMERA**, the company was able to achieve a six-fold increase in productivity in the forming of demanding ultra-high-strength steels.

by Konrad Saal

The market demands ever lighter, but at the same time more robust, vehicles to meet stringent CO₂ emissions and passenger safety regulations. Thus, many new models contain a larger amount of modern, ultra-high-strength steel (UHSS).

UHSS meets these demands, but is very difficult to process, meaning that tool service life is shorter and consequently that productivity is lower and costs are higher. As a result, tools used in forming UHSS components need surface solutions that offer even higher performance to guarantee high quality and productivity in these demanding applications.

High scrap rate after 100,000 strokes

Unipres has high-output 3,000-tonne transfer presses and state-of-the-art hot press machines to ensure it has a wide range of ways to meet its customers' ever-changing demands. Unipres states: "The quick onset of wear reduced the service life of our tools, thus producing a high scrap rate after 100,000 strokes with a CVD-coated die, which heavily impaired our productivity."

Stoppages in production had a domino effect: production costs and material losses due to the scrap rate increased, which in turn meant overall component manufacturing costs grew high enough to become a financial burden and reduced overall efficiency.

1 million strokes and the tools are still in operation

BALINIT FORMERA is an especially durable coating from Oerlikon Balzers that can withstand the demands of UHSS forming applications. "When we spoke to Andrew Murray, Product Manager for metal forming tools, it was immediately clear that he had a wealth of experience and expertise, and we knew that BALINIT FORMERA would be the best solution for our

applications. We tested lots of different coatings, but none came near the performance of BALINIT FORMERA. The coating from our previous provider lasted 120,000 strokes. Since we started deep drawing with BALINIT FORMERA we have nearly reached 1 million strokes, and our tools are still in operation. This coating from Oerlikon Balzers has hugely increased our productivity," says the expert from Unipres.

Less preventive maintenance needed

Product manager Andrew Murray is happy for his client: "Our solution hasn't just made the tools used

by Unipres last six times longer; it has also reduced the preventive maintenance frequency of the form tools significantly. This has also played a key role in increasing the company's efficiency."



"We tested lots of different coatings, **but none came near the performance of BALINIT FORMERA.**"



UNIPRES (UK), established in 1987 in Sunderland, UK, manufactures a range of press-formed body in white automotive components.

www.unipres.co.uk

AT YOUR SIDE

Even closer to our customers

1

BISINGEN, GERMANY: EPD COMPETENCE CENTER

At its new competence center in Bisingen, Germany, Oerlikon Balzers offers metallization of plastic parts with the environmentally friendly and sustainable ePD technology. Ideal for coating lightweight elements, ePD also offers innovative functions such as sensor transparency. Radar sensors, capacitive, smart or backlit control elements (individually or in combination with different functions) thus can be adapted and coated to the customer's individual design concept.

In Bisingen, Oerlikon Balzers offers serial coating of plastic components with a metallic look for the interior and exterior, such as exterior mirror caps, radiator grille, emblems, door handles, control knobs and trim strips. The fully integrable and automated production lines INUBIA I6 and I15, developed for large series, meet all REACH requirements in the end product as well as in the production process.



1 | Bisingen

2 | Balzers

3 | Bengaluru

3

BENGALURU, INDIA: SUMEBORE COATING SERVICES

Indian customers in the automotive industry now benefit from SUMEBore coating services at the new Oerlikon Metco coating service center in Bengaluru. The center focuses specifically on offering coating solutions for customers in the existing and emerging markets for high engine capacity motorbikes.

SUMEBore is Oerlikon's premium coating solution to protect engine cylinder bores. It addresses issues such as corrosion protection and wear reduction, decreases oil and fuel consumption, and improves engine performance. In the last couple of years, Oerlikon worked closely with Indian automotive OEMs to establish the SUMEBore coating.



2

75 YEARS OF OERLIKON BALZERS

75 years ago, an idea was born: to protect the surfaces of tools and components from long-term wear by applying coatings that don't just extend their service life but also enhance their performance. To that end a new business, the "Gerätebau-Anstalt" ("Equipment Engineering Institute") in Balzers, was founded by Professor Max Auwärter, Franz Josef II of Liechtenstein and the entrepreneur Emil G Bührlé.

They had a revolutionary plan to develop manufacturing processes for thin surface coatings and to construct the necessary equipment themselves in order to implement these processes on an industrial scale. As a result, the process and the equipment became a single unit for the first time and were offered and sold together.

Today, the former "Gerätebau-Anstalt" is called Oerlikon Balzers, operates over 110 customer centers in 36 countries across Europe, North and South America and Asia, has more than 1,300 coating systems in use and is part of the Surface Solutions Division of the Oerlikon Group. "From the beginning, our company philosophy has been to find solutions to questions the industry has often been unable to answer and to have the courage to turn ideas into reality," says Dr Wolfgang J Schmitz, Head of Business Unit Balzers Industrial Solutions.



Milestones:
www.oerlikon.com/balzers/history



cerlikon
balzers

cerlikon
metco

cerlikon
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