The thyssenkrupp Steel magazine
Issue 01/2024
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steel compact

Innovations for a sustainable future

How thyssenkrupp Steel is already developing solutions today for the challenges of tomorrow.

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Expansion of the production network:
Electric mobility in view

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Decarbonizing supply chains:
Siemens Energy leads the way

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thyssenkrupp

Solutions for tomorrow

The boffins at thyssenkrupp Steel are driving the development of new processes and products in various areas with creative approaches. A tour d'horizon of how innovations find their way into the steel industry.

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Fresh wind

The strategic partnership between thyssenkrupp Electrical Steel and Siemens Energy is entering its next phase. As part of an offshore project, the two companies are demonstrating how supply chains can be decarbonized.

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Protective melt

thyssenkrupp Steel is expanding its production capacities for zinc-magnesium products by adding new melt pots to FBA 6. The solar industry in particular stands to benefit from this.

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Thin and efficient

Non-grain-oriented electrical steel is indispensable for electric vehicles. Particularly efficient products are in greater demand here than ever before. This is especially true of 025-125Y420 – the new high-performance grade for electric motors.

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Credits

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thyssenkrupp Steel Europe AG
Kaiser-Wilhelm-Straße 100
D-47166 Duisburg

Telefon: +49 203 52-0
Telefax: +49 203 52-25102

Editorial staff:
Marcus van Marwick
(responsible in accordance with German Press Law)
Head of Communications

Christiane Hoch-Baumann
Strategy, Brand & Marketing Communications
(Editor-in-Chief)

Photographic department, layout and production:
achtung! Mary GmbH
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Please contact us to share your comments and suggestions: compact.tkse@thyssenkrupp.com

"We're seizing the initiative now, to remain a capable partner in the future."

Dr. Heike Denecke-Arnold,
COO thyssenkrupp Steel

Steel, as a fundamental industrial material, has been and continues to be a key indicator and marker of economic development. We are currently facing a period of economic weakness with stagnation this year and little hope for a sustained recovery. At the same time, our analyses indicate that we are experiencing long-term structural changes within our markets, along with a challenging regulatory framework. In light of these developments, we will be adjusting our production capacity to shipments of 9 to 9.5 million metric tons in order to remain competitive in Germany. This roughly equates to the average shipping level that our customers have called from us over the past three years. This represents a decrease of approximately 2 to 2.5 million metric tons from the already installed total production capacity, which is underutilized. We are seizing the initiative now, to remain a capable and reliable partner for our customers in the future. We will keep you informed about the details of our reorganization.

Irrespective of this, we will continue to push through the investments as part of our existing Strategy 20-30, so as to be able to offer you the premium portfolio you need for your markets in the future. This package of measures, currently in the final stages with the conversion of our Duisburg casting rolling line, remains the right course of action.

Our commitment to the green transformation is equally unwavering. At our Duisburg site, we are building one of the biggest green steel factories in Europe. Just over one year has passed since the contract for the construction of our first direct reduction plant in Duisburg was awarded – and a lot has happened since then. In summer 2023, after achieving a decisive milestone with our receipt of the funding decision from the regional and national governments, we were granted approval by the district council in Düsseldorf to begin construction in early 2024. The first foundations for our direct reduction plant are currently being laid on the construction site, which is the size of 40 soccer pitches. We have also initiated a call for tenders to supply hydrogen to the direct reduction plant, inked a green electricity agreement with RWE, and started a direct reduction test facility and a pilot melter to steadily advance our technological progress toward green steel.

In this issue, we report on the progress made in implementing the green transformation, our strategy and many other topics.

I wish you an interesting read.

Yours,

Heike Denecke-Arnold

Cover photo: Jennifer Chaaer | Photos page 2 – 3: Rainer Kaysers, Nils Röscher, Shutterstock, Full Frame Fotografie

Push boat fleet steers a climate-friendly course

thyssenkrupp Veerhaven, the Dutch logistics subsidiary of thyssenkrupp Steel, is planning to make its fleet climate-friendly. To this end, the company has commissioned two design offices to develop an environmentally friendly push boat that uses methanol instead of fossil diesel as fuel. In this way, CO2 emissions could be reduced by around 80%. In addition, the planned push boat is intended to be optimized for shallow waters so that it can also navigate rivers with low water levels during dry periods. thyssenkrupp Veerhaven transports around 18 million metric tons of raw materials between Europoort Rotterdam and the Ruhr area every year.

Photo: Norbert Kolster

Steel News

Personnel

Philipp Conze is the new CFO at Steel

On March 1, 2024, Philipp Conze was appointed the new Chief Financial Officer (CFO) of thyssenkrupp Steel Europe AG. The business graduate has held various management positions in Controlling at the thyssenkrupp Group since 2012, most recently from 2020 to 2024 as CFO of the globally operating Rothe Erde Group.

thyssenkrupp Steel – on all channels!

Always keep up with the latest information and trends in the steel sector by following us on our social media channels.

Product

patinax®: weather-resistant structural steels

Durable, sustainable, appealing: weather-resistant structural steels of the patinax® brand are perfect for structural elements in landscaping, bridges, lighting and electricity poles or exterior facades. patinax® is particularly resistant to atmospheric corrosion thanks to its special surface alloy of copper, chromium, nickel and phosphorus. The self-formed natural, firmly adhering rust layer not only protects, but also lends it a distinctive appearance that is in line with design trends. patinax® is available as a hot-rolled wide strip and also as a cut-to-length sheet.

More about patinax®:
https://www.thyssenkrupp-steel.com/en/patinax/

Transformation

DR plant: the next construction phase gets underway

Work on the major construction site for the first direct reduction plant at thyssenkrupp Steel in Duisburg is proceeding apace, and is on schedule. Another major contract has been awarded recently, namely for the second construction stage, placed with the Mainka building company. Over the next few months, the main foundations for the entire plant complex will now be poured and buildings erected. Supplier of the process and plant technology for climate-friendly steel production in Duisburg is the SMS group from Düsseldorf.

More about the green transformation:
www.thyssenkrupp-steel.com/climate_strategy/

Product

galfan®: convincing coating

Zinc-aluminium-coated steels from the galfan® brand are not only characterized by their excellent formability – they are also particularly corrosion-resistant and appeal to customers across the board in direct comparison with conventional hot-dip galvanizing. The coating consists of around 5% aluminum and 95% zinc, and is used for structural components in the automotive sector, among other things. However, galfan® is also ideal for wiper motor and oil filter housings, or refrigerators and washing machine claddings. galfan® is available for a wide range of steels.

More information on the current product range:
https://www.thyssenkrupp-steel.com/en/product-range/

Product

pladur® Aesthetic: innovative alternative

pladur® Aesthetic is redefining innovation in the field of organic coil-coated quality flat steels, and perfectly complements the existing portfolio of the pladur® product family.

With its unique ability to imitate long-wave surface structures, it sets new standards and easily replaces elaborate enameled surfaces. Not only does this help reduce customers' energy and cost burdens, it also makes an important contribution to sustainability by reducing the carbon footprint. pladur® Aesthetic offers impressive and brilliant color fastness, and a high gloss level. The remarkable chemical resistance and excellent formability set new standards. Compared to similar products on the market, pladur® Aesthetic scores points above all with its superior technical processing properties.

More about pladur® Aesthetic:
https://www.thyssenkrupp-steel.com/en/pladur-aesthetic/

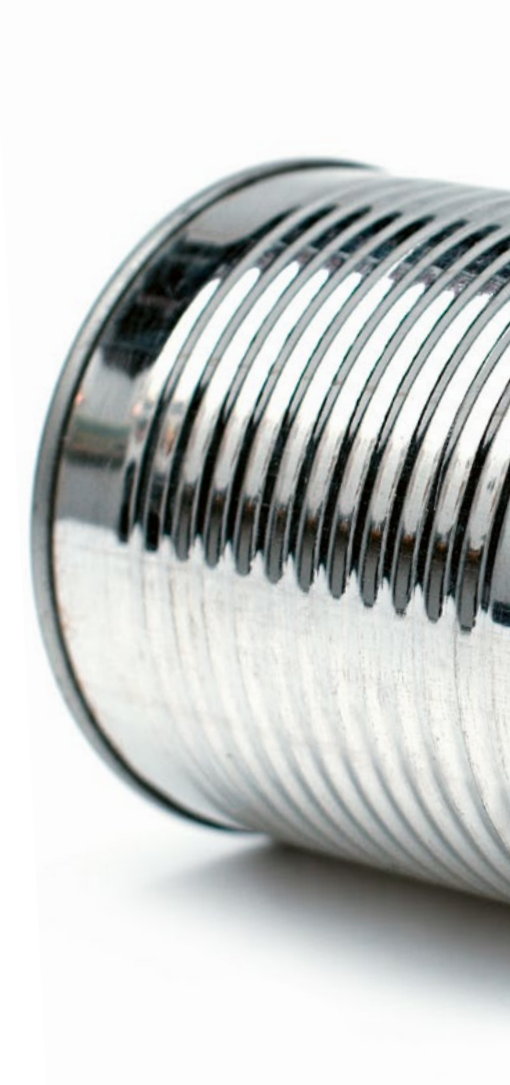
Recycling management

Recycling rate: tin plate remains at the top

According to the German Federal Environment Agency (UBA), tin plate remains at the top of the recycling-rate table. With a rate of over 90% in Germany and 78.5% in the EU, tin plate is setting standards for recycling management. Its material properties enable an efficient recycling process without any loss of quality. This makes the material a pioneer in terms of sustainability and resource conservation.

Specifically, tin plate can be almost 100% recycled in a closed material cycle, time and time again. Thanks to its magnetic properties, it is particularly easy to separate from other materials, which makes sorting the packaging quick, easy and cost-effective.

More on the sustainability of packaging steel:
www.thyssenkrupp-steel.com/en/packaging-steel/sustainability/



Photos: thyssenkrupp, thyssenkrupp Steel

Transformation

Contracts concluded for hydrogen infrastructure and supply

By 2028, thyssenkrupp Steel will be connected to the hydrogen supply network of the GET H2 initiative, and thus become part of the planned German hydrogen core network. The hydrogen economy in North Rhine-Westphalia and Germany is thus taking on a more concrete form. The pipelines will link the Duisburg-Walsum site with the GET H2 network and the Dutch import routes via the Vlieghuis border crossing. The GET H2 pipeline coming from Lingen will be extended via a new 40-kilometer pipeline from Dorsten to Duisburg-Walsum, and connect the steel mill. To this end, existing pipelines are being converted to transport hydrogen. The contractual partners in the supply network are thyssenkrupp Steel Nowega, Open Grid Europe and Thyssengas.

In order to be able to operate the direct reduction plant with electrically powered melter partly on hydrogen from 2028 as part of the tkH2Steel® decarbonization project, thyssenkrupp Steel published a call for tenders on various national and EU portals in early2024 for the amounts of hydrogen needed. It is aimed at all potential suppliers which have production projects for renewable green or CO_2-reduced blue hydrogen with the ability to deliver to Duisburg. The aim is to have the direct reduction plant operating fully on hydrogen by as early as 2029. The first use of hydrogen is planned for 2028, when the ramp-up to full hydrogen operation will begin. The use of around 143,000 metric tons of hydrogen (equivalent to 5.6 terawatt hours) will enable up to 3.5 million metric tons of CO_2 to be saved per year.

Meanwhile, part of the future green electricity supply for the plant complex has already been secured: thyssenkrupp Steel has signed a long-term contract with RWE to supply around 110 GWh of green electricity per year. The electricity will be generated at RWE's Kaskasi offshore wind farm, 35 kilometers off the coast of Heligoland. Offshore wind energy will thus make a significant contribution to the energy supply for the tkH2Steel® transformation project. Additional contracts with green electricity producers will be required to fully supply the system with green electricity.

Transformation

Contract awarded: DR and melter test facilities for research

Hydrogen-based direct reduction in combination with melters is an innovative approach that thyssenkrupp Steel is implementing on a large industrial scale for the first time – making it all the more important to test and apply various technologies on a smaller scale along the way. For this reason, a direct reduction and a melter test facility are currently being built in Duisburg. Among other things, the plants are used to research how different input materials such as pellets (photo) behave in the climate-neutral production of sponge iron and are then liquefied and further processed into pig iron.

The installations have a capacity of 100 kg/h of directly reduced iron, and can reproduce different direct reduction processes. Research will focus on CO_2 reduction, product quality and findings on plant handling and safety. The slag from the melter will also serve as a basic material for manufacturing cement, which is otherwise tricky to decarbonize. The first campaigns are scheduled to take place in the test facilities from 2026 onward.

Interview

4 questions to …

Christian Kuhn

Technical Project Management Direct Reduction Plant

Mr. Kuhn, about a year ago, thyssenkrupp Steel awarded the contract to build the first hydrogen-powered direct reduction plant to the SMS group. What has happened since then?

We have taken further important steps over recent months: following the EU Commission's approval under state aid provisions, the German Federal Minister for Economic Affairs Robert Habeck presented us with a funding decision from the national and state governments amounting to around two billion euros in July 2023. This seed funding will support the ramp-up of the European hydrogen economy. At the beginning of 2024, the Düsseldorf district government then granted us approval to make an early start on construction, meaning that the building work has already got underway.

The economic environment is challenging, and the steel market is also weakening. How do you deal with these uncertainties?

It's true, we are in a harsh environment. Nevertheless, we are sticking to our goal of building one of the largest green steel factories in Europe in Duisburg. With innovative technology and a highly motivated team. At the beginning of the year, the first 16 of our trainees passed the examination for a newly developed additional qualification in hydrogen technology. We are also actively preparing colleagues in various functions for the future of climate-neutral steel production.

Thinking about the future: you don't produce sustainable steel as an end in itself – what can customers expect in concrete terms?

It is particularly important to know that we can already produce 2.3 million metric tons of hot metal in a climate-friendly way with the new DR plant complex. In this way, we can guarantee sustainable steel of proven quality, because all the steps in the process from the steel mill onward remain in place, and our customers will continue to receive the full range of grades and products.

What does the green transformation mean to you personally?

Working as a project manager responsible for the major tkH2Steel® project and accompanying the green transformation process is a very exciting challenge and a great privilege. In less than a decade, an industry with over 200 years of history will have completely reinvented itself, transitioning its entire production to a new technological foundation. This not only establishes a new business model but also makes a significant contribution to climate change mitigation, and ensures a hydrogen ramp-up in Germany at the same time.

Christian Kuhn has been involved right from the start in the project to build the first direct reduction plant at thyssenkrupp Steel in Duisburg.

Photos: Rainer Kaysers, blutsbruder

Wafer-thin and highly efficient

When it comes to electric mobility, thyssenkrupp Steel supports its customers with its customary expertise. This applies to both products and plants: in addition to new high-performance grades of **non-grain-oriented electrical steel** under the **powercore® traction NGO** brand, the modernized production network is being supplemented by a new slitting line in Motta Visconti, Italy.

Text Jan Ritterbach

The new slitting line in Motta Visconti is primarily designed to slit very demanding, particularly thin electrical steel starting from a thickness of 0.2 millimeters.

Just as the goal in professional sport is always "higher, faster, further", the motto in the development of non-oriented (NO) electrical steel is "thinner, stronger, more efficient". The innovative materials marketed by thyssenkrupp Steel under the powercore® traction NGO brand name are indispensable for the construction of electric motors for electric vehicles in particular, and have a direct influence on the efficiency of a drive unit.

025-125Y420 sets new standards

"One of the key yardsticks for us is the hysteresis loss," explains Miguel Arrabal Lopez, head of the NO business sector at thyssenkrupp Steel. Put simply, this technical term expresses how much energy is lost on the way from the battery cell to the power transmission of a vehicle due to the electrical steel used. The lower the hysteresis loss, the higher the efficiency of an electric vehicle. It can then drive more miles on one battery charge, or the battery capacity can be reduced while maintaining the same range. This reduces the weight of the battery and therefore of the vehicle, as well as the production costs for automotive manufacturers. thyssenkrupp Steel is aware of the special requirements of its automotive customers and is therefore pushing ahead with the development of particularly high-performance materials. With the new 025-125Y420 grade, the steelmaker recently launched a material just 0.25 millimeters thick that sets new standards in terms of efficiency. The maximum hysteresis loss of this new grade is only 12.5 watts per kilogram (at 400 Hz and 1 T).

Full focus on electric mobility

Not only is the hysteresis loss of the new grade particularly low, the development time was also

Miguel Arrabal Lopez, head of the NO Electrical Steel business sector at thyssenkrupp Steel, emphasizes the importance of completing the investment and developing top grades at the right time.

Photos: Full Frame Photography, Jennifer Chaaer, Rainer Kaysers

The new line is part of thyssenkrupp Steel's investment in electric mobility, and enables high-efficiency electrical steel to be processed for the automotive industry.

exceptionally short – a particularly important factor in view of the high dynamics in the field of electric mobility. Miguel Arrabal Lopez: "Our electric mobility business is a top priority for us. For this reason, and with the aim of offering our customers the right products at the right time, we have focused our available resources on developing the new grade, significantly reducing the development time."

With 025-125Y420, thyssenkrupp Steel is the first European manufacturer to move into the range of top grades for high-volume series production. "This is something we are proud of," says Miguel Arrabal Lopez. Taking a holistic view of electric mobility, thyssenkrupp Steel is developing important market impulses and the necessary products to offer automotive customers optimum solutions on the way to electrifying their fleets. This also includes reducing the carbon footprint with the help of non-grain-oriented top grades from the bluemint® Steel brand. "We are particularly well placed here because our plants will enable us to produce the crude steel for our top grades without CO_2, and without having to compromise on the properties required by our customers. This is far from being the case with all our competitors," explains Miguel Arrabal Lopez.

With an eye on new requirements

Another important step towards supporting customers in all areas of electric mobility is the gradual modernization of thyssenkrupp Steel's production network. The latest example is the newly installed slitting line in Motta Visconti, Italy, which went into operation at the end of 2023. The investment was necessary to cope with the ever thinner electrical steel strips and changes in their chemical composition. For example, advanced adhesive and insulating coatings on the steel strips require special processing. "For us at Motta Visconti, the aim was to equip and design the line in such a way that, among other things, the adhesive coatings on the steels would not be removed by the rolls of the slitting lines, thus preserving the properties of the adhesive coating," explains Roberto Briano, Managing Director of thyssenkrupp Electrical Steel Italia. From now on, the line can reliably process even the thinnest materials with highly challenging coatings. This is something that thyssenkrupp Steel believes will become increasingly important for OEMs in the future.

Sees the investments as an important step to support customers on the road to electric mobility: Roberto Briano, Managing Director of thyssenkrupp Electrical Steel Italia.

Market expansion in southern Europe

"After Germany, Italy is the most important market for electrical steel in the EU. By investing in a new slitting line for thin and high-performance electrical steel grades at the Motta Visconti site, we are strengthening our market presence not only in Southern Europe but also in the strategically important growth market of electric mobility," says Simon Stephan, Senior Vice President Sales Automotive.

The new line can slit up to 500 meters of material per minute and is designed to process very demanding, particularly thin NO electrical steel starting at a thickness of 0.2 millimeters: the material will later be used in high-performance traction motors for electric vehicles. The line features a state-of-the-art laser-controlled thickness and width measuring unit, and a component for cutting products with particularly sensitive coatings such as adhesive and insulating varnishes.

Web

For more information about high-performance powercore® traction electrical steel:
www.thyssenkrupp-steel.com/en/powercore-traction-ngo-025/

Contact

Miguel Arrabal Lopez, Head of the NO Electrical Steel business sector, miguel.arrabal@steeleurope.com

Material concepts for the mobility of tomorrow

Electric vehicles are a crucial part of the **mobility revolution** – and are increasingly shaping road traffic. thyssenkrupp Steel offers innovative concepts and key materials to drive this **future market** forward.

Text Jan Ritterbach

It is clear that the design and construction of electric vehicles opens up new possibilities. After all, what has long been considered irrefutable with regard to the body and chassis of vehicles with the classic internal combustion engine is quite different with electric vehicles. "Manufacturers have more design freedom with the elimination of the combustion engine, transmission, fuel tank, and exhaust system, but this also necessitates adjustments to the crash concepts," says Clemens Latuske from the Application Concepts department at thyssenkrupp Steel. This mainly affects the energy-absorbing zones in the front area.

At the same time, the high weight of the battery cells used in the center of the vehicle's floor – weighing up to 800 kilograms – increases the stress on the bodywork in the event of an accident. The consumer industries have new requirements that material suppliers must meet as a result of this. For example, through concepts for economical lightweighting solutions for the vehicle structure and for highly robust and safe battery housings. The latter ensure that electric vehicles achieve the same level of safety as conventional vehicles.

"The primary purpose of a vehicle's safety concept has been to safeguard the occupants. Now, protection of the traction battery is also gaining priority," adds Andreas Breidenbach, also from the Application Concepts department. In the event of a crash, for example, only much smaller deformations of the car side walls are permissible.

Photos: Jennifer Chaaer

Thomas Böttcher (left), Andreas Breidenbach (right) and Clemens Latuske (center) discuss the mobility concepts of the future. The selectrify® reference structure in the background.

Virtual reference structures show the way

"We have been continuously developing our virtual reference structure selectrify®, which we first presented in 2019, to offer our customers the best possible support when choosing materials. We can use simulations to show which strengths and breaking strains we need where in the body and chassis of an electric vehicle," explains Breidenbach.

selectrify® is a digital image of a standard European compact-class vehicle model. An SUV reference structure is now also available for customer projects as an expansion to the range, with larger vehicles in mind. This was developed in close cooperation with Tagal, thyssenkrupp Steel's Chinese joint venture.

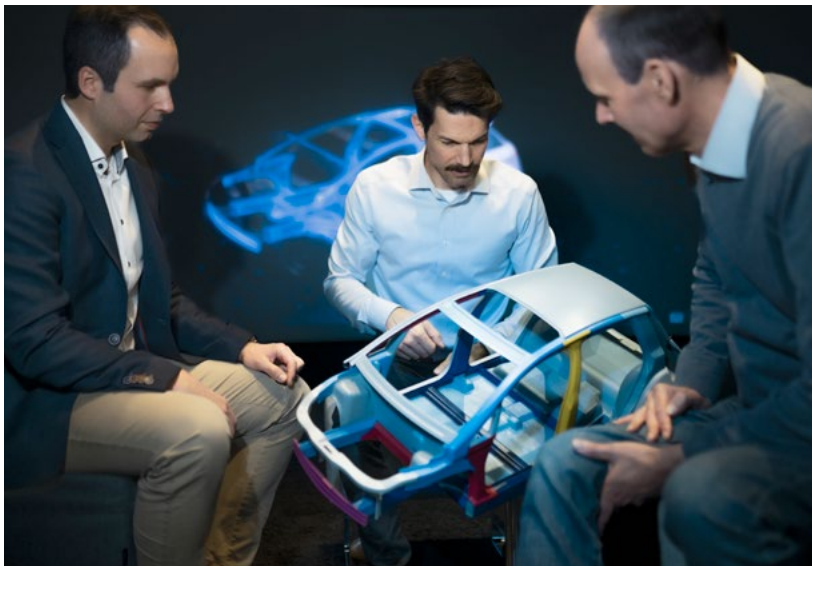
New steels for new requirements

At the same time, thyssenkrupp Steel is developing numerous new materials for a wide range of requirements. For example, ultra-high-strength, cold-formable dual-phase steels and manganese-boron steels of the MBW® brand for hot forming in strength classes from 1,200 megapascals, with increased ductility up to 1,900 megapascals with the innovative AS Pro coating for the highest strength requirements. They offer high lightweight construction potential for safety-relevant structural components in electric vehicles, and can be formed extremely effectively despite their high final strength. The new, high-strength, hot-rolled multiphase steel CH-W® 700Y950T with a strength of 1,000 megapascals and optimized hole expansion is ideally suited for the chassis area. In addition to a significant weight reduction, the grade also offers high fatigue strength for complex components such as single-skin control arms. Also ideal for use in bumpers: The high strength with fracture strain reserves ensures a significant resistance to deformation – which in turn delivers the required high crash energy absorption.

Component reduction as a goal

In addition, in terms of materials, thyssenkrupp Steel also supports its customers when it comes to electric mobility, as a consultant for efficient production. Reducing the number of components is an increasingly important issue in the automotive industry. In contrast to large-scale casting processes, in which entire areas – such as the rear end of vehicle – are manufactured from a single piece of material, the steel supplier aims to combine several components.

The basic idea is to join steel blanks of different grades, thicknesses and surfaces by laser welding, spot welding or gluing. The resulting complex component is then formed into the desired body part. Latuske: "By saving material, customers are able to reduce the working weight and also minimize production steps, resulting in cost savings. It is also possible to customize properties of the components using this process, such as making them especially stable in areas where the highest loads are to be anticipated in the event of a crash." In return, weight can be saved elsewhere by using thinner material. And: in a direct comparison with the large-scale casting process, component integration scores points for greater sustainability – thanks to CO_2-reduced steel and reduced material input weight. Thomas Böttcher, head of Application Concepts, sums it up like this: "Steel-based body concepts consistently demonstrate exceptional performance in terms of cost-effectiveness, lightweighting, and carbon footprint. Taking into account our material portfolio, which is also available across the board as bluemint® Steel, we see steel as the basic material for the green mobility of the future."



A case for the experts: in addition to protecting the occupants, protecting the battery cells is now a new challenge for the bodies of electric vehicles.

Web

More information about selectrify®:
www.thyssenkrupp-steel.com/en/reference-structure/

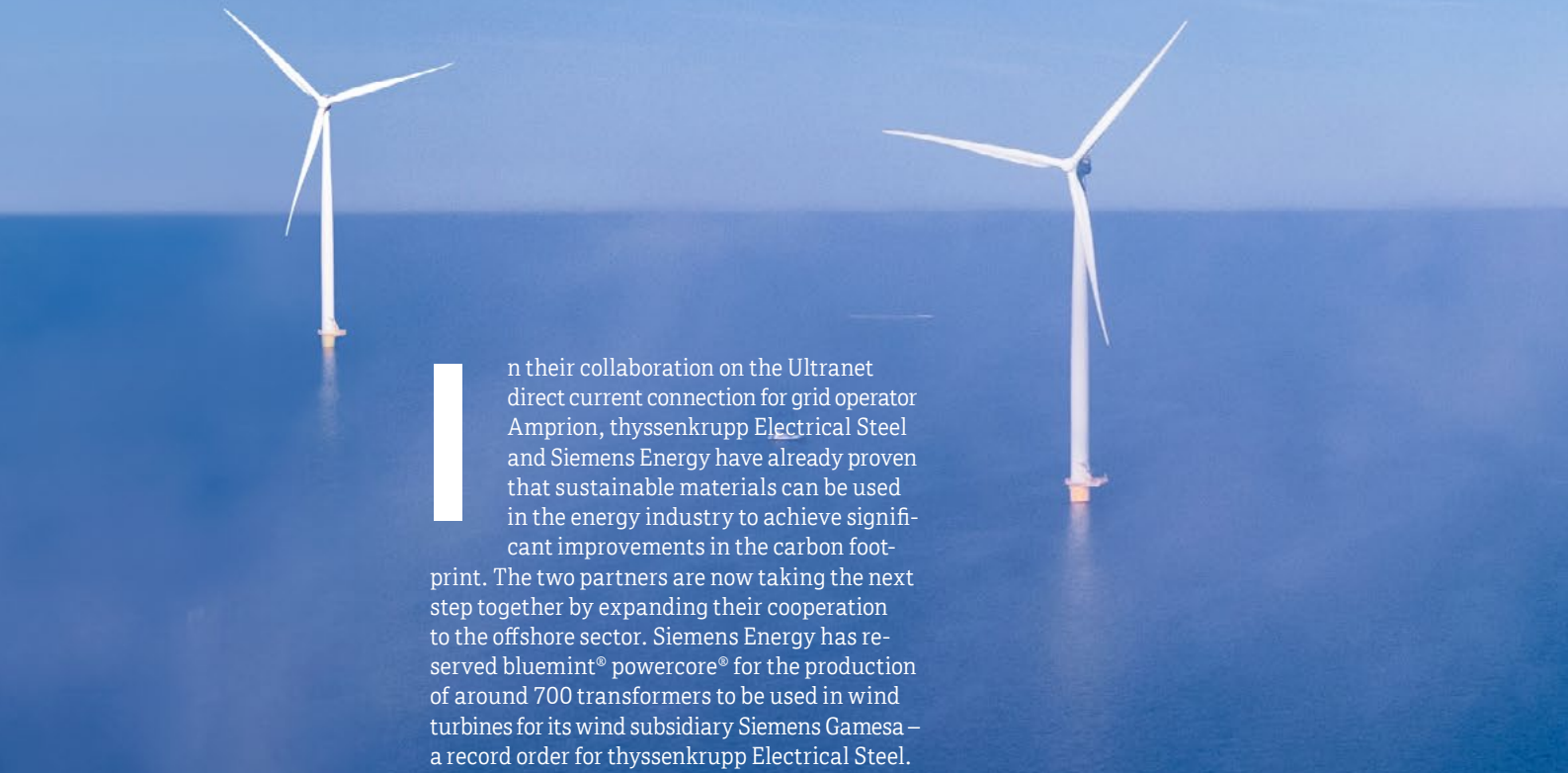
Contact

Thomas Böttcher, Head of Application Concepts,
thomas.boettcher@thyssenkrupp.com

A breath of fresh air for Europe's energy turnaround

The strategic partnership between thyssenkrupp Electrical Steel and Siemens Energy is entering its next phase. As part of an offshore wind turbine project for the wind subsidiary Siemens Gamesa, the two companies are demonstrating how **supply chains can be decarbonized** in the international energy industry.

Text Jan Ritterbach



In their collaboration on the Ultranet direct current connection for grid operator Amprion, thyssenkrupp Electrical Steel and Siemens Energy have already proven that sustainable materials can be used in the energy industry to achieve significant improvements in the carbon footprint. The two partners are now taking the next step together by expanding their cooperation to the offshore sector. Siemens Energy has reserved bluemint® powercore® for the production of around 700 transformers to be used in wind turbines for its wind subsidiary Siemens Gamesa – a record order for thyssenkrupp Electrical Steel.

The strategy of Siemens Energy: The company already wants to secure sufficient quantities of greener steel now, so that it will have suitable materials on hand for future energy turnaround projects. In doing so, Siemens Energy is laying the foundations and thus making a significant contribution to the ongoing expansion of the renewable energy grid and other EU measures – such as the Net Zero Industry Act. This provisional agreement provides for a simplified framework for investments in the sustainable energy infrastructure in Europe, among other things. Experts expect that this will additionally drive the already high demand for sustainable materials in Europe.

Scope 3 emissions reduced

In recent years, thyssenkrupp Electrical Steel has established itself as a key technology partner in security of supply for the European energy sector – especially when it comes to CO_2-reduced grain-oriented electrical steel. "The material is indispensable for producing the highly efficient transformer cores that make it possible to increase the voltage of the electricity," explains Marcel Hilgers, Sales Manager at thyssenkrupp Electrical Steel. Only in this way can the energy be fed into local power grids via high-voltage lines or underground cables with minimal losses.

Photos: Shutterstock

thyssenkrupp Electrical Steel is already supplying its customers with an up to 50% CO_2-reduced steel product-based on alternative feedstocks in the manufacturing process, which is now also being used in Siemens Gamesa's offshore plants. "Siemens Energy and Siemens Gamesa attach great importance to sustainability in their supply chain. The collaboration with thyssenkrupp Electrical Steel is therefore an important step towards decarbonizing our entire value chain. The partnership will help us and our customers to achieve decisive progress in reducing Scope 3 emissions," explains Christina Iosifidou, head of Sustainability Grid Technologies at Siemens Energy.

The onshore and offshore experts

Siemens Gamesa Renewable Energy is one of the international market leaders in the wind energy sector: the company has been designing and installing onshore and offshore wind turbines for more than 40 years now, and has already installed more than 137 gigawatts of output worldwide. Siemens Gamesa also offers a wide range of services, including maintenance and servicing. The company's registered office and global headquarters are located in the Spanish city of Zamudio. The company is represented in more than 90 countries and employs around 29,000 people.

Milestone for green markets

The cooperation represents a win-win situation for climate change mitigation in Europe: in future, even more renewable electricity will be generated in offshore wind farms, while the use of bluemint® powercore® will also reduce the carbon footprint of the transformers in the wind turbines. Together, Siemens Energy and thyssenkrupp Electrical Steel are thus contributing to the decarbonization of the value chain in the energy industry. "The current project is a milestone in our strategic partnership and a role model for how to establish green markets," says Georgios Giovanakis, CEO of thyssenkrupp Electrical Steel.

To this end, the two companies are already cooperating to work on further applications for bluemint® powercore® electrical steel as well as on joint concepts. When it comes to improving grid technology products in particular, both companies see themselves as enablers of the green transformation, with the goal of steadily advancing decarbonization in their industries. Marcel Hilgers: "We are facing a huge grid expansion, for which enormous resources will be required. Offering and providing these in a sustainable, green and resilient way – thyssenkrupp Electrical Steel and Siemens Energy are jointly committed to this task."

Web

More about bluemint® steel:
www.bluemint-steel.com

Contact

Marcel Hilgers, Head of Customers, Markets & Technology,
marcel.hilgers@steeleurope.com

The flaw in the "Yellow Bin" system

How the tin plate industry is currently cross-financing the recycling of plastic packaging. An op-ed by Dr. Peter Biele, CEO of thyssenkrupp Rasselstein.

France does it, Italy does it and so does Belgium: these countries consistently implement the principle of cost allocation according to the polluter-pays principle when it comes to recycling packaging materials. It goes without saying that this approach should also be adopted in Germany. Or rather, it should be once again. Because, as one of history's little ironies, the principle was applied when packaging recycling started in Germany, but has since been neglected over time.

The intention behind the "Yellow Recycling Bin" system is simple: according to packaging legislation in Germany, manufacturers and distributors of packaging are obliged to ensure that their packaging is disposed of properly at the end of its useful life, and returned to the material cycle wherever possible – this is known as extended producer responsibility. The dual systems help to fulfill this obligation. The quantities of packaging placed on the market must be registered with a dual system. Depending on the packaging material, participation fees must then be paid for the financing of collection, sorting and recycling. It would be logical to distribute the costs according to the polluter-pays principle: packaging that is easy and inexpensive to collect, sort and recycle should be assessed with lower participation fees and vice versa. But the reality in Germany is different: although tin plate is responsible for significantly lower costs in the overall recycling process than other material fractions, the participation fees are almost the same. The "Yellow Recycling Bin" system therefore clearly favors plastic packaging over tin plate.

The proportion of costs attributable to tin plate for collection, sorting and recycling amounts to just 2% of the total costs of the system. At the same time, it makes up around 10% of the total packaging volume and also contributes to the financing of the system to roughly the same extent. This is reversed in the case of plastics: a 50% mass share accounts for 74% of total costs. While the costs of the participation fees for plastic packaging fell significantly between 2003 and 2022, distributors of tin plate are now paying well north of twice the amount. This amounts to cross-subsidization of plastic recycling and plastic packaging by the tin plate industry.

We need a clear legal framework to bring the system back into balance. Distributors of packaging materials should bear their actual costs. This could restore fair competition between the materials, and allow tin plate to develop its full potential as a packaging material. That is because high recycling rates over many years and high recyclability of almost 100% without any reduction in quality make tin plate ideal for precisely this purpose.

Photos: Rainer Kaysers

Criticizes the current design of the "Yellow Recycling Bin" system: Dr. Peter Biele, CEO of thyssenkrupp Rasselstein.

Contact

Dr. Peter Biele, CEO of thyssenkrupp Rasselstein,
peter.biele@thyssenkrupp.com

The stuff of winners

Using high-formability tin plate from thyssenkrupp Rasselstein, packaging specialist xtracan produces revolutionary **monobloc aerosol cans.** The company received the prestigious international "Can of the Year" award for an aerosol can that serves as a fire extinguisher for the end consumer.

Text Jan Ritterbach

The Baden-Württemberg-based company received the Gold Award in the Aerosols category at the awards ceremony held during the annual Canmaker Summit in Edinburgh at the end of 2023. The award not only honors the performance of the product presented – it also takes into account the unique process for manufacturing the compact 0.5 liter fire extinguishing container, which comprises just a single piece.

A standard tin plate aerosol can is made from three separate parts: lid, body and base. Seams are created where the different elements are joined together. For its pressurized fire extinguishing agent container, txtracan took a different approach in the production of the winning can at its facility in Neuhausen ob Eck on Lake Constance. The result: the only Drawn and Wall Ironed (DWI) monobloc steel can in the world.

Highly complex production process

When manufacturing fire extinguishing containers for its British customer Zenova, the company uses a process that is unique in the world for tin plate: in many highly complex process steps, a customized monobloc container is manufactured from thyssenkrupp Rasselstein material at the Neuhausen plant – out of a single piece without any seams (see info box).

Why? "Containers designed for specific purposes often need to meet strict stability standards when it comes to handling high internal pressures," explains Frank Elberskirch from Technical Customer Service at Rasselstein. "The Can of the Year award proves how attractive, stable and efficient our customer's monobloc solution for aerosol cans is. We are all the more delighted that our Materials Technology experts played a significant role in developing the material for the product." High-formability tin plate is used because only this grade can be processed perfectly on the line.

Awards give you wings: materials consultant and supplier thyssenkrupp Rasselstein and packaging specialist xtracan intend to continue working on joint projects in the future. The monobloc containers from xtracan will be suitable for filling with all goods, such as cosmetics and household products.

Quality from a single piece

How a monobloc aerosol can is made:

In a first step, xtracan deep-draws a cup from tin plate on a line supplied by the machine manufacturer Mall & Herlan. This moves on to what is called the body maker, where it is deep-drawn and stretched into a cylinder in a complex forming process. In a subsequent process, the can is transferred to the integrated decoration unit with internal coating and printing machine in order to create the individual look desired by the customer. Finally, the cylinder opening is narrowed and brought into the correct shape by repeated pressing and compressing, known as necking.

Web

More information about the packaging steel from Rasselstein:
www.thyssenkrupp-steel.com/en/packaging-steel/

Contact

Frank Elberskirch, Technical Customer Consulting,
frank.elberskirch@thyssenkrupp.com

Photos: Jennifer Chaaer

Innovation journey of ideas: developing what will come tomorrow

Photos: Rainer Kaysers

"We've never done that before." What sharpens the spirit of research in product and process developers sets alarm bells ringing elsewhere in the industrial value chain: after all processes are good when they run smoothly. How innovations nevertheless find their way into the steel industry.

Text Katja Marx

Innovation begins in the mind – and so it was with Marina Do Carmo Carias. The engineer comes from Minas Gerais in Brazil, a region characterized by mining. "When you grow up here, it's natural to be interested in iron ore in some way. For example, the question of how it is used. Or how to ensure that existing reserves last for a long time," explains the 33-year-old.

Marina Do Carmo Carias enrolled in a technical course to gain a thorough understanding of the properties of ores. And the deeper she delved into the matter, the more specific her questions became. Which parameters influence the quality of the reducing agents in the blast furnace? What advantages are offered by modern processes such as the briquetting of coal blends? She discovered the answers during internships in the mining and steel industry, and through research projects at different universities. Since November 2022, the doctoral student has been working in the laboratory of the Metallurgy Competence Center at thyssenkrupp Steel to develop a new generation of iron ore pellets. They are intended to be suitable for use in the hydrogen-powered direct reduction plant, which is due to enter operation in 2027 (see info box).

A change with many consequences

This example shows how complex industrial innovations can be: if a manufacturing process changes, numerous small and large adjustments become necessary. Raw materials are not left out of the equation either. "For several hundred years, we have been perfecting and advancing coal-based steel production," says Dr. Matthias Weinberg, Head of the Metallurgy Competence Center in Duisburg. "There were three drivers of innovation in particular. They are meant to improve product quality, save costs or protect the environment." The result: processes in the steel industry have become increasingly efficient, systems more powerful and the materials produced more specific.

The jetQ® 980 and jetQ® 1180 multiphase steels which thyssenkrupp Steel has been marketing worldwide together with the Japanese manufacturer JFE Steel Corporation since 2023 show that technological development has also repeatedly resulted in new products (see info box on page 25). "In 2009, I discovered a newly patented process in a trade journal, and that's where it all began," explains Dr. Richard Thiessen, who is responsible for the Multiphase Steels focus segment at thyssenkrupp Steel. "By utilizing a unique heat treatment process, it was stated that two material properties that are typically considered to be mutually exclusive could be combined effectively: tensile strength and ductility. That sounded very promising." The product development team leader at the time recognized the potential: such a material would be ideal for use in crash-relevant vehicle parts, such as longitudinal members or B-pillars. This is because these components must, on the one hand, offer high strength and, on the other, good forming behavior without which the complex geometries cannot be produced in the first place.

The decision to test and further develop the heat treatment process for large-scale industrial applications was prompted by this idea. The work was carried out as part of a European funding project, and in collaboration with other steel manufacturers and research partners. A long road had to be traveled before the first laboratory tests could be derived from the initial basic research. And, it took even longer before the new steel was ready for its first trials in operation and for test runs with automotive customers. In the case of jetQ®, continuous investment in modern system technologies ultimately delivered the decisive breakthrough: "Since 2014, we have been aware of the market trends in the automotive industry and have consistently updated our FBA 7 in Bochum to align with the specific heating and cooling processes required for the production of our latest Advanced High Strength Steels (AHHS) grades," explains Richard Thiessen.

Innovative processes: Hydrogen pellets

What is it about? In contrast to blast furnaces, direct reduction (DR) plants are not operated with sinter, but with iron ore pellets – porous pellets up to 19 millimeters in diameter that are made from fine ores and have a high iron content. As there is little experience to date with hydrogen-powered direct reduction plants, it is unclear which properties of pellets will optimize the reduction process. Knowing this will be important for thyssenkrupp Steel, since the company will purchase around 3.5 million metric tons of iron carriers annually for the first DR plant alone. The better these react, the more efficient the system will be.

That is the status: Various pellet compositions are being tested and evaluated in the newly established agglomeration lab. In future, it will also be possible to test the quality of the pellets in the company's own test laboratory. At the same time, thyssenkrupp Steel is looking for partners to refine and manufacture the newly developed pellets.

Core team:

- **Marina Do Carmo Carias,** Reduction Metallurgy Engineer
- **Bartosz Smaha,** Reduction Metallurgy Team Leader
- **Dr. Alexandra Hirsch,** Ore & Iron Technology Team Coordinator

Interdisciplinary networking between research, teaching and business: Prof. Dr. Jutta Lommatzsch, Dean of the Department of Economics at the Ruhr West University of Applied Sciences, Niels Lohmeyer (left), Head of Innovation, and Dr. Matthias Weinberg, Head of the Metallurgy Competence Center, talk about this issue.

Photos: Rainer Kaysers

Innovation drivers in transition

The steel industry is one of the most innovative sectors in Germany – thyssenkrupp Steel alone holds around 2,250 patents. It is important to have the associated marketing rights for products and manufacturing processes in order to recoup the high development costs. But what happens if the economic benefit calculation does not pan out? When the drivers of innovation are not customers or costs, but social change?

"Attitudes to entrepreneurial success have undergone a dramatic shift in just a few years," says Prof. Dr. Jutta Lommatzsch, Dean of the Department of Economics at the Ruhr West University of Applied Sciences. "In Europe, we have experienced the consequences of large-scale global supply bottlenecks, and have been forced to accept that energy can become a scarce commodity from one day to the next. At the same time, many people have become more aware of climate change. Consequently, a new rationale has emerged due to the shift to renewable energies and the imperative to cut CO_2 emissions."

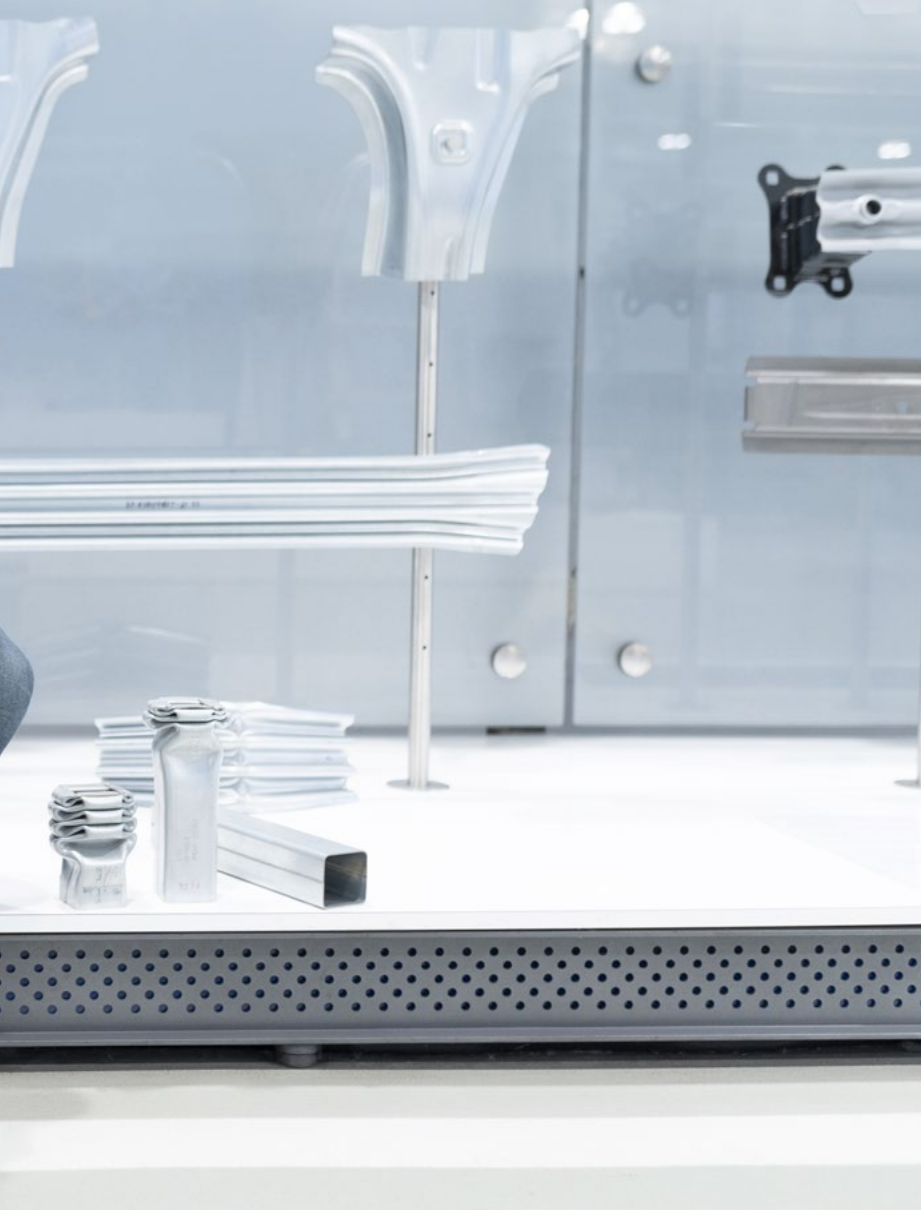
One of the beacons of hope: green steel. This is because not only can the material be recycled as often as required and thus kept within the cycle, it can also be produced in a carbon-neutral way by innovative processes. The high-tech material also enables further innovations in the downstream value chain. On the one hand, it will help the motors used in the latest generation of electric vehicles to employ green electricity particularly efficiently. On the other hand, it will ensure that precisely this green electricity can be generated with low losses. At the same time, steel ensures that the wind turbines that will be required near our coasts in the future are well protected against corrosion and premature material fatigue, despite adverse environmental conditions. However, a look into the carbon-neutral future also shows: various product and process innovations will have to be linked together for the vision of a green European continent to become a reality.

thyssenkrupp Steel currently holds

2.254

patents

Photos: Jennifer Chaaer



Dr. Richard Thiessen from the Development & Market Launch team helped develop jetQ® until it was ready for series production.

That development partnerships are also a question of the right timing sounds banal, but it is not. Product developer Richard Thiessen knows the dilemma: "If you share an idea too early, it is more difficult to present its strong points, because individual aspects might not yet have been sufficiently tested. If you share it too late, in the worst case you might not have taken a key requirement into account." In the case of jetQ®, the team decided after many internal discussions to involve key customers in product development at an early stage. At thyssenkrupp Steel, this approach is now regarded as a blueprint for customer-oriented innovation pathways. The idea: customer feedback should be taken into account during all phases of the structured process. Steel processing companies can smoothly integrate new products or processes into their existing operations with this procedure.

Forging new alliances

Constant innovation will be required for companies to master this complex task and compete for new markets. New alliances will also be needed. "We require research partnerships that unite specialists whose paths would not typically cross," says Niels Lohmeyer, Head of Innovation at thyssenkrupp Steel. "For years, this networking has been advancing, especially in the field of industrial research. The Rhine-Ruhr region is a hub of innovation, with small and large companies, research institutes, and universities already collaborating closely over an extended period of time. Almost any issue can benefit from the expertise of a specialist."

The innovators in the Research and Development departments at thyssenkrupp Steel are also densely networked: The primary goal of the product-oriented teams is to engage in an exchange of ideas with Sales and customers, while the process-oriented innovation team led by Matthias Weinberg cooperates with Production and partners in the upstream stages of the value chain.

thyssenkrupp Steel has

1.800

different steel grades

in its portfolio

Marina Do Carmo Carias is already working on the new generation of iron ore pellets that will in future be suitable for use in the hydrogen-powered direct reduction plant.

Putting together the right teams

However, it is not only external partnerships that foster success. For Niels Lohmeyer and Matthias Weinberg, innovation managers have a crucial responsibility to assemble teams with complementary mindsets, expertise, and skills: Creativity then meets implementation potential, while technical expertise encounters business acumen. Many people who deal with innovation at a company level know that such teams can develop a high degree of momentum.

Ideally, the prerequisites for this should already be created during training. Interdisciplinary approaches are therefore a top priority at the Ruhr West University of Applied Sciences. Professor Jutta Lommatzsch: "Our students are involved in overarching research projects right from the start. This gives them a feel for how innovations are driven forward. In parallel, we are committed to breaking down barriers and inhibitions in our interactions with other disciplines." To this end, the university has introduced a matrix structure: specific learning modules, such as from technical courses, are also taught in business subjects – and vice versa.

Innovators need to possess the crucial soft skill of being able to overcome barriers. After all, very few innovations go according to plan. The phase during which the transition from laboratory to industrial application takes place is proving to be a major challenge. This makes it all the

650 people

work in the Innovation functional area to ensure that products and processes are constantly evolving

Photos: Jennifer Chaaer

Patents were filed for

72

inventions

in the 2022/23 financial year

more important for teams to be able to recognize their own limits and seek outside help. "This is often one of the most difficult steps. Admitting that you are stuck at a certain point requires courage and openness," says Matthias Weinberg. He therefore advises managers to make sure they deal openly with mistakes themselves. And remain flexible. Niels Lohmeyer takes a similar view: "Today, the management style that we once experienced and internalized may no longer be effective. It is important to acknowledge that future generations have different working styles and expectations of management. Having this awareness is essential for anyone who wants to drive innovation forward."

Thinking ahead with developments

And this is also a characteristic of innovation: it is not a finished process, but a journey. And while the jetQ® team is already working on expanding the product family, Marina Do Carmo Carias is still at the beginning of a complex innovation process in the newly established laboratory. In the "Ore/Iron Technology" specialist team, colleagues compile information from the scientific literature. In parallel, the engineer sets up her own experiments. She tests, evaluates, winnows out. It is hard and painstaking work. But also a task that helps the metallurgy expert to put her wealth of knowledge to good use. This is because the better the pellet reacts with the hydrogen in the reduction process, the more efficient the new DR system will be. And that will do more than just save thyssenkrupp Steel money. It will also ensure that the valuable resource of iron ore can be used even more sustainably in the future.

Podcast

To the new episode of our podcast "Gekocht, gewalzt, veredelt" (Smelted, rolled, refined): Innovations – the future for Germany as an industrial location:

Spotify Podcast

Apple Podcast

Innovative products: taking the example of jetQ®

What is it about? Light weight, maximum crash safety – these are the properties that make steels attractive for automotive construction. High strength materials are needed to combine both, and they must still be easy to form so as to accommodate the geometrically complex components of the body structure. thyssenkrupp Steel has developed a new generation of multiphase steels (AHSS) through technical collaboration with the Japanese steel manufacturer JFE, using a new annealing process. jetQ® has a higher yield strength and higher toughness than other high-strength steels. The product also features a good balance between local and global formability.

This is the status: jetQ® 980 and jetQ® 1.180 were released for series production in 2023 as the first products in this family of grades. thyssenkrupp Steel and JFE are now working together on the further development of steel grades and new strengths.

Involved:

Around 50 internal and external partners were involved in turning the idea for a new steel product into a globally marketable material.

Web

More innovations can be found here:
www.thyssenkrupp-steel.com/en/innovations/

Contact

Niels Lohmeyer, Innovation Management,
niels.lohmeyer@thyssenkrupp.com

Dr. Matthias Weinberg, Head of Metallurgy Competence Center,
matthias.weinberg@thyssenkrupp.com

The forward thinkers

They recognize material trends and future technologies before others do. In the Innovation functional area, five specialist departments work across teams to develop and secure competitive solutions for the steel market.

Text Katja Marx

Development and Market Launch

"We are daring. But we aren't reckless."

"The day-to-day business in our division is to rethink products. We gather inspiration from the market, create solutions for our clients, and bring them to market readiness. We also support the introduction of new materials in our production and on-site at our customers' premises. We reorganized ourselves in 2023 in order to focus fully on these tasks.

Anyone who works in our team is a networker. We have a high proportion of female engineers compared to other technical departments. And we are also diverse in terms of our expertise. For each project, we work together with our colleagues from Product Development to find the right internal and external experts. Every task is different, but the path to the goal is clearly defined: once we have determined the direction of our journey and the production methods and properties that will define the new product, the actual development phase begins. This journey takes us from the laboratory to the first tests in the factory and ultimately to series production.

Convincing from technical and economic standpoints

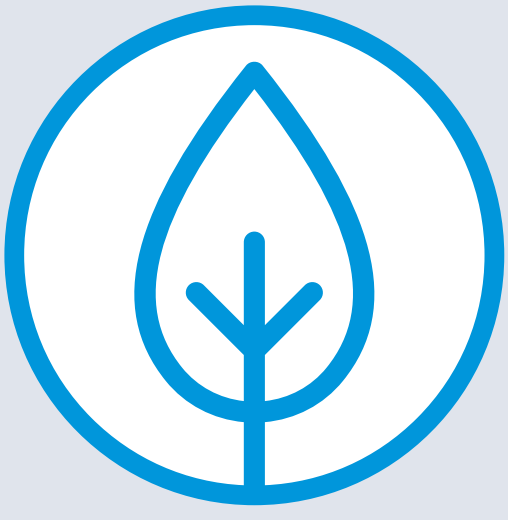
In each of our projects, there is a dual leadership consisting of technical and commercial management. This is important for making the right decisions in a complex innovation environment. Perhaps this is more true today than ever before, as the green transformation offers us huge opportunities. Our new systems demonstrate this, as they allow us to create not only different dimensions but also new material grades.

However, this also requires the power of persuasion, as every new idea is accompanied by the risk of disrupting established operational processes. Anyone working in product development must therefore accept that there are different perspectives on innovation, while still standing up for their own idea. The ability to anticipate and transform future trends into products that are relevant to the market is also crucial. We are helping to shape the future. It's sometimes strenuous, but it's worth staying on the ball."

Contact
Dr. Hans-Peter Schmitz,
Product Development ,
hans-peter.schmitz@thyssenkrupp.com

Application Technology

"We support customers in the green transformation"



Our Technical Center is buzzing with activity all day long, with melting, rolling, coating, forming and joining. But there are also the quieter areas where we produce benchmark analyses and trend studies, or prepare customer workshops. Our activities are focused on finding the best solutions for our customers: first of all, this means the characterization of new products and surfaces. We examine and describe in detail how our materials behave in the various processing stages. We also work directly for our customers, taking on material approvals or testing various application scenarios. Moreover, we conduct basic projects for the market launch. The three sub-areas often work together, with findings from product development, for example, directly impacting a current consulting project.

First-hand knowledge of customer processes

Our strength lies in identifying material concepts that fit perfectly into our customers' processes. Many of our employees know these processes at first hand. This helps us to exploit the potential of new materials. Thoroughly testing our products during the development phase also pays off, since it gives us a knowledge advantage of around five years when they are launched on the market.

At the moment, we are particularly concerned with the green transformation because it is generating a lot of pressure for change among our customers. With bluemint® Steel, we have introduced a convincing product on the market. Used in the right way, it allows us to save additional CO_2 in the subsequent processing stages. Consequently, in addition to analyzing the potential, we also offer decarbonization workshops in which we focus on specific customer hotspots and create comprehensive solutions – from the vehicle body concept to the casing of a heat pump."

Contact

Stefan Eiden,
Application Technology & Pilot Plants,
stefan.eiden@thyssenkrupp.com

Web

More information on Application Technology:
www.thyssenkrupp-steel.com/en/awt/

130

test facilities are used in Application Technology to determine the material properties of new products

Materials Testing

"We test to the standard. And find ways to analyze special cases."

If you observe how a hammer falls from a height of 20 meters onto a steel beam, you are probably in Materials Testing. Our drop tower is the largest experimental unit, most of them are much more compact. We determine the mechanical and technological parameters, identify microstructures and analyze surface coatings. Accredited release tests are also carried out around the clock for all the coils produced – in accordance with the applicable test standards in each country.

We also collaborate closely with other innovation areas, including Product Development and Application Technology. Our highly specialized materials testers and material scientists are the safest hands when it comes to even the most specific investigations into the properties of steels. To an increasing degree, we use artificial intelligence in image-based inspection processes, and we have already patented one of our own developments in this area.

Gradually adapting test procedures

Our mission? We make sure that our customers get the product they ordered. Part of our work also involves constantly adapting our test procedures to new products, requirements and market trends. For example, we are currently testing the corrosion resistance of steels that are used in solar supporting structures. We also need processes that deal with the effects of hydrogen on our steels, to take account of the transformation in the steel industry. In other words: there is a great deal of potential for innovation in our sector right now. To do this, we need people who pursue new market requirements with curiosity and further develop tried-and-tested processes."

Contact

Jörg Wehrstein,
Materials Testing,
joerg.wehrstein@thyssenkrupp.com

Web

More information on Materials Testing:
www.thyssenkrupp-steel.com/en/materials-testing/

Chemical Laboratories

"Analytics is constantly evolving."

When we show visitors around our chemical laboratories, many are surprised at how large the area is. We don't just examine bits of coal and ore, but everything that goes in and out of the mill: raw materials, products in various stages of production, by-products and residual materials, as well as wastewater and waste gases. Quality assurance and environmental protection play a key role here. Our analytical procedures are correspondingly diverse and complex.

Steel is a high-tech product. Many factors have to work together to ensure optimum quality. Analytical processes therefore always represent an opportunity to improve, optimize material properties and support the development of innovative products. Analytics itself also

Web

More information about Chemical Laboratories:
www.thyssenkrupp-steel.com/en/chemical-laboratories/

thrives on the fact that it is constantly undergoing change and adaptation. The earlier and more precisely we can assess the quality characteristics of a product, the better. Many years ago, for example, we developed a method to analyze the hydrogen sensitivity of our materials.

Becoming faster, more mobile, more digital

Time and costs are also important drivers of innovation. Ideally, the analysis will be sufficiently fast that it does not affect the process times. Automated laboratories, innovative rapid tests and mobile analysis methods provide support here. Our laboratories also utilize artificial intelligence, such as for identifying and eliminating paint defects on the finished coated strip. Accordingly, the digital skills of our employees are becoming increasingly important alongside their scientific specialization. What else do our people need? Curiosity and a desire to develop processes further. And they need to be very good listeners, because our internal and external customers bring highly diverse requirements to the table. As a partner to companies, we always strive to find the best solution."

Contact
Dr. Eckard Pappert,
Chemical Laboratories,
eckhard.pappert@thyssenkrupp.com

60.000

samples and analyses are evaluated by Chemical Laboratories every month, which also contributes to the quality assurance of new products

IP-Management

"Patents are an engine for technical progress"

Patents are basically a clever invention in themselves. They mean companies need to invest in research and development, and make their knowledge accessible, in order to ensure technical progress. Patent law rewards patent holders by allowing them to prohibit others from using their product or process for up to 20 years, or else to license it. In return, the patent applicant must describe its idea in detail, and it will be published 18 months after submission.

In the IP Management department, we support patent processes from the application through to enforcement of our license rights. We also keep an eye on market trends and new developments from our competitors. And we regularly encourage our technical experts to develop patentable ideas. A lot of detailed knowledge is needed to assess what is promising. Everyone in our team is therefore specialized in one area.

Securing unique selling points

In recent years, the main focus has been on the further development of our portfolio. We are currently in a new phase because of the green transformation. At thyssenkrupp Steel, we have chosen a technological path that provides us with the potential for numerous patents. With our help, almost 50 ideas relating to the green transformation have already been developed into patent applications, and filed.

This brings us to an ability that everyone in our department should have: staying power. Firstly, because the investigation procedures can sometimes take years. And secondly, because no one can predict how the market will develop in the future. Consequently, it takes a few years before we can know which patented solutions have established a unique selling point for us, and will ultimately contribute to our company's financial success."

Contact
Christine Groth,
IP-Management,
christine.groth@thyssenkrupp.com

Jennifer Schulz (Product Development) with her colleagues Andreas Martin (Team Leader FBA 6, left) and Arne Schreiber (Product Management), inspecting coated material in FBA 6.

Protective melt

thyssenkrupp Steel is expanding its production capacities for **zinc-magnesium products** by adding new melt pots to the hot-dip galvanizing line (FBA) 6. The **solar industry** in particular stands to benefit from this, because it requires high-quality coated steels for robust and long-lasting **supporting structures.**

Text Jan Ritterbach

Power squared: the two new melting furnaces in FBA 6 give thyssenkrupp Steel new possibilities in the coating of steel for the solar industry.

Photos: Rainer Kaysers

Twenty metric tons in weight, seven meters high and with enough space inside for 85 blocks of zinc-magnesium, each weighing 2,000 kilograms, stacked next to and on top of one another: the two new melt pots and melting furnaces of the hot-dip galvanizing line (FBA) 6 in Ferndorf in Germany's Siegerland region are huge systems for an equally huge growth market. It is about renewable energies and the European solar industry in particular. This is because the constantly growing number of photovoltaic (PV) surfaces in the open air require robust and corrosion-resistant supporting structures that are able to withstand different weather conditions effectively – and over very long periods of time: the average service life of a solar installation today is between 20 and 25 years.

Application thickness is reduced

Steel is increasingly establishing itself as the preferred material for economical and robust PV substructures – especially when it is coated with zinc-magnesium (ZM). Take for example ZM Ecoprotect® Solar from thyssenkrupp Steel, which offers a number of different advantages over conventional galvanizing. "Thanks to the additional magnesium, the thickness of the coating can be significantly reduced while offering the same level of corrosion protection, and even better protection on the cut edges and drilled holes," says Jennifer Schulz from Product Development for Surfaces at thyssenkrupp Steel. This makes the coating ideal for durable outdoor steel structures – and in greater demand than ever before in the context of the energy transition. FBA 5 in Eichen, which produces a broad portfolio of ZM-coated steels for

various industrial applications, is working flat out and is already no longer able to meet customer demand on its own.

New pots for more capacity

Since 2022, thyssenkrupp Steel has thus been investing millions of euros to gradually upgrade its production site in the Siegerland region. In addition to the new melt changing system, investments have been made in a new double chemcoater to improve the surface quality of the steel strips (see steel compact 2/23) and in the modernization and expansion of logistics areas. In one of the two new twin furnaces installed below the mill floor level, up to 170 metric tons of zinc-magnesium are liquefied at over 450 °C within just a few days. The resulting molten metal is then transported via a mobile pipeline to the hot-dip galvanizing line, where it serves as a bath for the starting material ordered by the customer. Passing the steel strip through the alloy creates particularly resistant and durable protective layers on the surfaces, which protect the material from corrosive atmospheres. All test runs were successful, making it clear that ZM coatings can also be produced on FBA 6 in proven thyssenkrupp quality.

Specialist institutes confirm performance

The excellent properties of ZM Ecoprotect® Solar are confirmed by the building regulations approval from the German Institute for Construction Technology (DIBt) and tests by the Karlsruhe Technologies Institute (KTI) – both of which are neutral bodies. For this purpose, cyclic corrosion tests – among other procedures – were carried out on the coated steels to demonstrate the good corrosion resistance of the coatings. Surface expert Jennifer Schulz also emphasizes the improved processing properties of the ZM coatings: "ZM-coated steels are excellently formable and particularly suitable for roll forming. Their surface is harder than that of zinc coatings, which means significantly less abrasion is generated in the die, and this in turn reduces wear on the tooling."

Looking to the future, further optimizations are planned for solar customers: In light of the recent investments in FBA 6, thyssenkrupp Steel will continuously expand the number of layer thicknesses and dimensions available in its ZM portfolio in 2024. This also applies to a wider assortment of ZM Ecoprotect® as CO_2-reduced ZM-coated bluemint® steel.

Web

More about ZM Ecoprotect® Solar:
https://www.thyssenkrupp-steel.com/en/solar

Contact

Arne Schreiber, Product Management,
arne.schreiber@thyssenkrupp.com

Three advantages of ZM Ecoprotect® Solar

How system manufacturers, profilers and system operators stand to benefit

Corrosion-resistant

Increased corrosion protection compared to conventional hot-dip galvanizing

Extremely weather-resistant

25-year warranty

Approved by the DIBt (German Institute for Construction Technology)

Reliable process

Extremely good formability

Less abrasion on the tooling

Economical alternative to batch galvanizing

Sustainable

Husbanding of resources by cutting down the use of zinc

100% recyclable

CO_2 savings possible with bluemint® Steel

MBW® AS Pro – the next generation of hot forming

For hot forming, thyssenkrupp Steel offers the automotive industry a broad portfolio of application-optimized products and surfaces as well as a high level of consulting expertise based on over 20 years of experience. The best example is the **AS Pro** coating for **high-strength MBW® steels.** The high-tech coating guarantees reliable production of highly durable components in safety-relevant body areas.

Text Jan Ritterbach

Expertise meets innovation: a good example of this is the Finnentrop region in South Westphalia – the site of thyssenkrupp Steel's hot-dip galvanizing line (FBA) 3. This is where the production expertise of around 220 employees meets continuous further development and investment. Finnentrop is now considered one of the most advanced and experienced automotive locations within the steel manufacturer's production network.

Advantages for economical lightweighting

Finnentrop focuses on producing surface-coated sheet, which is mainly used in the automotive industry. This is made possible by an ingenious interchangeable pot system that allows the user to switch quickly between a conventional aluminum-silicon (AS) alloy and the innovative AS Pro coating. The Pro also features a specific amount of magnesium that is added to the molten bath.

"The small change in chemistry has a big impact," explains Georg Parma, Product Manag-

Photos: Rainer Kaysers und Nils Roscher

Fred Jindra (left), head of Production Finnentrop, and Georg Parma, Product Management Hot Forming, check the AS Pro coating applied to a miniature B-pillar shaped blank. In future, the portfolio will include shaped formed blanks tailored to customer requirements.

process that is controlled and monitored using state-of-the-art plant and camera technology.

The manganese-boron steel coated with AS Pro is then checked for quality, rolled up into coils for onward transportation, and sent all over the world. Thanks to its special properties, the high-tech material is used by customers for safety-relevant structural components in particular. These include A- and B-pillars, bumper crossbeams, side intrusion beams, and body reinforcements

Georg Parma: "Together with our MBW®steels, AS Pro offers even more options for increasing the performance and reducing the weight of a component. Just think of the combination of different steel grades thanks to the use of joining technologies such as laser welding, tailored tempering and patches. In the future, our customers will be able to meet higher lightweighting requirements and conserve resources, thanks to the optimal combination of material, coating, and technology."

The premium: MBW® 1900+AS Pro

When the high-tech AS Pro series coating meets manganese-boron steel in its currently highest available strength class, we are talking about a premium product: MBW® 1900+AS Pro, which combines the specific advantages that are particularly important for automotive customers as regards efficient vehicle production based on economical lightweighting. While the crash-proof MBW® 1900 has a particularly high potential for cost and weight reductions in vehicle construction, the AS Pro coating enables reliable processing in the hot forming process, and integration in the car body.

er Hot Forming at thyssenkrupp Steel. It significantly minimizes process-related hydrogen absorption during the annealing process in hot forming, and furthermore ensures a more economical production process. Specifically, energy-intensive and costly additional measures such as dew point control of the air humidity in the furnace, which are normally required in the customer's hot forming process, are no longer necessary. This reduces the risk of failure and increases process reliability.

Another advantage: the processing properties of AS Pro are comparable to the standard product. Joining processes such as laser beam and resistance spot welding can be used as usual, while paintability and corrosion performance remain completely unaffected. To put it briefly: "AS Pro in combination with our MBW®steels sets a milestone in the hot forming of weight-optimized and crash-relevant structural components for vehicle construction," emphasizes Parma.

Ideally suited for safety-relevant structural components

During production, the steels go through a number of production steps in FBA 3: Over a distance of several hundred meters, the uncoated steel strips, which can be processed up to a thickness of 3.3 mm – uniquely in the world – first pass through an annealing furnace. They are then immersed in a bath of molten aluminum, silicon and magnesium at around 680 °C: a complex

When it comes to hot forming, thyssenkrupp Steel not only has the right products and surfaces, but also the consulting expertise to support the automotive industry in meeting all of its challenges.

Web

More information about AS Pro can be found here:
www.thyssenkrupp-steel.com/en/as-pro/

Contact

Georg Parma, Product Manager Hot Forming,
georg.parma@thyssenkrupp.com

GD-OES: A milestone in measurement technology celebrates its anniversary

25 years ago, thyssenkrupp Steel was the first company in the steel industry to introduce an analytical technique in production plants that can simultaneously determine the chemical composition of materials and coating systems. It was called **glow discharge optical emission spectroscopy**, or GD-OES for short. To this day, measurement technology is indispensable in production – continuously developed and improved.

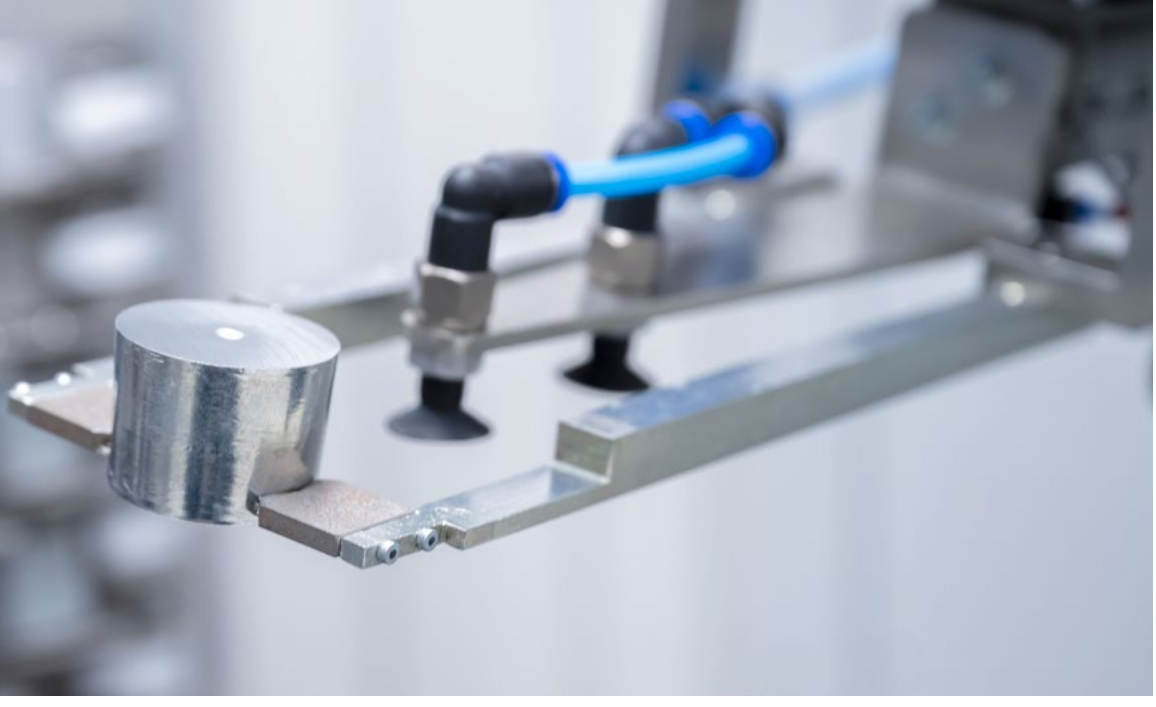
Text Julia Joswig

Juan Müller, Thomas Brixius and Roger Hannig (from left) inspect the quality of a workpiece in FBA 10.

Photos: Rainer Kaysers

The introduction of glow discharge optical emission spectroscopy in FBA 3 at thyssenkrupp Steel in Finnentrop still represents a milestone in quality control and process optimization for the manufacture of hot-dip coated flat steel. "Since 1999, the technology has allowed us to achieve much more precise and efficient quality control above all else. The importance of this cannot be overstated, as it directly impacts the quality of our products and, by extension, the quality delivered by our customers," explains Roger Hannig, head of Technical Customer Service SSC Automotive at thyssenkrupp Steel.

As a measuring method for determining the chemical composition, GD-OES always reveals its strengths when it comes to reliably analyzing the material composition directly at production plants. However, integration into ongoing operations proved to be a major challenge at the end of the 1990s: Several months of intensive collaboration between production staff, developers and system manufacturers were necessary to get the highly complex system up and running to the complete satisfaction of everyone involved.



Confidence is one thing, control is better: thanks to GD-OES, thyssenkrupp Steel can precisely and efficiently control the quality of its materials, and optimize its processes.

About GD-OES

Glow discharge optical emission spectroscopy (GD-OES) refers to a spectrometric method for characterizing metals and other non-metallic solids. By continuously removing the sample material layer by layer and simultaneously analyzing the resulting light spectrum, it is possible to investigate element composition, layer thickness and concentration gradients, for example in steels, metallic coatings and pre- and post-treatments.

From Finnentrop into the world

In 2024, GD-OES technology will continue to be used in various thyssenkrupp Steel production facilities, including FBA 3 and FBA 10. "In the last quarter of a century, there has been a remarkable evolution in development technology within the system, transitioning from numerous manual processes to a fully automated method," says Thomas Brixius, developer and Senior Expert Surface Analysis and Laboratory Coordination at thyssenkrupp Steel. Not only has this increased the accuracy and reliability of the measurement results, the efficiency of optimization of production processes has also been boosted. Process automation in particular has eliminated many manual work processes, resulting in considerable time and cost savings.

GD-OES technology has gradually become widespread and established itself in production areas of industry: it is now used by many companies worldwide as a standard material analysis procedure. However, widespread use at thyssenkrupp Steel's production plants was only made possible by the development of proprietary software for operating and monitoring the GD-OES systems, which ensures simple and reliable operation by plant personnel. Ingenious developers are continuously refining the measurement technology in detail. Roger Hannig: "At thyssenkrupp Steel, we are continuously developing the technology to meet our needs. For example, new or modified products can be examined at the production facilities using GD-OES analysis and the trends can be monitored."

Innovativeness of the next generation

Just as measurement technology advances, the people who work with it also need to constantly improve their technical skills. In order to ensure a seamless transition between the generations of experts, the duo of Thomas Brixius and Roger Hannig, who were responsible for the introduction of GD-OES in Finnentrop, have now been joined by Juan Müller from the surface analysis department. "Juan Müller and our other young colleagues bring their specialist knowledge, expertise, and passion for innovation to the table, constantly enhancing our technology to meet our customers' needs," explains Thomas Brixius, who strongly links GD-OES to the future of thyssenkrupp Steel: "thyssenkrupp Steel's long-term competitiveness and success will be ensured by the key and undoubted role that measurement technology plays in optimizing our production processes."

What began in Finnentrop in 1999 has long since become a standard throughout the industry: thanks to the pioneering work by thyssenkrupp Steel, GD-OES has established itself as a measurement method in the steel industry.

Web

To the online article:
www.thyssenkrupp-steel.com/en/gd-oes/

Contact

Roger Hannig, Head of Technical Customer Service SSC Automotive,
roger.hannig@thyssenkrupp.com

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