The thyssenkrupp Steel magazine Issue 02/2022 thyssenkrupp-steel.com

compact

Into the future with electrical steel High-tech stee brings tension

High-tech steel from thyssenkrupp Steel brings tension to the green transformation.

Green transformation: Direct reduction plant for $low-CO_2$ steel is on its way Page 24 Steel strategy 20-30: Conversion of the production network is making rapid progress Page 32

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VIRKIN



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Under new management

Passing the baton at thyssenkrupp Steel: André Matusczyk (I.) hands over the management of Sales Automotive to Simon Stephan and becomes the new CEO/CTO of thyssenkrupp Hohenlimburg. In steel^{compact}, they both talk about the challenges of the new positions and of the material steel in times of climate protection and fragile supply chains.

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Showing profile together

thyssenkrupp Steel is placing its expertise in roll forming on a broader basis. To better support customers in selecting materials in the future, the company is now investing in additional simulation technology.

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Interview with COO Dr. Heike Denecke-Arnold

In May 2022 she was appointed Chief Operations Officer (COO) of thyssenkrupp Steel with responsibility for iron and steel production as well as quality and logistics. In an interview with steel^{compact}, the metallurgist reveals what drives her and what her projects for the future are.

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Weighty advantages

After rasselstein[®] Solidflex, the tinplate experts from Andernach have succeeded in developing another material: rasselstein[®] D&I Solid, a material grade suitable for use in the production of two-piece D&I food cans, where it can enable thickness reductions.

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AHSS steels of the 3rd generation

With jetQ, Japan's JFE Steel Corporation and thyssenkrupp Steel have jointly launched a high-strength steel for the automotive industry. The development is the most recent result of a successful collaboration that has been ongoing for 20 years.

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Credits

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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 Ratinger Strasse 9 40213 Düsseldorf · Germany

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"Tailwind for implementing our transformation."

he year 2022 will remain in our memories: the pandemic has not yet been overcome, and in February the first war of conquest in Europe since 1945 broke out. Russia's invasion of Ukraine is changing the geopolitical situation and shaking fundamental

economic certainties. The situation is open. The "new era" can accelerate necessary transformation processes; but it could also be the starting point for structural upheavals that cause lasting damage.

At thyssenkrupp Steel, we have stayed on course despite this unstable environment and achieved important milestones. Especially in our green transformation. By releasing equity, thyssenkrupp AG has laid the foundations for investments of over two billion euros in our first direct reduction plant with two melting units. And we are pleased at a strong commitment from the state government of North Rhine-Westphalia, which intends to provide a mid-three-digit million euro sum for this purpose. We are now close to awarding the contract.

The first climate-friendly hot metal is expected to flow from the new plant in 2026. Interest is high and we have already signed letters of intent with the first customers to supply them with low- CO_2 bluemint[®] Steel.

We are also on track with the implementation of our Strategy 20-30. Our new walking beam furnace in the hot strip mill 2 in Duisburg has been completed and we are laying the foundation stone for the expansion of our Bochum site into a center of excellence for electric mobility. We recently inaugurated our tenth hot-dip galvanizing line for top-quality surfaces in Dortmund and completed the new coating line 13 in Andernach on schedule.



Bernhard Osburg, CEO thyssenkrupp Steel Europe AG

All this is evidence that, despite adverse conditions, we are consistently pursuing our strategy of supplying our customers with the right premium products to meet their future requirements.

But of course, we are not immune to external shocks. The extreme cost of energy is a huge burden on us. Wherever possible, we are relocating production to our integrated site in Duisburg to take advantage of the energy network there. Nevertheless, we cannot rule out the temporary shutdown of individual plants. We are also saving gas and energy wherever possible. But that won't be enough: across Europe, insolvencies and production shutdowns show that the situation is serious. There is a threat of creeping de-industrialization that could irreparably damage our economic brand essence: a strong SME foundation and a diversified, broad-based industry. Brussels and national governments must guickly and decisively curb the rise in energy prices and present suitable instruments to ease the burden on companies and consumers. We must work together and resolutely to overcome the current energy price crisis, particularly if we want to stick to our climate targets in order to secure long-term competitive advantages in climate-friendly technologies.



Oppor becko

The newly established thyssenkrupp Steel Logistics GmbH started operations on 1 July 2022. As part of its forward strategy, the company intends to further develop its processes and, in the long term, work with a partner to, among other things, drive ahead logistics processes at the ports on the Rhine axis.

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Knowledge & value

Material news



Now also hotdip galvanized!

The hot-rolled chassis steel CH-W® 660Y760T with guaranteed hole expansion of at least 60 percent is now available in a hot-dip galvanized variant. The special chassis grades, a further development of proven complex-phase steels, are ideal for cold-formed parts with high hole expansion requirements and for highly demanding control arm components. The new corrosion-resistant variant is available with zinc coating in typical automotive layers.

More info on our chassis steels can be found here: www.thyssenkrupp-steel.com/en/ material-of-mobility

With "Calli" through the steel mill

Shaping the game with technology and endurance: In a new short film, soccer legend Reiner Calmund explains the importance of steel in the value chain and how thyssenkrupp Steel is changing its game in the future – away from coal and towards hydrogen.

Three or four-man defensive chain – it makes a value chain! For soccer expert Reiner Calmund, the connection is obvious: "If you want to be at the forefront economically, you have to put a lot of energy into the value chain. Just like I did back then in the four-man defensive chain." On a tour of Europe's largest integrated iron and steel plant in Duisburg, "Calli" explains why the steel value chain is so crucial for Germany as an industrial location.

As a high-tech material, steel plays a key role in the energy and mobility revolution – for example as a material in electric vehicles or wind turbines. "It is precisely these complex interrelationships that we want to explain in our new short film in an understandable, but also sympathetic way," says Marcus van Marwick,



Head of Communications at thyssenkrupp Steel. "The link to soccer in a World Cup year was obvious, and we are very pleased to have been able to win over Reiner Calmund to our idea so quickly. He embodies competence and passion in one person like no one else – and that fits thyssenkrupp Steel." A compliment that "Calli" is happy to return to the company: "thyssenkrupp Steel is a strong player with a top team!"

The video with the famous soccer manager Reiner Calmund will be available for viewing from the end of October 2022 on Youtube as well as at www.thyssenkrupp-steel.com.



20 years

In numbers

ago, thyssenkrupp Steel and the Chinese steelmaker Angang Steel combined their expertise in the **50/50 joint venture company, Tagal**. Today, headquartered in Dalian, northern China, the company operates four hot-dip galvanizing lines with a total annual capacity of 1.7 million metric tons. The product portfolio includes high-quality hot-dip galvanized sheet for the automotive industry.

CC Stable production, good quality performance and optimum logistics are key features in our delivery performance."

Dr. Heike Denecke-Arnold, Chief Operations Officer (COO) thyssenkrupp Steel

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Industry compact

China remains the world's largest steel producer

The Chinese steel industry produced more than one billion metric tons of crude steel (1,032.8 million metric tons to be precise) in 2021 – that is just over half of global steel production. As in the previous year, Germany ranked 8th with 40.1 million.

	2021	2020
1st China	(i) 1,032.8 mmt	(i) 1,064.7 mmt
2nd Indien	0 118.2 mmt	00100.3 mmt
• 3rd Japan	96.3 mmt	83.2 mmt
4th USA	85.8 mmt	0 72.2 mmt
8. Deutschland	(0) 40.1 mmt	0 35.7 mmt

Steel recycling

Recycling with certificate

A processing plant for a particularly high-quality recycled steel is currently being built in the port of Duisburg. TSR40, a product scheduled to be produced there from December 2022 onwards, will provide the raw material for CO_2 -reduced bluemint[®] recycled from thyssenkrupp Steel.

Mona Neubaur, Minister of Economics and Climate Protection of North Rhine-Westphalia, pointed out the showcase character of the project during her visit in summer 2022. With regard to the decarbonization of industry, the minister said: "Our understanding of waste must change fundamentally: These are potential recycling raw materials. The industry in North Rhine-Westphalia with its dense cross-sector interconnections holds particularly great potential for new value creation, greater competitiveness and more climate protection." The use of steel scrap not only saves valuable resources, it also reduces local CO₂ emissions. This applies in particular to TSR40, the innovative recycling product from Duisburg which has a particularly high iron content. After all, the higher the use of metallic iron, the lower the demand for iron ore, coke and coal. For every ton of recycled product, around one ton of CO₂ from the blast furnace can be avoided in this way. "In addition to the long-term transformation of our plants, we are exploiting all opportunities to avoid CO₂ in the conventional blast furnace process as well. The use of scrap-based recycled material is an important step in this direction, from which our customers can also benefit," says Dr. Arnd Köfler, Chief Technology Officerat thyssenkrupp Steel. The process forms the basis for the TÜV Süd-certified CO₂-reduced material bluemint® recycled from thyssenkrupp Steel.



Mona Neubaur (center), Minister for Economic Affairs and Climate Protection of North Rhine-Westphalia, visited the processing plant in Duisburg in the summer.

Tin plate news

Updated standard for packaging steel

The revised Euronorm 10202:2022 has also been available in Germany since July. It sets the standards for "cold rolled packaging metal products

 electrolytically tin-plated or special chromium-plated steel" and replaces the previous version from 2001.
"The revision reflects the current state of the art in the production of packaging steel," says Carmen Tschage, spokesperson for the thyssenkrupp Rasselstein company. "We therefore welcome the changes made there, and see benefits for our customers from the new standards."

In terms of content, the REACH-compliant chromium(VI)-free products CFPA and TCCT® (special chromium-plated packaging steel, ECCS-RC) have been added and additional steel grades integrated. In addition, the new standard now describes exactly how a tensile test must be carried out. "This will increase the comparability of steel grades from different manufacturers. But it might also mean that individual temper designations will change," Tschage says. "Our customers can rely on the full support of our Technical Customer Advisory Service in implementing the revised standard." Another new feature concerts purchase orders. Here, according to Euronorm, every customer will be obliged to provide detailed information on the intended application of the steel grade they have ordered. "In this way, the optimum production recipe can be defined for every application.'



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News





The tension is rising: How electrical steel is driving the energy and mobility revolution

steelcompact 02/2022

powercore[®] electrical steel is the key

material of the energy and mobility revolution. With the help of the proven branded product from thyssenkrupp Steel, not only can the rotational energy of wind turbines be efficiently converted into green electricity, but also the transformer process required for energy transport can be carried out with high efficiency – and therefore particularly low losses. In addition, there is the special significance for electric mobility: Because without electrical steel, these vehicles won't go anywhere.

away f largest project after V

he energy and mobility revolution are gigantic challenges. The move away from fossil fuels heralds the largest German infrastructure project since the reconstruction after World War II. In order to reliably supply society and the econ-

omy with electricity and heat from renewable energy sources, the energy landscape between the North Sea coast and the edge of the Alps must be repositioned. This is true on both the large and small scales. While solar farms, wind turbines and electric vehicles serve as visible symbols of the transformation, the real change is taking place in areas that remain hidden from many people – at the material level. More than ever, intelligent materials are needed here that enable highly efficient generation, distribution and use of energy in the first place.

Using energy resources sustainably

In the energy sector, particular attention is currently being paid to a material that has been established for a long time, but whose potential is only really energy turnaround: high-alloyed electrical steel. The high-tech material, which is manufactured in a complex production process, shows its strengths, among other things, in areas where rotational movements are efficiently converted into electrical energy or energy has to be transformed from one voltage to another with low losses.

Copy Jan Ritterbach

"Without electrical steel, a transformation of the energy infrastructure is not feasible. It is the key material for core components of the energy transition such as wind turbines and transformers. Electromobility will not work without electrical steel either, because it is needed for every electric vehicle and in every charging station," agree Georgios Giovanakis, CEO of thyssenkrupp Electrical Steel, and Simon Stephan, Senior Vice President Sales Automotive. At thyssenkrupp Steel, they are responsible for the two electrical steel divisions: grain-oriented and non-grain-oriented. thyssenkrupp Electrical Steel, as an international premium manufacturer of grain-oriented powercore[®] electrical steel products and one of the leading suppliers in Europe, mainly serves the transformer sector. The Sales Automotive unit, on the other hand, with its non-grain-oriented powercore[®] brand gets wind turbine generators moving, for example, and brings electric mobility up to speed with its powercore® Traction products.

Giovanakis continues: "With our high-tech powercore[®] electrical steels, we are helping to meet the increasing ecological demands in transformer construction. The material enables high efficiencies that help our customers meet the demanding efficiency targets of the EU Ecodesign Directive, helping to reduce global energy demand and associated CO₂ emissions."

Innovation through cooperation

In developing these key materials needed for the energy and mobility revolution, thyssenkrupp Steel relies on intensive customer cooperation. Stephan: "We are continuously researching and developing further solutions to accompany the increasing demands of the energy and mobility industry. Cooperations in the field of research and development for innovative products are a matter of course for us. In doing so, we place great value on long-term partnerships."

High-tech electrical steels

thyssenkrupp Steel is one of Europe's leading manufacturers of high-tech electrical steels. The powercore® products are indispensable basic materials for the energy and mobility revolution in various places:

In wind turbines generators, it reliably converts mechanical energy into electricity.

In transformers, it enables the efficient transportation and provision of energy.

In electric motors, it provides the economical drive.



GG

With our high-tech powercore[®] electrical steels, we are helping to meet the increasing ecological demands in transformer construction."

Georgios Giovanakis, CEO thyssenkrupp Electrical Steel

Material for wind and weather

To see how successful practical projects emerge from such development partnerships, it is worth taking a look at Aurich. Just as Berlin is the political epicenter of Germany and Frankfurt am Main enjoys a reputation as a financial metropolis, the small northern German town, an hour and a half's drive from Bremen, is the unofficial capital of wind energy. Not only because of the stiff breeze that blows here about 30 kilometers away from the Wadden Sea and

CC Since our beginnings, we have relied on high-quality non-grainoriented powercore[®] electrical steel from thyssenkrupp Steel for our generators."

Ralf Mühlenbrock, Senior Component Head Generator at Enercon Production

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the East Frisian Islands. But above all because Enercon has its headquarters here. Germany's biggest wind turbine manufacturer has been using non-grain-oriented electrical steel from thyssenkrupp Steel for many years.

"Since our beginnings, we have relied on powercore[®] products for our generators," says Ralf Mühlenbrock, Senior Component Head Generator at Enercon Production. Why, is easily explained: In the wind energy sector, materials are needed that can withstand demanding environmental conditions over a long period of time – for example, the salty air in coastal areas. No problem for non-grain oriented electrical steel, which is mainly used for the blades of the generators. But even more important: The soft magnetic steel concentrates and amplifies the magnetic flux inside the wind turbine generators in a very efficient way. So, the mechanical rotational energy can be converted into electric current with almost no losses.

For the Enercon engineers, the electrical steel from Bochum is a core component in several respects: They use the material not only to generate electricity, but also across the entire energy value chain thanks to Enercon's versatile product portfolio. Right through to the consumption of energy in electric motors and devices. Depending on the electrical steel grade used, powercore® can achieve high efficiency there. "The performance of the generators and thus the efficiency of the entire wind turbine (WT) depends to a large extent on the material properties," explains Thomas Sube, Key Account Manager for non-grain-oriented electrical steel at thyssenkrupp Steel.

Tailor-made for customer requirements

Enercon, as one of the world's market leaders with over 31,600 wind turbines installed, has individual requirements for the material; for this reason, thyssenkrupp Steel adapted the properties and composition of the electrical steel especially for the wind turbine manufacturer. For example, through a special alloy that ensures better conductivity and good punchability. These material properties are necessary because Enercon combines important manufacturing steps. For example, the company cooperates with a foundry in the district of Aurich, where rotor hubs, machinery frames and blade adapters are produced. The special feature: just under half of the material used is steel scrap from the company's own generator production. The chads from electrical steel are collected, melted down and recycled - this is only possible thanks to the tailored material from thyssenkrupp Steel.

The excellent cooperation between the two partners is now more than paying off: wind turbines from Enercon with electrical steel from thyssenkrupp Steel are already in use on the French Atlantic coast, in the vast expanses of Anatolia and even in Canada. And the starting position on the domestic market is also favorable, because the demand for green power is already high - and continues to grow due to the current geopolitical situation. With a view to expanding renewable energies, the German government has committed itself to successively increasing existing wind power capacity from the current 54 gigawatts to 136 gigawatts. Reason enough for Enercon and thyssenkrupp Steel to stay on course for innovation. Thomas Sube: "First and foremost, we're interested in even better magnetic properties for our electrical steel. We've already been able to accomplish a lot and are working on more." >

Enercon: Pioneer in renewable energy

As a pioneer in wind energy technology and a partner in the energy turnaround, Enercon specializes in the development and production as well as sales and service of onshore wind turbines. With its mission "Energy for the World", the company has been committed to sustainable energy generation from onshore wind since 1984, and is one of the world's leading manufacturers thanks to innovative turbine technology, high quality standards and a total installed capacity of around 58 gigawatts (31,600 WTs in total, as of 08/2022). The wind turbine manufacturer, headquartered in Aurich, Lower Saxony, employs around 13,500 people at administration, sales, production and service locations worldwide.

Ultranet: the 2-in-1 network

The new 340 kilometer DC link between North Rhine-Westphalia and Baden-Württemberg can transmit around 2,000 megawatts of electrical power and is intended to help relieve the strain on the partially overstretched infrastructure of the Rhine corridor. Here, for the first time. innovative electrical engineering is used to transport direct and alternating current at a voltage of 380 kilovolts on the same high-voltage pylons. Commissioning is planned by the responsible arid operators Amprion and TransnetBW for 2026.

Ultranet reduces the strain on the supply system

The energy turnaround is also being driven forward in North Rhine-Westphalia. For example, by the grid operator Amprion, which is expanding its extra-high voltage grid for the current transformation of the energy system. Among other things, the company is responsible for transporting the green electricity generated by wind or solar power in northern Germany to the major consumer centers in southern and western Germany. An expansion of the electricity infrastructure is essential for this - after all, the share of renewable energies in gross electricity consumption is to rise to at least 80 percent by 2030. At least, that's what the 2021 amendment to German Renewable Energy Act (EEG) envisages. That's why Amprion and its project partner TransnetBW are currently planning and constructing the so-called Ultranet, a 340 kilometer-long electricity highway. It stretches from Osterath in North Rhine-Westphalia to Philippsburg in Baden-Württemberg and, as things stand at present, will come on stream in 2026. According to Amprion, the total cost of the mammoth project is around 1.7 billion euros.

Like a bypass, the new connection is intended to route the wind energy arriving from the north to the south past the grid in the Rhineland, which is already operating at full capacity today. And in a technically new way for Germany. To understand this, you need to know: Electric current can be transported by two different methods: as alternating current or direct current. Until now, alternating current, in which the polarity changes constantly, has been considered the European standard. Against the backdrop of the energy turnaround, however, high-voltage direct-current (HVDC) transmission lines, which have lower losses for long-distance transport, are gaining in importance. Ultranet will soon enable more powerful use of the existing power line because an AC circuit on the mast can be operated in DC technology in the future.

New technology improves energy transport

"All HVDC lines planned in Germany will in turn complement the existing AC grid, relieving the AC system. With Ultranet, both types of electricity can be transmitted together on one pylon. With direct current targeted both from north to south, but also in the opposite direction if required – for example, to transport surplus



photovoltaic electricity," explains Joëlle Bouillon, Ultranet project spokesperson for Amprion.

In order for green offshore electricity to be used by consumers in Baden-Württemberg, it must first be made ready for transport in a converter station in Meerbusch near Düsseldorf before it travels via the HVDC line. Here, at the starting point of the Ultranet, in addition to the work of switchgear and converter modules, the most important thing is the performance of the transformers. During the necessary conversion from alternating to direct current and back again, they ensure the efficient transformation to the higher or lower voltage level that is required in each case – and make it usable again at the end point for the 380-kilovolt alternating current grid of the end consumers.



Transformers need top grades

Twelve high-tech transformers are doing their job in each of the three converter stations required for the Ultranet and its extension called A-North in Meerbusch, Philippsburg and Emden. Each is the size of a normal semi-detached house with three floors: twelve meters high, ten meters long, weighing 280 metric tons. The giant apparatuses are manufactured by Siemens Energy, a world leader in energy technology and one of only three global suppliers of direct current technology. Grain-oriented electrical steel plays a key role in the design process, according to commodity manager Mike König. For the central component of the machine, the transformer core, a material is needed that reduces energy losses to a minimum.

"Only top grades from thyssenkrupp Electrical Steel are used for the Ultranet transformers," says König. These are hair-thin iron-silicon alloy electrical steel strips, often no thicker than 0.23 millimeters. They are already partly made of bluemint[®] powercore[®], a reduced-CO₂ and thus more climate-friendly material that helps to noticeably reduce the ecological footprint of transformer production at Siemens Energy. Thanks to the innovative high-tech plates, the transformers used for the Ultranet achieve an efficiency of around 99 percent under full load. König: "This means that our systems not only meet the highest standards of energy efficiency, but also fulfill the recently further tightened requirements of the EU Ecodesign Directive." Marcel Hilgers, Sales Manager at thyssenkrupp Electrical Steel, knows the savings potential that can be realized through the successive modernization of transformers in Europe with the help of electrical steel: "The EU hopes the stricter requirements for transformers will save about 16 terawatt hours annually by 2030. This is roughly equivalent to half the electricity consumption of Denmark." >

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Only top grades from thyssenkrupp Electrical Steel are used for the Ultranet transformers"

Mike König, Siemens Energy

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Non-grain oriented electrical steel powercore[®] and powercore[®] Traction are our contribution to greater energy efficiency for renewable energy generation and sustainable mobility on rail and road."

Simon Stephan, Senior Vice President Sales Automotive at thyssenkrupp Steel

Electric mobility is the future

The advancing energy turnaround is not only changing the energy system itself, but also the use and application fields of energy in general. A serious change can already be observed in the area of mobility: Among other things, the EU Commission is demanding that only zero-emission vehicles be sold from 2035 onwards. It fits into the picture that Germany has joined the Zero-Emission Vehicle Alliance (ZEV) as part of its adapted climate policy. This international alliance, which includes the United Kingdom and the Netherlands, among others, aims to accelerate the global switch to zero-emission vehicles. By 2050, there should only be zero-emission passenger cars. Consequently, the automotive industry is also working at full speed on new vehicles and technologies, the operation of which should no longer be dependent on fossil fuels. Instead, manufacturers are focusing on the direct use of electricity through battery-electric drives - and are increasingly striking a chord with customers. Germany already represents the largest market for electric cars in Europe.

Low-CO₂ hightech materials

With the growing expansion of renewable energies, the carbon footprint in the use phase of electricity is decreasing. As a result, the focus in the future will shift more and more to the carbon footprint of the products themselves. In other words: In order to achieve climate neutrality, the production of cars or transformers must increasingly involve low-CO, materials. With bluemint® Steel, thyssenkrupp Steel is already providing its customers with a corresponding offer, which will grow further in the coming years with the construction of the first hydrogen-powered direct reduction plant.

Steel from thyssenkrupp Steel is an indispensable part of this development. Numerous renowned brand manufacturers rely on this versatile material in every respect for the development and design of contemporary automotive solutions. For example, there are already CO_2 -neutral vehicle models on the market, the steel content of which, including doors and hood, is well over 90 percent. However, steel plays a very important role not only in the body, but also in the heart of the electric vehicle – the electric motor. And again, it is electrical steel products that pave the way to the future.

Heart of steel

"Non-grain-oriented electrical steel is indispensable for electric mobility," says Frank Bosch, Key Account Manager in Sales Automotive at thyssenkrupp Steel. This is due to the special requirements placed on the drive unit in electric vehicles. Because in contrast to conventional electric motors, for example for elevators or household applications, where the operating frequency is around 50 Hz, motors for electric cars have high speeds. This results in significantly higher electrical frequencies of well over 400 Hz. Soft magnetic materials are needed to prevent high remagnetization losses at these frequencies, which would have a negative impact on the efficiency of the motor and thus also on the range of the vehicle. Ideally thin, with homogeneous mechanical and magnetic properties. Non-grain oriented electrical steel falls into this category. "The magnetic flux density of the material, which is crucial for the torque of the motor, is additionally positively influenced by a special processing," observes Frank Bosch.

The result: with non-grain-oriented powercore® Traction electrical steel, the core losses in electric motors for electric vehicles are almost 30 percent lower than those of today's standard grades. This would not be possible without constant research and development work. Frank Bosch: "We operate our own engine rig in our Application Technology department, where we test our powercore® Traction grades in the various motor types. This enables us to provide our customers with the best possible advice on selecting the right grade depending on the specific requirements." How well this functions is shown not least by the success with end customers. In the past year, the number of new registrations of battery-powered electric cars in the EU increased significantly compared with the previous year: from 539,000 to 878,000 vehicles.

A trend that is continuing: As reported by the Association of European Automobile Manufacturers (ACEA), registered all-electric vehicles accounted for just under 10 percent of total registrations in the second quarter of 2022. This is a significant jump compared with the same period of the previous year. And who knows: perhaps some models will soon be charged with green offshore electricity from the Ultranet?

Web

Read our cover story online as well: www.thyssenkrupp-steel.com/en/energy

Contact

 Thomas Sube, Key Account Management NO, thomas.sube@thyssenkrupp.com
Marcel Hilgers, Sales Manager thyssenkrupp Electrical Steel, marcel.hilgers@thyssenkrupp.com
Frank Bosch, Key Account Management Sales Automotive, frank.bosch2@thyssenkrupp.com 18

Wheels made of **bluemint® Steel** are picking up speed

Market leader Accuride is breaking new ground in the production of truck wheels. At the IAA Transportation in September 2022, the global player from Solingen presented product innovations for the first time on the basis of reduced-CO₂ **bluemint**[®] **Steel.**

Copy Jan Ritterbach

hen it comes to delivering goods, trucks are indispensable worldwide: trucks transport more than 70 percent of all goods in Europe, the USA and China alone. The share of trucks in traffic emissions

is correspondingly high. In Germany, trucks contribute around one-third of climate-damaging emissions each year. More than ever before, therefore, the topic of CO_2 efficiency is in demand from both commercial vehicle manufacturers and their suppliers.

Production process crucial for life cycle assessment

As one of the pioneers of the industry, the wheel producer Accuride is leading the way. Over the past ten years, Accuride has not only invested heavily in the development of particularly lightweight truck wheels, but has also gained

Jörg Schumacher of Accuride sees two advantages at once in wheels made of bluemint[®] Steel: Firstly, the CO₂ saving during steel production and, secondly, throughout the wheel's service life.



deeper insights into the choice of materials in its cooperation with thyssenkrupp Steel as a supplier and development partner: "Looking at the life cycle assessment of a wheel, we realized how important it is to consider the entire life cycle," explains Jörg Schumacher, Vice President Product Engineering at Accuride. "When it comes to sustainability and climate protection, CO_2 savings that can be realized in the production process of the wheels play a key role," Schumacher continues.

For this reason, Accuride presented a brand new truck wheel made of ultra highstrength steel at the IAA Transportation. Because the wheel's entire starting material is





made from CO₂-reduced bluemint[®] Steel from thyssenkrupp, the CO₂ intensity of the product has shrunk significantly. "By using bluemint[®] Steel, we can save around two-thirds of the greenhouse gas emissions in wheel production compared with conventional steel – and even up to 90 percent compared with aluminum wheels," explains Dr. Andreas Strecker, President Accuride Wheels Europe & Asia. And Simon Stephan, Senior Vice President Sales Automotive at thyssenkrupp Steel, adds: "The bluemint[®] Steel truck wheels project is the result of many years of successful cooperation with Accuride, driving innovative solutions for our customer."



Sustainability through material optimization

The climate-friendly effects are achieved through bluemint[®] Steel's innovative production process, in which HBI, already reduced iron ore, is used in the blast furnace. This saves coking coal and ensures emission reductions. In addition, Accuride's material concept ensures the product's future viability. A steel with a higher strength is used, which allows a smaller plate thickness with the same performance. This weight reduction effect enables a weight saving compared with a conventional wheel steel, resulting in lower fuel consumption in the utilization phase.

Over the full life cycle, which averages around 1.2 million kilometers, CO₂ emissions can be reduced by over ten percent compared with a conventional wheel. "This means that a bluemint[®] wheel weighing 32 kilograms is better than significantly lighter forged aluminum wheels of the same size," reports Andreas Strecker. For trucks or commercial vehicles with lower mileages, such as refuse collection vehicles or concrete mixers, the advantage of bluemint[®] Steel is even greater, he says. Andreas Strecker: "This is a significant step toward greater sustainability in the commercial vehicle industry." Sustainable product solutions through interdisciplinary materials optimization – based on this approach, thyssenkrupp Steel supplies the wheel producer with low-CO₂ steel. In the picture, Dr. Andreas Strecker of Accuride (left) and Simon Stephan of thyssenkrupp Steel show the model presented at the IAA.

This is bluemint® Steel

With bluemint® Steel. thyssenkrupp Steel is producing a flat bar product which does not have any effect on the balance of emissions at the Duisburg site - the emissions of what is referred to as the upstream chain (Scope 3) are reported. These are all emissions that occur during the production and transport of the input materials. In this way, the CO₂ intensity of each metric ton is reduced by 1.5 metric tons, to 0.6 metric tons on the balance sheet. This calculation methodology as well as the produced quantity of bluemint® Steel has been confirmed by the international certifier DNV.

Significant CO₂ reductions are also made possible by bluemint® recycled. Customers who rely on this product save 1.35 tons of CO, per ton of material. This represents a 64 percent reduction compared with conventional steel. The savings result from the fact that 100 percent processed steel scrap is used in production to replace the coking coal in the blast furnace on a pro rata basis.



Web

More bluemint® applications can be found here: www.bluemint-steel.com

Contact

Dr. Carmen Ostwald, Head of Business Development bluemint[®] Steel, carmen.ostwald@thyssenkrupp.com Sales Automotive, info.auto@thyssenkrupp.com

Greener annealing

thyssenkrupp Steel aims to make production in Duisburg completely **carbon-neutral** by 2045. This also applies to the downstream processes of rolling and coating – here, we do not stop at the steel mill. What this means for the world's largest packaging steel site is currently being researched at thyssenkrupp Rasselstein in Andernach.



Torsten Schmitt, Dr. Peter Kirchesch and Christian Trapp (v.l.) are pushing ahead with the use of hydrogen at thyssenkrupp Rasselstein.

Focused on sustainability for the future of thyssenkrupp Rasselstein: Mario van Hall, Head of Sustainability & Digitalization.



Copy Katja Marx

h a r 1 s b

hyssenkrupp Rasselstein produces around 1.5 million metric tons of tin plate for cans and closures every year. The company agrees that packaging steel should be produced in a carbon-neutral way in the future. "In order to position the company for

the future and use our resources efficiently, we have developed a sustainability target for our site that includes economic, ecological and social objectives," says Mario van Hall, Head of Sustainability & Digitalization at thyssenkrupp Rasselstein in Andernach. CO_2 -free production is a key issue here. Because our customers are also increasingly interested in the life cycle assessment of our packaging steels."

Their carbon footprint depends to a large extent on the carbon dioxide emissions generated during the production of the hot strip supplied from Duisburg – but also on the energy sources generated during further processing into tinplate in thicknesses from 0.100 to 0.499 millimeters.

Energy-intensive annealing campaign

Up to now, natural gas has been primarily used for the annealing of steels. In the future, the fossil fuel is to be gradually replaced by the addition of green hydrogen – a project that thyssenkrupp Rasselstein has been systematically preparing since spring 2022 together with partners from industry and science (see info box). A particular focus of the research projects funded by the German Federal Ministry for Economic Affairs and Climate Protection is on energy-intensive annealing processes: these are needed to restore the crystalline structure of the material destroyed during cold rolling. "The steel regains its original formability. This is necessary so that it can later be processed into cans," explains Dr. Peter Kirchesch, who dealt extensively with the heat treatment of steels in his doctoral thesis. "During the so-called annealing campaign, the steel strip is heated to up to 750 °C for this purpose."

Depending on the desired final strength, the mill has two different heat treatment processes available for this purpose: traditional batch annealing, in which the coils remain stacked for up to 48 hours; and continuous annealing, in which the steel strips are uncoiled and guided over rollers at high temperature and short cycle times for recrystallization.

Numerous questions

"The planned flexible use of hydrogen in the burners raises various issues," says Dr. Peter Kirchesch. "Hydrogen, for example, burns hotter than natural gas. Therefore, the burners and radiant heating tubes must be adjusted. We will also build the necessary infrastructure as part of the project. And we need adapted safety concepts to operate our plants reliably at all times." Another research question relates to the handling of nitrous oxides - because the higher the admixture ratio of hydrogen, the higher the combustion temperatures, as a result of which the undesirable exhaust gases also rise more sharply. And there is another practical consequence of the changeover that is keeping the team in Andernach busy: What happens to the water in the flue gas? Mario van Hall: "During combustion, hydrogen now reacts with oxygen from the air. So instead of CO_2 , the flue gas stream will contain a lot of water vapor. We will see what this means in the process when we have completed our experiments in the laboratory, and apply our findings to the large-scale plant in real operation."

Practical basic research

Until this milestone is reached, the project team will work through a long to-do list. The test facilities at the Institute for Industrial Furnace Construction and Thermal Engineering (IOB) in Aachen and in the Duisburg technical center of the VDEh Operations Research Institute (BFI) are set up, burner technologies are developed, and experimental set-ups and hydrogen admixture gradations are determined. In parallel, the plant's internal energy processes in Andernach are being adapted. For this purpose, a suitable automation concept for the batch annealing will be developed together with the project partner Küttner Automation. Similarly, the development of the complete burner system for the continuous annealing is being carried out by the company WS Wärmeprozesstechnik in cooperation with RWTH Aachen University.

With the experiments, the partners conduct practical basic research that is of interest far beyond their own plant. "Whether in melting, casting, forming, drying or heat treating: Burn-

Technology offensive hydrogen: Overview of projects

"FlexHeat2Anneal" project		Gefördert durch:	
Objective:	Flexible use of hydrogen as a fuel on continuous annealing lines and hot-dip galvanizing lines for steel strip	Bundesministerium für Wirtschaft und Klimaschutz	
Partners:	thyssenkrupp Rasselstein GmbH, WS Wärmeprozesstechnik GmbH, Institute for Industrial Furnace Construction and Thermal Engineering of RWTH Aachen University	aufgrund eines Beschlusses des Deutschen Bundestages	
Funding code:	03EN2078 A-C	The projects within	
Funding period:	1 April 2022 to 31 March 2025	the framework of the 7th Energy Research Program of the	
"H2-DisTherPro" project		German government	
Objective:	Substitution of carbon-containing fuel gases with hydrogen at discontinuous thermoprocessing plants	are being funded over three years by the German Federal	
Partners:	thyssenkrupp Rasselstein GmbH, VDeH Betriebsforschungsinstitut GmbH, thyssenkrupp Steel Europe AG, Küttner Automation GmbH	Affairs and Climate Protection.	
Funding code:	03EN2077 A-D		
Funding period:	1 April 2022 to 31 March 2025		



Expert for CO₂ avoidance in Duisburg: Dr. Daniel Schubert from the Competence Center of Metallurgy at thyssenkrupp Steel.

er technologies are used in various industries," says Dr. Daniel Schubert from CO₂ research at thyssenkrupp Steel's Competence Center of Metallurgy in Duisburg. "The more decarbonization takes place, the more knowledge we can harness for various industrial processes." That's why thyssenkrupp Steel is also involved in one of the two research projects (see info box).

In Andernach, the two research projects are an important part of the company's own sustainability strategy: by 2045, the site aims to save around 400,000 metric tons of CO₂

emissions per year. This is roughly equivalent to the emissions caused by private consumption of natural gas in the surrounding district of Mayen-Koblenz with its 215,000 inhabitants, over a period of two years. The climate plans of thyssenkrupp Rasselstein thus offer the region great leverage for climate neutrality.

Web

Here you can find more information about the hydrogen projects at thyssenkrupp Rasselstein: www.thyssenkrupp-steel.com/en/thyssenkrupp-rasselstein-researching

Contact

 $\mbox{Dr. Peter Kirchesch}, \mbox{Expert on sustainability at thyssenkrupp Rasselstein GmbH, peter.kirchesch@thyssenkrupp.com}$

Mario van Hall, Head of Sustainability & Digitalization thyssenkrupp Rasselstein GmbH, mario.vanhall@thyssenkrupp.com

Dr. Daniel Schubert, project manager for testing facilities of CO₂ research at thyssenkrupp Steel,

daniel.schubert@thyssenkrupp.com

Working flat out for a climate-neutral energy supply

Europe wants to be carbon-neutral by 2050. The use of hydrogen in industrial processes plays a key role here. A high-capacity pipeline network will be built in the coming decades to ensure that the flexible energy source arrives safely at the plant sites. **Pipeline steel from Duisburg** can play a major role in this.

Copy Katja Marx

Characteristics of our pipeline steels

Hydrogen suitability of low-alloy steel grades X42 and X52

Optimized material concepts for the strength range up to X70

Consistently precise thicknesses

Dimension: Thicknesses up to 25.4 millimeters, widths up to 2,000 millimeters

The thyssenkrupp Steel magazine

n impressive 53,000 kilometers long, the European hydrogen network is to be in place by 2040 to supply numerous industrial companies with climate-neutral energy from export regions that are rich in wind, water and

solar power. This is the goal of the European Hydrogen Backbone (EHB) initiative. To make it a reality, not only will existing pipelines have to be repurposed, but thousands of kilometers of new pipelines will have to be laid. "After a long dry spell, the major pipe manufacturers are now gearing up for full order books again. This is because the hydrogen not only has to be transported in large quantities, but also stored. This mega project can be realized most economically via pipelines," says Axel Duhr, Key Account Manager Line Pipe & Export at thyssenkrupp Steel.

The company is one of the few suppliers of high-quality pipeline steels needed to gradually convert the natural gas and petroleum-based energy supply to hydrogen. The challenge here is to keep transport costs low, so that large quantities of the energy source can be compressed and pumped through the pipelines at high pressure in the future. The infrastructure partners involved are breaking new ground with this project. "Current hydrogen lines are operated at up to 25 bar. Now we're talking about operating pressures of up to 100 bar or more, as prevails in high-pressure natural gas pipelines, for example," explains Armin Büttgen, Technical Account Manager in the Sales Industry division. "This raises the question of the extent to which the lines currently used in Germany are up to the new requirements." How do the steels behave in interaction with hydrogen? And how long and how reliably do the longitudinal and spiral seam tubes withstand the pressure?

Preventing hydrogen embrittlement

The team led by project manager Mark Hirt from thyssenkrupp Steel's Application Technology department addressed the material issue. Five hot-rolled steels that can currently be used for



natural gas and CO₂ pipelines according to ISO standard 3183 and API 5L were first compared with the requirements of the applicable codes for hydrogen pipes, such as EIGA guideline IGC Doc 121/14. "Hydrogen can penetrate the pipe, especially in high-strength steels, and cause what are called brittle fractures," says Mark Hirt. "Our investigations therefore concentrated on the toughness of the materials and their behavior in relation to crack formation." The bottom line: all tested steels from thyssenkrupp Steel are ready for use in hydrogen pipelines according to current requirements.

Expanding test procedures

The next step will now be to expand the analysis to the new application scenario together with the pipe manufacturers. Armin Büttgen: "Designing a pipeline for the quasi-static operating condition is comparatively simple. The possible harmful influence of fluctuating pressures in hydrogen lines, on the other hand, requires additional consideration. Fracture mechanical

Overview of the portfolio

thyssenkrupp Steel supplies special steels for all large-diameter pipe applications

CO₂ transport lines according to ISO 27913

Sour service pipes according to API 5L, Annex H

Pipes for transporting hydrogen according to the EIGA Directive

Oil country tubular goods (OCTG) according to API 5CT

Line pipes of product class PSL 2 according to API 5L/DIN EN ISO 3183, with DWT test on request

Structural pipes and sections according to DIN EN 10219-1 and API 5 PSL 1

Water tubes according to DIN EN 10224 and API 5L PSL 1 Making an important contribution to the development of an efficient hydrogen infrastructure with pipeline steels: from I.: Mark Hirt, Axel Duhr, Armin Büttgen.

characteristic values are required to ensure operational safety. To put it simply, we look at the resistance of the material to crack growth."

thyssenkrupp Steel is ready to meet the growing demands on its specialty steels and optimize existing concepts together with steel pipe producers. "How our special steels behave in a specific application is best tested in interaction with our customers on the pipe itself," Armin Büttgen summarizes. From the point of view of the Duisburg-based materials specialists, it is clear what needs to happen to realize the vision of a European hydrogen infrastructure: "We urgently need the regulatory framework to be clarified, and to have the pipeline industry carry out proactive testing and research activities."

Ready for hydrogen: for thyssenkrupp Steel, achieving this quality criterion is a desirable goal not only from a sales perspective. Rapid expansion of the hydrogen infrastructure is also essential for the company's climate transformation.

Web

More info on our pipeline steels can be found here: www.thyssenkrupp-steel.com/en/steel-for-line-pipes

Contact

Axel Duhr, Key Account Management Line Pipes & Export, axel.duhr@thyssenkrupp.com

Armin Büttgen, Customer Service Processing Industries, Pipe, SSC, Export,

eelcompact 02/2022

armin.buettgen@thyssenkrupp.com

Green transformation accelerated

Good news for climate protection: In September, the Supervisory Board of thyssenkrupp AG supported the Executive Board's decision to finance the corresponding equity portion of the investment in Germany's biggest **direct reduction plant** for low-CO₂ steel.

Copy Katja Marx

bout 2.5 million metric tons of directly reduced iron are to be supplied annually by the plant for further processing into premium flat steels – more than originally planned. The release of the corresponding equity portion for the investment will enable

thyssenkrupp Steel to accelerate the start of low-CO₂ steel production.

"With the officially confirmed approval by the Executive Board and Supervisory Board of thyssenkrupp AG, we are continuing to accelerate our path to climate-friendly steel production," comments steel boss Bernhard Osburg. "Our tkH2Steel® transformation project is the key to this. We are thus reaffirming our goal of playing a leading role in the competition for the green steel markets of the future and supporting our customers in achieving their decarbonization targets."

Premium quality is retained

As part of its transformation strategy, the company is pursuing a plan to successively replace its coal-based blast furnaces with hydrogen-powered direct reduction plants. The iron produced there, which will have been directly reduced with hydrogen, will then be liquefied



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The joint memorandum of understanding by the state government and thyssenkrupp Steel on the 'tkH2Steel[®]' project is an important step for the transformation of industry in our country."

Hendrik Wüst, Minister-President of North Rhine-Westphalia

high-quality hot metal. The innovative concept has a decisive advantage over other discussed methods: all subsequent production stages for the manufacture of steel are retained. In this way, thyssenkrupp Steel will continue to produce its entire premium product portfolio using technologies optimized over decades – and with a significantly smaller carbon footprint.

The company is already seeing growing demand for CO_2 -reduced steel products, the first volumes of which have been available under the bluemint[®] Steel brand since October 2021. This is based on real CO_2 reductions in the conventional manufacturing process, which are allocated to a specific product quantity in the balance sheet. The procedures used in this process have been confirmed by internationally renowned certifiers.

With the accelerated expansion of production capacities by means of direct reduction, the company is now making a further important contribution to achieving national and European climate targets. Osburg: "From 2026, we will supply our customers with around three million metric tons of premium steel per year produced with low CO_2 emissions, considerably more than previously planned. In addition, we are fulfilling our social responsibility and are reducing the CO_2 emissions of our production by just under 20 percent in the first step. That is 5 percent of the Ruhr area's greenhouse gas emissions."

NRW promotes DR plant

The North Rhine-Westphalia state government is supporting the green transformation of thyssenkrupp Steel with a mid-three-digit million euro sum. This is for the construction of the hydrogen-powered direct reduction plant at the Duisburg site. Politicians are hoping that the financial aid will have a leverage effect for further investments in future technologies. As the largest single consumer of hydrogen in the Rhine-Ruhr region, thyssenkrupp Steel is seen by the blackgreen coalition as an important driver in the ramp-up of the hydrogen economy, and the government wants the company to contribute to the transformation of the former coal region into a carbon-neutral industrial location.

Tekin Nasikkol, Chairman of the Works Council at thyssenkrupp Steel, sees the investment as a strong signal for the future, also from a skills perspective: "New innovative production concepts require new skills. We therefore want to prepare our employees specifically for the carbon-neutral steel production of the future."

Next steps in planning

In parallel with the increase in plant capacity, the company is also adjusting its climate targets. Chief Technology Officer Dr. Arnd Köfler: "We are now aiming to offer around five million metric tons of steel produced with low carbon emissions by 2030. With then two direct reduction plants, this also amounts to CO₂ savings of well over 30 percent compared to the reference year 2018."

With its project, the company also sees itself as a pioneer for other integrated steel sites. To ensure that work can proceed quickly, thyssenkrupp Steel is preparing the contract award and all associated planning steps. The first tapping is then scheduled to take place at Germany's largest direct reduction plant in the summer of 2026.

Web

More information about our climate transformation: www.thyssenkrupp-steel.com/climate_strategy

Contact

Mark Stagge, Head of Public and Media Relations, mark.stagge@thyssenkrupp.com

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Great things are happening here!"

At the end of the 1990s, she started as a trainee at the blast furnace – today **Dr. Heike Denecke-Arnold** is Chief Operations Officer (COO) of thyssenkrupp Steel and thus responsible for iron and steel production as well as quality and logistics. In an interview with steelcompact, the metallurgist reveals what has been driving her to work for Steel for 23 years and what her projects for the future are.

Ms. Denecke-Arnold, hand on heart: how are you feeling after about four months of exceptional circumstances in your new office?

The current situation is an enormous test for all of us – not just for me. In the last few years, a lot of things have come together for us – and on top of that, the pandemic and this war have exacerbated the situation. We had to restructure, resort to short-time working in some cases and generally act sparingly. I therefore have great respect for the commitment of the workforce – despite all the uncertainties. The green transformation and our Strategy 20-30, however, give us a strong perspective. For us and for our customers.

What can customers look forward to in the near future?

To the results of our hard work! We are moving ahead with important issues all over the mill. Many of my colleagues are working on Strategy 20-30 plant projects right now. Great things are happening here.

For example, the new walking beam furnace. I was allowed in before the start of production: the interior of the facility looks like a small cathedral – impressive is definitely the word for it. We will have significantly better surfaces and increase our production capacity. And the double reversing stand, for which we will lay the foundation stone in Bochum and serve the boom in non-grain-oriented electrical steel. Many things are now becoming real. We are a great company that does not need to be backward in

The fascination of glowing steel: under the direction of Dr. Heike Denecke-Arnold, thyssenkrupp Steel's new walking beam furnace produced its first slabs. In addition, investments have been made in further largescale plants.

> ڻڻ We have a key lever for shaping the transformation of an important industry."



A passion for the steel industry for more than two decades: Dr. Heike Denecke-Arnold wants to improve and develop the production performance of thyssenkrupp Steel.

CC One very important issue is stabilizing our production process. That is my personal focus."

coming forward and that, as a stabilizing factor in the Ruhr region, secures many jobs. We have great customers – that's why we give everything here.

Let's stick with the modern plants that are starting to operate now. For example, the new FBA 10 in Dortmund and the VA 13 in Andernach. What are the advantages here?

With the FBA 10 hot-dip galvanizing line, we can much better serve the demand for hot-dip galvanized sheet in the automotive industry. The VA 13 coating line in Andernach is the world's most modern plant for chrome(VI)-free packaging steel. We are proud of these major projects.

What feedback are we getting from the market from our customers?

We have a customer base that believes in us. They appreciate our company, our products and our quality. Looking ahead, customers are also very positive about the fact that we have introduced bluemint[®] Steel. Interest in green products is growing rapidly. And our customers also know that it is currently a major task for us to build new plants given the integrated gas supply systems that have been optimized over the years.

Given the challenges ahead: What is your focus looking ahead to the coming year?

One very important issue is stabilizing our production process. That is my personal focus. This naturally also includes optimized logistics and excellent quality performance. After all, the greatest demand is of no use to us in the end if we can't meet it. I am confident, however, because many good things have already been initiated here. Among other things, there is a comprehensive action plan that pays full attention to our Strategy 20-30. We are a great company that doesn't have to hide its light under a bushel."



Finally, a personal question: 23 years in one company – that's quite unusual these days. What is the attraction of thyssenkrupp Steel for you?

Steel is simply fascinating, it has a long tradition and yet is enormously versatile. The size of the plants and the red-hot steel – if you've never seen this, you're missing out! Then there's the mentality of our teams: the great cohesion here, the solidarity, even when things go badly. And: now we also have a central lever to achieve climate targets by converting our production and to shape the transformation of such an important industry. From trainee to Chief Operations Officer (COO): in conversation with steel^{compact}, Dr. Heike Denecke-Arnold describes what thyssenkrupp Steel means to her as a company. She reviews the successful implementation of Strategy 20-30 and takes a look at upcoming tasks.

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More information about Strategy 20-30 can be found here: www.thyssenkrupp-steel.com/en/interview-heike-denecke-arnold

Contact

Mark Stagge, Head of Public and Media Relations, mark.stagge@thyssenkrupp.com



In a new function: André Matusczyk (I.) as CEO/CTO thyssenkrupp Hohenlimburg and Simon Stephan as Senior Vice President Sales Automotive at thyssenkrupp Steel.

Under new management

Passing the baton at thyssenkrupp Steel. **André Matusczyk** hands over the management of Sales Automotive to Simon Stephan and becomes the new CEO/CTO of thyssenkrupp Hohenlimburg. Both gentlemen talked to the editorial team of steel^{compact} about the challenges of the new positions and of the material steel in times of climate protection and fragile supply chains.

Mr. Matusczyk, you headed flat steel sales for the automotive industry for many years. Now you are Managing Director of thyssenkrupp Hohenlimburg. Is the change also a farewell to the automotive world?

MATUSCZYK: In my new role, I am now responsible not only for sales but also for technology, production planning and quality assurance for our precision steel strip production. The more direct influence on the product makes my new task challenging but also extremely appealing. At the same time, my market access is broadening and with it my perspective on steel as a material. New to me, for example, is the business with cold-rolling and fineblanking companies, as well as certain applications in the agricultural machinery sector. But the automotive industry also remains an important part of my work. The specialty product precidur[®] precision strip is in demand above all from auto manufacturers and the cold-rolling companies that supply them.

Mr. Stephan, the journey from China to the Ruhr was much longer for you...

STEPHAN: Yes, but only geographically. The product landscape of premium steels for the automotive industry was already my bread and butter in China. There, I was most recently Managing Director of Tagal in Dalian, a joint venture between thyssenkrupp Steel and Ansteel. Tagal

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operates four modern hot-dip galvanizing lines for high-quality automotive sheet metal in China with various partners. Before that, I gained experience as Managing Director at an international automotive supplier, among other things. I am therefore also not unfamiliar with the demand side. At Sales Automotive in Duisburg, the marketing of powercore[®] electrical steel is new to me, a very special challenge in view of the upcoming mobility and energy turnaround.

It's obvious that you both have a passion for steel. What exactly is this fascination?

STEPHAN: Steel is the most successful lightweight material in automotive construction. And the success story is continuing. Because lightweight steel construction naturally continues to be an important topic for electric vehicles. The main reason for the continued high use of steel is the cost-effectiveness of the material – important for making individual mobility affordable for everyone in the future. However, steel is also indispensable in the generation of renewable energy from wind and water power. Without our material, there will be no energy revolution and no mobility revolution.

MATUSCZYK: Steel has been processed in our region for more than 400 years, precision steel strip in Hohenlimburg for 150 years now. Today, Hagen and the Sauerland region are an important center for the cold-rolling industry in Germany. And we supply high-quality precidur® precision strip starting material with the tightest tolerances for our customers, half of whom produce within a radius of only 60 km from our plant. For me, however, the fascination of steel as a material also lies in its universal use and continuous further development to its current level of performance. It is not for nothing that we refer to hot-rolled precision strip from Hohenlimburg as Precision Steel.

> On a flying visit to thyssenkrupp Hohenlimburg: Simon Stephan (r.) visits CEO/CTO André Matusczyk, his predecessor in office as Senior Vice President Sales Automotive.

What exactly characterizes the steel of tomorrow?

STEPHAN: Especially for body and strength-driven structural elements of electric vehicles, the requirements are increasing. The best example: the battery housing, which must protect the sensitive voltage source of the electric vehicle in the event of a crash. In addition, demanding applications with complex requirements for formability at the same time as a high final strength call for optimized materials. Here, we are in the starting blocks with the third generation of AHSS steels, modern ultra-high strength jetQ multiphase steels. At the same time, we are continuing to optimize steel technologies which have been established for decades, such as hot forming. Compared with current market solutions, our new AS Pro surface coating, for example, significantly reduces process-related hydrogen absorption and thus the risk of hydrogen-induced cracking in components made from ultra high-strength MBW[®] manganese-boron steels. N

Simon Stephan succeeds André Matusczyk in the position of Senior Vice President Sales Automotive. Previously, he was General Manager of TKAS Auto Steel Company Ltd., also known by the brand name "Tagal", in Dalian, China.

André Matusczyk has been CEO and CTO of thyssenkrupp Hohenlimburg since May 2022. Previously, he was CEO of the Automotive business unit and Head of Sales Automotive at thyssenkrupp Steel.



MATUSCZYK: New highly ductile, microalloyed precidur® HSM HD steels offer the best prerequisites, for example, for lightweight, crash-resistant and economical vehicle seats without compromising comfort. In agriculture, there are also applications where steel materials are in great demand: the cutter bar, for example – a heavily loaded component with a high degree of complexity. Tight tolerances, high resilience and good processing properties are therefore generally characteristic of our development activities. However, the dominant issue for all of us in the coming decades is most certainly the decarbonization of the steel industry.

Good keyword: In view of climate protection and crises – what are the implications for our business?

STEPHAN: Not only that, if we want clean mobility, the material steel must also be produced without CO₂. All other industries have also registered their needs for CO₂-optimized products. We have developed our own technology for the transformation of steel production and set ourselves very ambitious targets. By 2030, we aim to supply a large volume of reduced- CO_2 bluemint[®] Steel products and achieve total CO₂ savings of more than 30 percent. We intend to be completely CO₂-free by 2045 at the latest. But that's not something that can be done lightly the technology is extremely expensive. We can only survive in international competition if the same rules apply to all steel suppliers. Here, in China, India and everywhere else in the world. Only governments can regulate that. At the same time, it must be clear to everyone that environmental protection and zero emissions do not come for free.

MATUSCZYK: Absolutely right. Climate protection also includes the sustainable design of all processing stages at specific sites. The use of renewable energies and green hydrogen is a key lever in a development that will accompany us for decades. Global supply chains represent a current challenge. That they are highly fragile structures is something we have known for some time, not just since the COVID pandemic and Russia's invasion of Ukraine. Long-term supply relationships, strategic partnerships and regional, robust supply chains are the basis for a

Web

The interview is also available online: www.thyssenkrupp-steel.com/en/interview_matusczyk_stephan

Contact

Sales Automotive, info.auto@thyssenkrupp.com thyssenkrupp Hohenlimburg, info.precisionsteel@thyssenkrupp.com



André Matusczyk (I.) and Simon Stephan together get an overview of the opportunities for steel in times of climate change and fragile supply chains.

high level of supply security and will once again determine customer relationships in the steel industry to a greater extent in the future. As a firm partner of the regionally concentrated cold rolling industry, Precision Steel is in a particularly good starting position here. A substantial part of the precision steel strip for the region is produced in Hohenlimburg.

Which topics and projects are particularly important to you in the coming months?

MATUSCZYK: I want to secure thyssenkrupp Hohenlimburg's excellent position as a specialist in precision strip with optimized tolerances and further expand it through systematic digitization, among other things – in the automotive industry and for our customers in other business areas. Through targeted diversification, we manage industry-specific risks and sustainably safeguard our broad product and application know-how.

STEPHAN: I am particularly happy to continue driving forward the development of our strong thyssenkrupp Steel brand. For me, this means working every day as part of a team to improve our position as a competent and reliable partner for our customers. In addition, my aim is to successfully support the strategic portfolio shift with a focus on ultra high-strength grades for the automotive industry and the rapid electrification in vehicle construction with a corresponding range of premium electrical steel grades.

Thank you very much and good luck to you both.

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Weighty advantages

After rasselstein[®] Solidflex, the tinplate experts from Andernach have succeeded in developing another material: a material grade suitable for use in the production of two-piece D&I food cans, where it can enable thickness reductions. Its name: **rasselstein[®] D&I Solid.**

Copy Katja Marx

&I stands for "drawn and wall ironed" – typically used to make two-piece cans for beverage and food products. The can body and bottom are made from a single part, which means the can does not have either the classic verti-

cal weld or the bottom seam to connect the body and the bottom. This increases the quality of the can, as precisely these areas are critical points of attack for corrosion.

"In the U.S., this type of can is increasingly replacing the three-piece variant because it can be manufactured more efficiently in high production volumes," reports Frank Elberskirch, Head of Technical Customer Service (USA) at thyssenkrupp Rasselstein. In the U.S., the market share of two-piece cans is currently already an estimated 65 percent, which corresponds to about 19 billion cans. "For our American customers, this packaging steel is therefore very attractive."

Potential for thickness reduction

thyssenkrupp Rasselstein therefore had the U.S. market in its sights in particular when it explored the potential of rasselstein® Solidflex technology for the development of other material grades. With success: in the near future, the D&I material will expand the portfolio. It allows manufacturers to further reduce the wall thickness of their cans while maintaining stability.

"Axial stability plays a key role in food cans, ensuring that products can be stacked safely over 10 meters high without the lower cans collapsing under the load. In addition, the filled can must withstand the external pressure during sterilization," summarizes project manager Anne Reichardt, a development engineer in application technology. "This is precisely where our newly developed packaging steel grade can show its advantages. It gives our customers the possibility to use this material to produce two-piece cans with higher strength values. Conversely, we can in turn reduce the thickness without sacrificing stability compared to the standard grade."



Reduced use of materials

Up to ten percent tinplate can be saved by using the new grade. This not only reduces the mining, use and transportation of finite resources, but also the environmental footprint of the can. Emissions can be reduced even further if the innovative rasselstein[®] Solidflex material is used in the lid, because additional sheet thicknesses can be reduced.

In the U.S., the new development from Andernach has already completed its first round of presentations. "We are currently in talks with companies that are interested in getting to know and testing the new material," says Jochen Lohscheidt, Head of Sales USA.

Web

Click here for more information on the thyssenkrupp Rasselstein experts and D&I material: www.thyssenkrupp-steel.com/en/dwi-can

Contact

Frank Elberskirch, Head of Technical Customer Service (USA), frank.elberskirch@thyssenkrupp.com

The production networks

tenova

thyssenkrupp Steel continues to press ahead with the implementation of its **Steel Strategy 20-30.** The focus here is on expanding production capacities in the areas of premium surfaces, sustainable packaging steels and high-quality electrical steel for electric motors. Three new plants are currently being ramped up. In addition, construction work is underway in connection with the expansion of the Bochum site into a center of excellence for electric mobility.

Copy Katja Marx

NEW HEATING TECHNOLOGY FOR PREMIUM SHEETS

In September 2022. the first slab passed through the new walking beam furnace in Duisburg hot strip mill 2. Since then, the state-of-the-art unit has been bringing up to 300 slabs per day to a uniform specified rolling temperature, in an energy-efficient manner, over an area of 54 meters. Different heating zones allow variable temperature control – in this way, the slabs can be provided in advance with special material properties. In addition, because the solid steel blocks are carried through the furnace and not pushed, as opposed to the previous technology, process-related scratches on the underside can be almost completely eliminated.

The new walking beam furnace from thyssenkrupp Steel ensures that surface defects are avoided when reheating and rolling slabs. This is achieved by special lifting and lowering devices which prevent surface damage to the slabs weighing up to 30 metric tons.

DUISBURG

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developing steadily

DORTMUND

PREMIUM SURFACES FOR THE AUTOMOTIVE INDUSTRY

More than 2,000 people work on the Westfalenhütte site – the location which, with production facilities and a world-leading development center, stands for the combined surface competence of thyssenkrupp Steel. Around 100 high-tech jobs have been added as part of the commissioning of FBA 10 in October 2022: the hot-dip galvanizing line, which is one of the most modern of its kind in the world, serves the increased demand for premium surfaces in wider dimensions. FBA 10 supplies high-quality zinc coatings, pure zinc and zinc-magnesium coatings (ZM Ecoprotect®) for all inner and outer skin panels, also in primetex® quality. In total, the expanded capacities will allow up to 600,000 metric tons of additional steel to be hot-dip galvanized each year.

With the FBA 10, thyssenkrupp Steel is setting an important strategic course to support the automotive industry as it switches to hotdip galvanized products. The new plant will be used, among other things, to produce zinc-magnesium products which are in great demand.

The cold-rolling mill at the Bochum site is equipped with a new double reversing stand and a new annealing and insulation line, thereby expanding it into a center of excellence for electric mobility.

BOCHUM

HIGH PERFORMANCE STEELS FOR ELECTRIC MOBILITY

On Essener Strasse in Bochum, thyssenkrupp Steel is driving forward the expansion of its plant into a center of excellence for electric mobility. An important milestone was reached with the laying of the foundation stone for a new double reversing stand in October 2022. In the future, this unit will be used to produce high-quality, non-grain-oriented electrical steel for use in high-efficiency electric drives. The trend towards ever thinner and highly silicized materials places particularly high demands on cold-rolling technology. The new rolling stand is capable of rolling particularly thin materials by means of an arbitrarily controllable number of forward and backward rolling operations – reversing, in other words. The new facility is scheduled to be completed by spring 2023.

The thyssenkrupp Steel magazine

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More information about Strategy 20-30 can be found here: www.thyssenkrupp-steel.com/en/investments

Contact

Mark Stagge, Head of Public and Media Relations, mark.stagge@thyssenkrupp.com

INNOVATIVE COATINGS FOR THE PACKAGING STEEL INDUSTRY

In fall 2022, thyssenkrupp Rasselstein will start production of special chromium-plated packaging steel at the new VA 13 coating line. The line uses innovative Trivalent Chromium Coating Technology (TCCT®) which is based on chromium(III) in the manufacturing process instead of the chromium(VI) previously used. Thus, the product manufactured on the line fully complies with the requirements of the EU REACH Regulation. The special chromium-plated packaging steel is typically used for the production of lids and bottoms for pet food cans, crown corks, paint cans and valve plates. The new coating line also enables the chrome-plating of even wider and thinner sheets.

ANDERNACH

On the VA 13 in Andernach, packaging steel is specially chromium-plated using an innovative process. The investments made for this are in the three-digit million range.



AHSS steels of the 3rd generation for high-strength automotive steel

jetQ: that's the name of the new high-strength steel jointly launched for the automotive industry by Japan's JFE Steel Corporation, one of the world's leading integrated steel producers, and thyssenkrupp Steel. The new products are the latest result of 20 years of **successful cooperation** and are now available on the global market.

Copy Jan Ritterbach

etQ are high-strength steel grades (AHSS) for cold drawing. JFE and thyssenkrupp have jointly developed and brought these to market to support global automotive customers in meeting the current challenges of vehicle design – in particular where electric mobility is concerned. The aim here is to achieve weight reductions – while at the same time



The thyssenkrupp steel team led by CEO Bernhard Osburg visited the production facilities of JFE to mark the 20th anniversary of the collaboration. increasing crash safety. But saving weight in particular is anything but easy with the bodyin-white. This requires materials in the high strength range that can be easily formed with a view to the demanding geometry of individual components.

International and innovative

The solution to this problem now comes from the international partners JFE and thyssenkrupp Steel. The purpose was to make the corresponding jetQ product variants in strengths of 980 and 1180 MPa available for automotive applications worldwide. Compared to conventional high-strength steels, the new AHSS grades have a higher yield point and toughness. The new grades also feature a very good balance between local and global formability. In particular, their high hole expansion capacity leads to more

Top 5 advantages of jetQ

New-generation AHSS with optimized local and global forming properties

Robust processing in the stamping shop

High lightweight construction potential

to achieve good hole expansion capability with high resistance to shear edge fracture

Optimized crash behavior compared with conventional DP steels





robust and reliable processing in the stamping shop. In combination with their higher yield point compared with conventional DP steels, higher crash energy absorption can be achieved in the event of a crash, while at the same time exhibiting more ductile behavior, which leads to thinner structural components and thus to a reduction in the weight of the component.

AHSS for the next generation

The special properties of jetQ products enable users to further reduce the weight of the body frame and meet increasing crash-related requirements. Dr. Patrick Kuhn, product manager for multiphase steel at thyssenkrupp Steel: "With the jetQ products, we are expanding our materials portfolio so that we can also provide our customers with optimum support for next-generation vehicles – including battery-powered electric drives."

Stefan Eiden, head of application technology in the Innovation functional area of thyssenkrupp Steel adds: With the joint development and marketing of jetQ steels, we have further intensified our successful global cooperation after 20 years, and leveraged additional synergy effects." And the Japanese-German cooperation is far from over: JFE and thyssenkrupp Steel have already set their sights on new targets and are working together to achieve even higher strength values. Kuhn: "By bundling development know-how, we are addressing customer demands for innovative material solutions in globally available product solutions." thyssenkrupp Steel has been involved in the development of the new AHSS grades from the outset: Dr. Patrick Kuhn (left) and Dr. Richard Thiessen.

About JFE

JFE Steel Corporation, one of the world's leading integrated steel producers, was founded in 2003. The company operates several steel mills in Japan and numerous branches and subsidiaries around the world. The company reported consolidated sales of 2.255 billion yen (1.555 billion euros) and consolidated crude steel production of 23.96 million metric tons in the fiscal year ending March 2021.

Advantages for the automotive industry

3 questions for Keiji Nishimura, General Manager Sheet Business Planning Department JFE.

Mr. Nishimura, JFE and thyssenkrupp Steel can look back on 20 years of successful cooperation. What major milestones have been achieved during this time?

The decision on joint research and development to develop the market for Q&P steels in 2020 is one of the most important milestones achieved in the stable relationship between JFE and thyssenkrupp Steel, which has existed for 20 years.

Where do you see the greatest synergy effects in terms of the expertise of the two partners in 2022 and beyond?

I see the most important synergy effects in the cooperation in the "carbon-neutral area", where each side has built up its own expertise.

What do you hope to gain from the joint marketing of jetQ and what are the advantages for customers?

I hope that JFE and thyssenkrupp Steel will use jetQ to tap into the new AHSS market in order to further expand the business with high-strength automotive steel and give OEMs the opportunity to produce lighter, safer, and lower-carbon vehicles on a global scale.



Praises the joint research and development work of JFE and thyssenkrupp Steel: Keiji Nishimura.



Stefan Eiden, head of application technology and pilot plants in the Innovation functional area of thyssenkrupp Steel, coordinates and pushes ahead the cooperation with JFE.

Web

Further information about AHSS steels can be found here: www.thyssenkrupp-steel.com/en/ahss

Kontakt

Dr. Patrick Kuhn, Product Manager Multiphase, patrick.kuhn@thyssenkrupp.com

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Welding galvanized sheets? It can be done!

Due to their specific welding behavior, galvanized steel sheets have rarely been used in chassis. However, the coating would provide much better protection against corrosion for the safety-relevant components than non-galvanized sheet. In a practical research project, the automotive supplier **Kirchhoff Automotive** and thyssenkrupp Steel worked out optimization possibilities for the welding process.

Copy Katja Marx



Ζ

inc-coated quality sheets are ideal for meeting the high corrosion resistance requirements of the automotive industry for safety-relevant components," says Melanie Dinter, sales engineer at thyssenkrupp Steel in the Automotive sales area.

But there is a catch: coated sheets are not ideally suited to the MAG welding process commonly used in this segment in the chassis. The reason: zinc has a lower boiling point than steel, so evaporation can occur on the surface, leading to increased pore formation. In addition, the zinc oxide that forms causes electrophoretic deposition coatings (EPD) to adhere less well.

Processing in focus

These impairments led to ungalvanized steel sheets still being predominantly used in the chassis. The reason is that what is called metal active gas (MAG) welding has become established worldwide. "The MAG welding process is extremely easy to automate and allows significantly higher tolerances than other welding processes," says Marco Queller from the Innovation department at thyssenkrupp Steel. "In combination with galvanized steel sheets, however, there is significantly more rework. As a result, processing takes more time and processes are more susceptible to disruption overall."

Combined materials expertise

Against this background, it was an obvious step for thyssenkrupp Steel to investigate the influences of different zinc coating systems with

For two years, Kirchhoff Automotive and thyssenkrupp Steel have worked in parallel in different welding laboratories to test the joining behavior of different galvanized surface coatings.



Melanie Dinter, sales engineer at thyssenkrupp Steel in the Automotive sales area, is pushing the practical research project ahead together with Kirchhoff Automotive.

regard to weldability and corrosion behavior. This resulted in a practical research project that the development engineers from Duisburg carried out together with their long-standing customer, the internationally positioned supplier Kirchhoff Automotive. "The decisive factor for the cooperation was above all promising further developments in the field of process control and regulation of welding processes," recalls Marco Oueller.

This cooperation was nothing new for the companies: they had already developed a process in 2019 to reduce silicate deposits during MAG welding. Dr. Jan Stuhrmann, R&D manager at Kirchhoff Automotive says: "Based on the positive cooperation in the past, we thought it made sense to also work on the topic of 'practically oriented welding of galvanized steels' so as to combine our expertise and carry out the investigations jointly." The new cooperation was therefore planned and implemented jointly from the outset.

Over a period of two years, the engineers tested different zinc surface coatings as well as various influences and process optimizations in the process parameters. The investigations were carried out on microalloyed and multiphase steels, such as the DP-K®330Y590T and CP-W® 660Y760T, in thicknesses of 1.5 and 3 mm. Because the tests were carried out in parallel in the welding laboratory in Duisburg and in the Attendorn welding technology center of Kirchhoff Automotive, equipment from various manufacturers was also used in the process.

In the end, the research partners reached a positive conclusion: "By choosing a high quality coating in conjunction with specific changes in the welding process, we have succeeded in improving the quality of the weld seam of zinc-coated sheets while at the same time optimizing the good corrosion properties. Decisive improvements in the process were also brought

Christian Dahmen from Kirchhoff Automotive (left) and Marco Queller from thyssenkrupp Steel taking a very close look during the surface assessment.



about by the use of modern electrical power sources, with which the heat input and thus also the current and voltage curves can be controlled in a more targeted manner," says Marco Queller.

Various combinations possible

The criteria for evaluation were the stability of the arc, the amount of pores and their size, as well as the amount of zinc evaporation, or zinc oxide and spattering. "A good compromise between weldability, quality and corrosion resistance is the common Z100 hot-dip galvanizing," says Christian Dahmen, technology development specialist at Kirchhoff Automotive. The zinc-magnesium coating ZM Ecoprotect® has also proven to be well suited. It has significantly improved corrosion protection compared to standard galvanizing.

"With ZM Ecoprotect[®], we have been able to achieve the best arc stability," reports Marco Queller. The knowledge gained will enable the research partners to significantly improve the welding qualities of galvanized materials in the future and to specifically reduce rework rates. At the same time, corrosion protection is ensured.



Dr. Jan Stuhrmann is R&D manager at Kirchhoff Automotive and coordinates the joint research project.

Web

More information on the MAG welding research project: www.thvssenkrupp-steel.com/en/mag-welding

Contact

Melanie Dinter, Product Management & Product Launches, melanie.dinter@thyssenkrupp.com

among other things, for support structures in solar farms.

In 2022, thyssenkrupp Steel has invested in new simulation tools and internal tests to further develop the scalur[®] +Z steel grades, our hot-dip galvanized flat product with the tightest tolerances and a very flat thickness profile, and to build up additional consulting capabilities for customers. "The computer-aided processes provide designers with information on, for example, which geometries are feasible and how thick or strong a material needs to be for the planned further processing and production properties," explains Roger Hannig, head of technical customer consulting SSC automotive at thyssenkrupp Steel. And all this without having to carry out time-consuming and costly real-life tests prior to practical use.

No room for errors

Steffen Jaekel, development team leader at furniture hardware manufacturer Hettich, which sources its materials from, among others, the steel service center Flachstahl Werl of thyssenkrupp Steel, explains why these characteristic values are so important: "In order to optimize our products, we need to know exactly how a material behaves under certain conditions. In order to simulate this reliably, we need, above all, precise material characteristic values. This is the only way we can quarantee the process accuracy in production that is crucial for our business." After all, as a renowned supplier to the kitchen industry, Hettich cannot afford any errors. The company's customers include well-known brand-name manufacturers, some of which deliver more than 5,000 kitchens per week. Ten or more drawer and runner systems designed by Hettich per kitchen guickly add up - high-quality and precisely processed materials are the be-all and end-all.

Development partner for many years

Hettich's optimized and efficient production processes owe much to the characteristic values for simulation generated at thyssenkrupp Steel. A circumstance to which the traditional family business from Kirchlengern itself has contributed a great deal. The two companies have been working together for many years in the field of materials analysis and product development. Specialist departments, simulation teams and

Showing profile together

thyssenkrupp Steel is placing its expertise in roll forming on a broader basis. To better support customers in selecting materials in the future, the company is now investing in additional **simulation technology.** Cooperation with longstanding partners is already showing the benefits this brings.

Copy Jan Ritterbach

oll-profiled slit strips are used in a wide variety of applications. For example, in the automotive, electrical or furniture industry. Among other things, this involves very application-specific rail elements. These are needed in

vehicles for the construction of seats, for example, and are also used in the production of ovens or in the furniture segment for drawer systems of all kinds. In addition, the importance of roll forming in the field of renewable energies is increasing. Here, roll-formed slit strips are used,

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materials professionals are in close contact with one another. "Some time ago, we were struggling with cracks in the material of our drawer guides in the rails," recalls Steffen Jaekel. To find out the reason, Hettich and thyssenkrupp Steel set up targeted joint analysis processes at that time. In the course of this, it was first possible to find the cause of the problems, which were then later successfully rectified.

The project was the prelude to the cooperation that continues to this day and benefits all parties involved. Jaekel: "The cooperation – and in particular the determination of characteristic values at thyssenkrupp Steel – gives us a better calculation basis for product development. That has helped us enormously. Even though we at Hettich have positioned ourselves very well in terms of simulation over the past ten years: We don't have the capabilities of thyssenkrupp Steel with its gigantic test lab like this."

On the other hand, the Duisburg-based steel supplier and development partner benefits from the telescopic rail manufacturer's distinctive know-how in forming processes, especially in the area of roll forming. "This is, after all, a core process of the Hettich company and, through the established transfer of knowledge, we can further expand our own expertise in this important forming process and also optimize our materials in this respect," says Roger Hannig.

All good things come in threes

An additional competitive advantage for Hettich's roll-formed telescopic rails is the fact that the slit strip supplier Flachstahl Werl (FSW-Industrials) means another partner is involved in the process chain at an early stage. FSW cuts the supplied steel into narrow strips

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The trend towards higher-strength materials reflects the increasing demands on roll-formed components. As the strength of the material increases, so does the process complexity of producing highly dimensionally accurate components. To this end, we support our customers with our products and our know-how. We look forward to hearing from you."

Thorsten Beier from the Application Technology department at thyssenkrupp Steel

for subsequent processing, thus forming an important link between steel production and subsequent finishing. "Because we are in continuous close coordination with thyssenkrupp Steel with regard to Hettich's special requirements, we can provide highly specific slit strip products at the time of delivery that differ in quality from conventional products," explains Sascha Zimmermann, sales manager at Flachstahl Werl. Zimmermann continues: "This three-way constellation, in which thyssenkrupp Steel, FSW and Hettich work hand in hand, has proven its worth and developed successfully in recent years. Last but not least, this also benefits the furniture industry's end customers."

Web

Click here for the online article with many more photos: www.thyssenkrupp-steel.com/en/roll-formin

Contact

Roger Hannig, Head of Technical Customer Consulting SSC automotive, roger.hannig@thyssenkrupp.com



Giving steel slit strips the necessary contours for use in rail systems is anything but trivial and requires several steps. So, in roll forming, slit strip is unwound and gradually shaped into a special form using several roller tools arranged in series. The roller sets used for this work extremely precisely and ensure that the material is given the profile required by the customer step by step through gentle forming movements. The result is longitudinally formed components with a high stiffness that cannot be matched by conventional deep-drawing and bending processes, for example.



Trio of experts: Roger Hannig from thyssenkrupp Steel, Sascha Zimmermann, Sales Manager at Flachstahl Werl, and Steffen Jaekel, team leader for development at Hettich. (from l.) Market and use cases — **7**

High Ductility: The full range in HD

The precidur[®] family is growing: thyssenkrupp Hohenlimburg is rounding off its portfolio of high-ductility materials for the automotive industry with new **HD grades**.

Copy Katja Marx

he regular development dialog with customers is an important event for the product development of the precision steel strip specialists: The challenges and needs that are formulated here provide the engineers with decisive indications of the application potential of new material

concepts. This was also the case with the newly developed high-ductility precidur[®] grades. "In discussions with the automotive indus-

try, the focus is always on improving steels so that, despite high strengths, they can be reliably formed into demanding component geometries," summarizes Maximilian Nagel, Senior Manager Application Technology at thyssenkrupp Hohenlimburg. The fact that standard grades are reaching their limits here is often related to the switch to electric mobility, as a result of which vehicles are becoming heavier. Consequence: in the new electric models, more weight rests on the chassis. This increases the strength requirements for the safety-relevant and sometimes very complex components used there.

Finer cutting, better bending

This is where the new precidur[®] high ductility grades HSM 380 HD, HSM 420 HD and HSM 460 HD come in: Compared to the proven micro-alloyed fine-grain structural steels of the company, they offer increased forming potential with the same strength. This becomes apparent, for

HD steels from thyssenkrupp Hohenlimburg improve process and component safety in the automotive industry.



Precision is everything: Maximilian Nagel, Senior Manager Application Technology at thyssenkrupp Hohenlimburg, inspects a hole expansion test.

example, in better bending and folding capacities, as well as higher process reliability during fine blanking. A hole expansion test carried out in the laboratory also shows that significantly optimized edge cracking resistance can be achieved with the higher-strength HD variants.

Another advantage lies in the chemical composition of the microalloyed steels, which have been specifically designed to meet the required properties in the narrowest scatter bands. In addition, the reduced manganese content results in better marketing opportunities for process scrap.

"All new HD grades comply with the requirements of DIN EN 10149 as well as VDA 239-100, and can therefore be used directly to replace the standard steels as well," says Dr. Andreas Tomitz, Head of Research and Development at thyssenkrupp Hohenlimburg.

With the latest product expansion, the company is not only closing the last gaps in its portfolio, but also supplying the right material concept for many different customer needs: "In the European market, we are currently the only manufacturer to offer the entire range of

precidur[®]-HD: All advantages at a glance

Enables complex component geometries even in high strength ranges

Increased forming reserves increase component safety

More stable manufacturing processes due to improved material properties

Available in dimensions from 2.15 to 5 mm and widths from 450 – 650 mm (HSM 380 HD) or 430 – 690 mm (HSM 420 HD). Other dimensions are possible on request. microalloyed fine-grain structural steels in the yield point range from 315 to 700 MPa with increased ductilities," says Maximilian Nagel.

More process and component safety

The high-ductility grades are used in the chassis of state-of-the-art electric vehicles – for example as subframes. Other applications are in transmission components such as plate carriers and in the area of seats. This is precisely where particularly high demands are placed on the safety of components. Maximilian Nagel: "HD steels not only provide greater stability in manufacturing processes thanks to their optimized forming capacity. They also increase the safety of occupants in the vehicle because they can withstand higher deformations in the event of a collision, and thus better withstand special stresses."



Helps to drive forward the development of new HD grades: Dr. Gerhard Gevelmann, Senior Manager Product Development at thyssenkrupp Hohenlimburg.

While grades 380 and 420 are already available with immediate effect, the 460 grade is still under development. "We currently expect to be able to offer the grade for series production from spring 2024 at the latest," says Dr. Gerhard Gevelmann, Senior Manager Product Development in Hohenlimburg. Common to all new grades is extensive characterization by means of material cards, which are made available to customers for material simulations. Sample sheets and test rings can also be requested at short notice for the precidur[®] HSM 380 HD and HSM 420 HD products that are available with immediate effect.

Web

Here you can find more information about precidur® HD grades: www.thyssenkrupp-steel.com/en/precidur-high-ductility-steel

Contact

Dr. Andreas Tomitz, Head of Research and Development thyssenkrupp Hohenlimburg, andreas.tomitz@thyssenkrupp.com

Heads the research and development department at thyssenkrupp Hohenlimburg: Dr. Andreas Tomitz. ΔΔ

Plenty of room for effective cooperation

thyssenkrupp Steel has created a new **office space** for some of its staff: 460 modern workplaces have been available for some colleagues in the new office building in Duisburg-Hamborn since September. And customers can also look forward to new possibilities for meetings, workshops and presentations.

Copy Jan Ritterbach





teelCube is the name of the new building on Franz-Lenze-Strasse, which impresses at first glance with its unusual appearance. "The elegant façade system consists of curtain-type, rear-ventilated liner trays, which are made from

our own steel," explains Thorsten Holtermann, who is responsible for corporate architecture at thyssenkrupp Steel. "For this, we processed 2,500 m² of pladur® reflections Pearl input stock in two bronze shades. This means the new building visually fits into the architectural context of the surroundings, while standing out from it in terms of color. The language of form in the existing building has been respected and interpreted in a contemporary way without copying what was already there." This creates a clear demarcation from the neighboring high-rise ensemble and the Alte Verwaltung (Old Administration), which appears both high-quality and down-toearth at the same time.

Flexible and functional

The new home of the administration is aligned with modern work requirements, which opens up new opportunities for both employees and customers. The concept is based on the idea that modern office workplaces must complement the world of mobile working. For this reason, the new office building is designed with functionality in mind, offering space for collaboration on the one hand and retreat areas for undisturbed work on the other.

In concrete terms, the floors are divided into areas for office use on the upper floors and areas for reception, product presentations, meeting rooms and a café on the ground floor. Another trump card of the new building is its increased flexibility: To make optimum use of the office space, all workplaces are equally equipped. The





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Behind the scenes



layout of the areas and offices was also carried out with the active involvement of the employees and takes into account the requirements of mobile working more than ever before. This makes it possible to get by with fewer workplaces. "The space concept allows users to act flexibly and choose the exact zone for the tasks at hand during the workday," says Thorsten Holtermann.

However, the new administration building is not only an eye-catcher and functional wonder – the non-visible values are also convincing. For example, the SteelCube meets the "Gold" standard of the German Sustainable Building Council (DGNB) and is certified accordingly. In this system, three sustainability areas of the building were rated positively at once: Ecology, Economy and Sociocultural.

The SteelCube also plays a leading role in terms of energy. In line with a KfW efficiency program, for example, triple glazing was installed across the board. In addition, district heating and cooling from the in-house thyssenkrupp Steel network is used to supply the buildings. The carbon footprint proves that building size does not necessarily mean large CO_2 emissions. The entire building was built to be carbon-neutral. Holtermann: "The emissions generated for the construction were recorded in collaboration with a climate protection specialist and compensated for by planting 3,000 trees in Duisburg."





Modern, functional, sustainable: that is the SteelCube, the new administration building of thyssenkrupp Steel.

Click here for the online article with many more impressions of the building: www.thyssenkrupp-steel.com/en/steelcube

Contact

Thorsten Holtermann, Corporate Architecture, thorsten.holtermann@thyssenkrupp.com

Multiphase steels for safe and light vehicle seats

With two new high-strength, cold-rolled multiphase steels with special forming properties, thyssenkrupp Steel is supplying the automotive industry with ideal materials for **weight-reduced seat structures**.

Application

Vehicle seats consist of complex safety and crash-relevant structural components. As is the case throughout vehicle construction, saving weight in these components is also a key issue. thyssenkrupp Steel offers two new steel solutions for this. Specifically, we are talking about uncoated dual- and complex-phase steels with strengths of 800 and 1,000 megapascals for lightweight structural components with high crash relevance and forming complexity. Firstly, the dual-phase steel DP-K® 440Y780T HHE for components in the seat frame with good deep-drawing and elongation properties. The grade offers impressively high work hardening properties, and absorbs significantly more energy in the event of a crash than conventional microalloyed steels. This is complemented by the complex-phase steel CP-K® 780Y980T, which increases the functional reliability of seat rails thanks to its maximum strength. Both materials allow a reduction in material thickness without limiting function and safety.



Processing

In addition to the possibility of weight optimization and good crash performance, both steels offer very good forming properties – the best prerequisite for efficient production of complex seat components. With its property profile, the robust DP-K[®] 440Y780T HHE is suitable for deep-drawn, flanged, complex structural elements such as the backrest side section. Its special analysis makes the grade more resistant to edge cracking in complex forming geometries. The CP-K® 780Y980T has an even higher hole expansion capacity, can be optimally processed by roll forming, bending and edging and is ideal for seat rails.



Sustainable lightweight construction

Thanks to high-strength multiphase steels, seat components can be designed thinner, thus reducing weight – and also saving CO_2 . With bluemint[®] Steel, the high-quality flat steel with reduced carbon footprint, maximum CO_2 savings are achieved – with the same excellent material and processing properties as the existing grades.

CC Lightweight construction, crash safety and forming complexity – these are the hallmarks of our new multiphase steels."

> Sarah Abraham, Product Management Industry, sarah.abraham@thyssenkrupp.com

Web More info on steel seat structures: www.thyssenkrupp-steel.com/lightweight-steel-seat-structures

Performance of **precidur**[®] increases customer satisfaction

As Technical Manager, Dr. Christoph Evers is responsible for the precision strip mill at thyssenkrupp Hohenlimburg, which has recently been able to carry out a number of very successful projects on the subject of **strip geometry**. In conversation with steel^{compact}, he reveals what matters to customers today.

Dr. Evers: What do your customers want when it comes to hot-rolled flat steel strip?

"Even higher precision and more resistant to wear" are requirements we hear from customers every day. In addition, the profile requirements are becoming more multi-faceted: i.e. from slightly to strongly cambered, to a box-shaped thickness cross-section. For example, a wellknown manufacturer in the cold rolling industry approached us for a project involving the production of rotationally symmetrical components from longitudinally split cold rolling strip. The profile trace achieved in this case proves the performance of the precision strip mill innovative precidur[®] with box profile. The big challenge is to manufacture in a reliable process within these tight tolerances, not only in trials, but on a 24/7 basis..

Targeted modernizations were necessary at various points to achieve this enhanced performance – Where exactly did you start?

The technological controls, and here in particular the profile and strip flatness control, are continuously being further developed. Specifically, the profile control was expanded to include additional backup points in order to display a profile contour in the controller and thus to be able to implement customer requirements even better. To improve and validate the roll gap setting, a profile measuring device was installed behind the intermediate train, so that we now know the profile of the transfer bar. With the new combination grinding machine, we are able to grind the profile of the backup and work rolls to tighter tolerances, especially in the roll barrel edge area, which has further improved the predictability of the actual roll gap. With the upgrading of the intermediate train, we can ultimately also enter the finishing mill faster and hotter, and allow the material to flow better. The increase in rolling force combined with two new drives and



a reinforced gearbox make the two interstands equally suitable for meeting the requirements of "even thinner and stronger".

What distinguishes the approach of your specialist department as a "problem solver" for customers?

We are very close to customers, and always ready to talk and develop the specific solution together with them. Our technically very experienced customer service with high material competence is known for this. As a team, we then jointly translate these requirements for the processes at the precision strip mill. The customer is closely involved in this process and follows the individual test steps at close quarters. We look forward to hearing from you!

Web

More about hot-rolled precidur[®] precision steel strip: www.thyssenkrupp-steel.com/en/precidur

Contact

Dr. Christoph Evers, thyssenkrupp Hohenlimburg, christoph.evers@thyssenkrupp.com

Dr. Christoph Evers shows the profile trace of precidur® with box profile – i.e the tightest tolerances – which can be produced in thyssenkrupp Hohenlimburg's precision strip mill.

We're looking forward to your visit! EuroBLECH 2022 October, 25–28 Hall 17 | Booth E33

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