

compact steel

Edition 04/2015

The thyssenkrupp Steel customer magazine
thyssenkrupp-steel.com



Story

From carmakers to breweries - our steel is used on all continents

Development

TRIBOND® is a pioneering composite material

Infographic

How does a transformer work, and what part does electrical steel play?

A strong brand

CEO Andreas J. Goss and design expert Michael Trautmann
on thyssenkrupp's new look

engineering. tomorrow. together.



thyssenkrupp

Contents

04/2015

View 04

New logo, new color, new slogan – thyssenkrupp has changed

Title 08

Our World Wide Web – steel from Duisburg is in use all over the world

Market + Use Cases 22

From coal to cookies – process gases converted into baking powder

06 News

Optimizing production – the RECOBA project tests and checks cutting-edge technologies

18 Development

TRIBOND® composite material – thyssenkrupp Steel has the first formula for it

24 Agenda

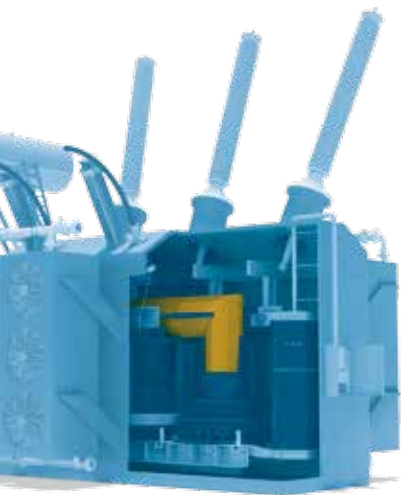
What does a brand say about a company? A conversation with Andreas J. Goss (CEO of thyssenkrupp Steel) and Michael Trautmann (CEO of thjnk)



In every part of the world

Manufacture locally, deliver globally – the expertise of thyssenkrupp Steel is in demand worldwide. Our special steel is found in LNG tankers and car gearboxes, but also in bottle caps. The use of cutting-edge technology plays a decisive role.

Page 8



16

Down to the wire

How does electricity reach an outlet? And what role do transformers play? An infographic explains.

14

Crucial for transformers: Electrical steel strips await deployment



22





Dear readers,

thyssenkrupp now has a brand new look. We have modernized our lettering and logo, picked out a fresh color, and updated our slogan.

What makes us think that now is the right time to make these changes? You will find out in our agenda interview with thjnk agency CEO Michael Trautmann, who helped develop the new brand, and thyssenkrupp Steel CEO Andreas J. Goss. Our new brand also includes an important promise: that you, the customer, will always remain the center of our attention. We will increase our efforts to listen closely to your needs, work with you to come up with solutions, and discuss them with you so as to better provide you with individual support through our combined technological expertise.

We are already working with you today to develop increasingly effective, market-oriented solutions that will have a permanent place in the global world of tomorrow. In addition, the cover story talks about flagship products that have already been produced or are pending successful release. For these and many other products we supply flat steel of consistently high quality, such as our new lightweight TRIBOND® composite. This innovative steel material offers undreamt-of characteristics that will benefit more than just the auto industry. Buckle up and enjoy this edition!

Sincerely,
Dr. Heribert R. Fischer
Director of Sales & Innovation



Nothing ventured, nothing gained: Holger Thielert (left) and Peter Liszio have already tried out a lot and put it into practice.

Title: Illustration: C3 Visual Lab; Photos: thyssenkrupp Steel Photography, Illustrations: C3 Visual Lab

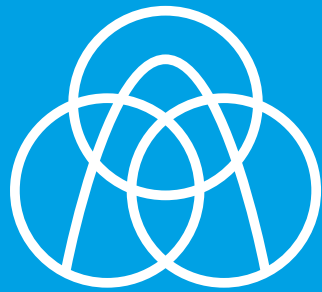
The new brand

ThyssenKrupp has become thyssenkrupp. But that's not all. There is more to the change in the writing style than meets the eye. Over the years, the company has developed into a modern, broad-based, and internationally active industrial group. And because the market is constantly changing, our strategic orientation and product portfolio must change as well. The time has come for a new brand.

Without the initial capitals, the original names are no longer separated from each other. What is more, the new signet merges the arch and the rings, the symbols of Thyssen and Krupp, into a unified whole. The Steel business is an integral part of this whole, while the bright blue in the logo is fresh, light, and inviting.

Today more than ever before, thyssenkrupp stands for outstanding development, guaranteed high quality, and close cooperation within the Group. At the same time, we serve as a reliable partner that you, the customer, can count on, a partner with whom you can develop innovative and market-oriented applications now and in the future. That is the meaning behind our new slogan: engineering.tomorrow.together.

engineering. tomorrow. together.



thyssenkrupp

Always stay flexible



How can complex production methods be optimized? The international research project RECOBA explores this question.

Even the slightest changes can positively affect the production of larger quantities of material, such as liquid steel, emulsion polymers, and silicon metal. It is therefore necessary to introduce innovative sensor technologies, employ new process models, and implement progressive control methods. The task of the RECOBA project is to test and demonstrate the applicability of these approaches. The consortium consisting of members from industrial companies, universities, and research groups aims to improve the product quality, energy consumption, raw material usage, and production costs of the processes in question. thyssenkrupp Steel is concentrating on optimizing the production process for liquid steel in secondary metallurgy, as pictured here in a vacuum facility for the treatment of molten steel at temperatures of 1,600 degrees Celsius (photo). New techniques for measuring the temperature of different treatment units are being developed with the goal of improving process management. The RECOBA project is funded by the EU. The goal of the project is to increase the competitiveness of European companies in the steel and chemical industry. Six million euros in funding has been earmarked for the project, which is scheduled to last three years. BASF SE (Germany) is coordinating the international project, which is a part of Horizon 2020, the EU framework program for research and innovation.

More information: <http://ec.europa.eu/programmes/horizon2020/> and <http://www.spire2030.eu/>

thyssenkrupp increases its international presence

Çetin Nazikkol has been appointed as CEO of the Group's Middle East & Africa region (MEA). The head of the regional office in Turkey faces a major challenge together with his team: developing new markets in approximately 70 countries with diverse languages and cultures.

In the United Kingdom, a new regional office has commenced operations. Terry Sargeant, who previously served as CEO Materials in the UK, will now also represent the Group as CEO UK. His goal is to exploit the numerous synergy possibilities presented by that region's business areas.

6.5 jobs

... in industry depend on one job in the steel industry – when viewed from a macroeconomic perspective. The steel industry therefore plays a decisive role in determining how competitive the German economy is in the international arena.

Successful research: XAR®MS with new grade

Good news from the heavy plate unit at thyssenkrupp. Considerable progress has been made in research into wear-resistant heavy plates from the XAR®MS series with a hardness of 400 Brinell and a thickness of up to six millimeters. The first step was to develop the concept of micro-alloyed, martensitic steel through extensive laboratory tests. Operating trials aimed at achieving suitable rolling and cooling parameters are currently in full swing. The tests will help ensure that the material is ready for operation as soon as possible.

Photos: Stefan Sychalski, Shutterstock, thyssenkrupp, Steel Photography (2)



A summer's tale in October: third place for thyssenkrupp's SunRiser in Australia.

Bronze medal for German SunRiser

The SunRiser from thyssenkrupp took third place at the world championship for solar cars in Australia. First place went to a vehicle from the Netherlands, while second went to a solar car from Japan. The team from Bochum University of Applied Sciences competed in the Cruiser Class, which emphasizes interior fittings, design, and comfort along-side speed and technical reliability. Experts from an American company even specifically recommended the SunRiser as especially suitable for everyday use. The two-seater sports coupé was the only German participant in the event, known as the World Solar Challenge. As in previous years, the car was created as a cooperative research venture between the University in Bochum and thyssenkrupp. ■

Decoiling center purchased in Belgium

At the port of Antwerp, thyssenkrupp now owns its own decoiling center with a staff of 25 employees. thyssenkrupp Steel Heavy Plate Antwerp specializes in cutting coils into sheets with strengths of up to 1,600 MPa and dimensions of up to 20 mm in thickness and 16,000 mm in length. The Steel Service Center is strategically located, with convenient access to ocean and inland shipping and direct connections to rail lines and long-distance rail services. ■



Lighter than its predecessor: a container with a bottom made of SCALUR®+Z galvanized sheet metal.

SCALUR®+Z – more strip per coil

A new product from thyssenkrupp Steel helps optimize production processes thanks to its exceptional thickness tolerance.

With a thickness of ± 0.06 millimeters, SCALUR®+Z offers considerably closer tolerances than conventional hot-dip galvanized sheet. This ensures that the customer receives a lot more meters of strip per coil, while also greatly reducing the set-up times required for further processing the product.

Scalor®+Z also allows closer tolerances, thereby ensuring consistently high production quality. And using the product also reduces the weight of

components. thyssenkrupp Steel offers these special tolerances for various steel grades with different coatings. Thanks to the broad range of products in the SCALUR®+Z series, the material is an ideal solution for numerous applications, such as profiles, runners, stampings, and container bottoms.

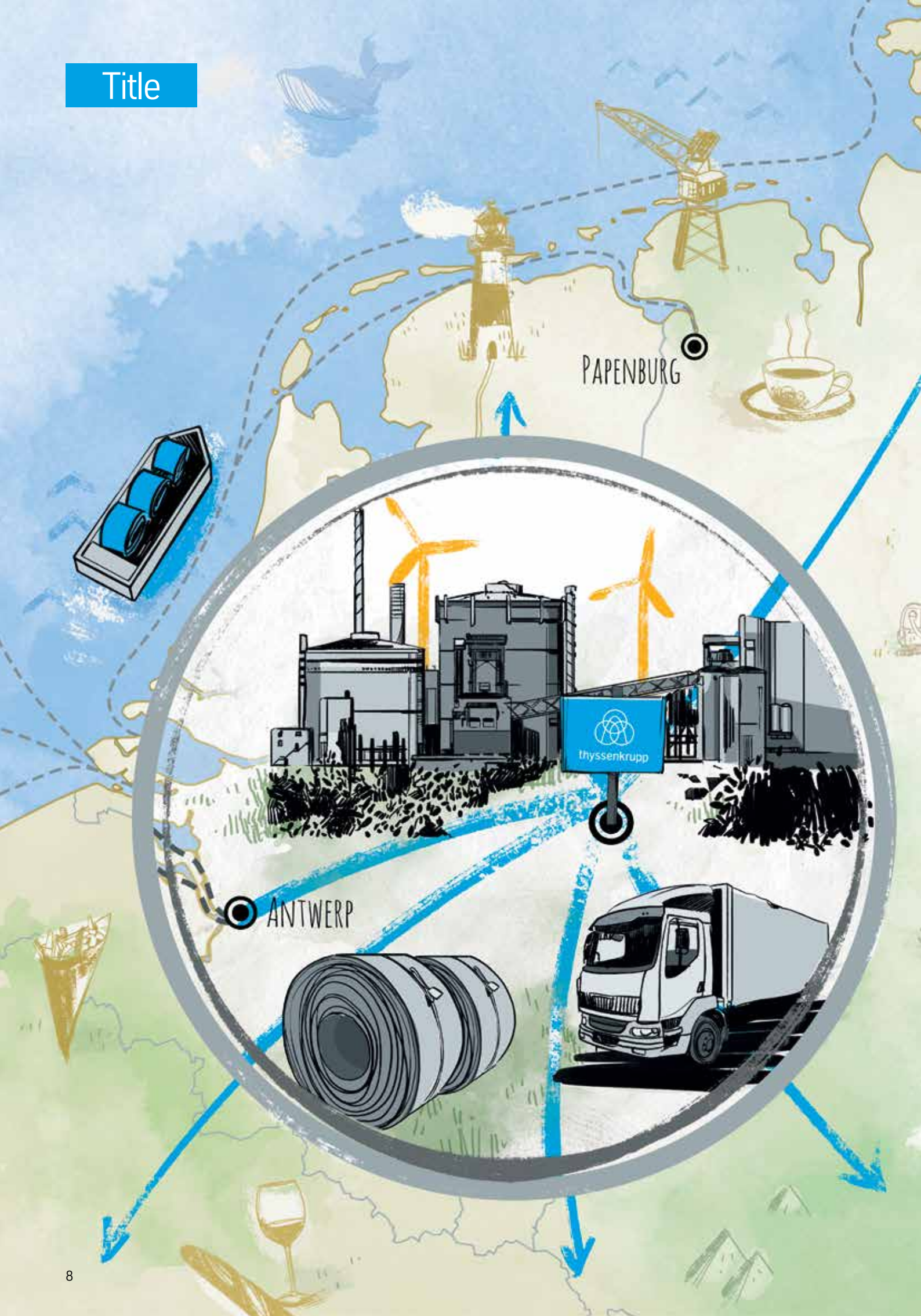
To find out more, visit: <https://www.thyssenkrupp-steel-europe.com/en/products/sheetcoated-products/scalor-z/scalor-z.html>.



New testing machine

A new tension testing machine for high-strength steel is now in operation at the Steel Service Center in Krefeld. It uses LaserXtens and VideoXtens cameras to measure mechanical values such as yield strength, elongation, and tensile strength better and more accurately than ever.

Title



PAPENBURG

ANTWERP



thysenkruip

Made in Germany

Produced locally, delivered globally:
Special steel from thyssenkrupp Steel is a
giant leap for innovation in many sectors.

Text Judy Born

Not a plane in the sky, not a ship in the harbor. New York has no skyscrapers, and Paris no Eiffel Tower. Tires roll through the streets past sidewalks lined with abandoned car upholstery. The houses have no handles on their doors, and there are no sinks or faucets in the kitchens and bathrooms. Everything goes dark after sunset, and people have to dress warmly against the cold, because radiators and lamps don't work without electricity. Wind power, solar panels, high-voltage pylons, transformers – none of these exist. It isn't the end of the world. It's a world without steel.

Nearly everything we hold dear contains steel. In Europe, company founders Friedrich Krupp and August Thyssen are partially to thank for this. The Krupp cast steel works was founded in 1811, and in 1891 the Thyssen group began with the expansion of *Gewerkschaft Deutscher Kaiser* and the tapping of the first steel at the new steelworks. Both companies played a crucial role in accelerating the pace of industrialization through the development of heavy manufacturing.

Today, thyssenkrupp Steel is the largest steel manufacturer in Germany, and Germany the largest in the EU. And German steel production ranks seventh worldwide. Roughly two thirds of the steel comes from integrated steel mills, where the material is melted in blast furnaces,

and basic oxygen steel plants. The remaining third comes from electric steel furnaces. From tin cans, baking trays, and household appliances to building facades, construction equipment, and pipelines, steel is everywhere to be found. And each year thyssenkrupp produces 12 million tons of it in Germany – 1,800 different grades and 2,000 alloys, with ever increasing ingenuity, value, and distinctiveness. They are often produced for special products originally developed in Duisburg and sold throughout the world.

The steel sector is extremely important for Germany as an industrial location, because it forms the basis of the German value chain. Successful innovations from other industrial sectors are often developed thanks in part to close cooperation with the steel industry. A quarter of Germany's total steel production goes to meet the needs of the construction sector, another quarter goes to the automotive industry. The other half is used in mechanical engineering, pipe manufacturing, metalware, and electrical engineering, as well as in steel construction itself.

thyssenkrupp Steel stands for effective solutions that originate from the Group's combined expertise and inventiveness and depend on close and trustworthy collaboration with our customers. These are important factors that help set apart both Germany as an industrial location and thyssenkrupp Steel itself.



The brewery saver: thinner crown corks for South America

Franz Dirrigl, who works in technical customer support in thyssenkrupp's tinplate operations in Andernach, says: "The thinnest crown corks in the world come from Peru." This is no empty boast; he can prove it. At 0.17 mm, the caps are approximately 20 percent thinner than the standard 0.22 millimeter thickness. "That may not seem like much for a single cap, but the difference is enormous in larger quantities," says Dirrigl. It means savings on materials, lower costs, and, last but not least, reduced CO₂ emissions. But why Peru, of all places? "Ten years ago, we were considering how we could increase the competitiveness of our tinplate products," says Sales Manager Miguel Valdivia. "Our customer Packing Peru was ready to support us in this endeavor from the outset." The easiest solution was to reduce costs by using less material. But as the sheet gets thinner, it becomes weaker. In order to ensure that the crown corks were stable, a stronger steel grade was required.

In the meantime, the product has established itself on the South American continent and is being used by almost every major brewery. European manufacturers were hesitant at first, but thinner caps are now becoming a trend here as well, primarily as a result of pressure from large, international beer corporations. Of the 100,000 tons of tinplate produced by thyssenkrupp Rasselstein each year for crown cork production, a third is already being made from the thinner material. And so the thinnest crown corks in the world also come partly from Andernach.

Contact: Miguel Valdivia, miguel.valdivia@thyssenkrupp.com

Fire under the lid: sheet metal improves U.S. barbecues

Curing, smoking, and grilling are hot topics. The process involves heating not only meat and sausages, but also the barbecue itself. The interior of the lid and the doors in particular must be exceptionally heat-resistant. This fact is not lost on the manufacturers at Weber. The American company produces gas, charcoal, and electric barbecues, from small, portable models to free-standing barbecues the size of a baroque display cabinet.

And Weber uses fal, a hot-dip-coated sheet developed by thyssenkrupp Steel, as the material of choice in its gas models. Fal is exceptionally resistant to chemicals and natural contaminants and can withstand temperatures of up to 800 °C. thyssenkrupp Steel has its American customer Block Steel to thank for the use of fal sheet from Duisburg in a premium product known throughout the world. The steel service center is based in Skokie, near Chicago. "Block Steel processes our master coils into tailor-made slit strips that are delivered to Weber on a just-in-time basis to be immediately used in the production of lids and doors," says Linda Nguyen of Sales Industry at thyssenkrupp Steel.

"We consider hot-dip aluminized steel a special product," adds her sales colleague Axel Duhr. "On the one hand, it provides the required material properties, and on the other, it meets the toughest surface requirements. That's why we are able to satisfy Weber's exacting demands regarding functionality and appearance." And that means the barbecue itself makes a good impression, and not just the guy behind it.

Contact: Axel Duhr, axel.duhr@thyssenkrupp.com



DURBAN[©]

Success on the Cape: From Duisburg to Durban

Pickup trucks are designed to handle rugged terrain, so they are an ideal vehicle for a safari. Anyone traversing the wilderness of South Africa in a Toyota Hilux pickup truck from now on will be surrounded by steel from Duisburg. That's because thyssenkrupp Steel is now supplying steel as a material for side panels, as well as floor panels and reinforcements for roof and chassis components. "This is really something extraordinary," says Stefan Slawik, Key Account Manager for Toyota in South Africa. Toyota is known throughout the world for its high expectations with regard to quality. "It shows just how much faith Toyota has in our expertise as a steel manufacturer, both in South Africa and in the company's homeland, Japan."

Galvannealed, a product with a zinc-iron coating that protects it against corrosion, is largely supplied from the Ruhr region. "This is a very special product that is primarily used by our Asian customers," says Slawik. The material is shipped from the Ruhr region to Antwerp via the River Rhine. From there it is loaded in the harbor for transport to Durban, where Toyota's production headquarters are located. Only a fraction of the many Toyota Hilux models remain in South Africa. The majority are sent to Europe or other markets. Johannesburg is yet another location where thyssenkrupp Steel delivers large quantities of steel. With a population of millions, this city is home to one of the most important Steel Service Centers in South Africa. All of the car manufacturers that number among Duisburg's key customers in Europe are also supplied via this route.

Contact: Stefan Slawik, stefan.slawik@thyssenkrupp.com

“There is still a lot more to do”

Where can improvements be made at thyssenkrupp Steel? And how can they be implemented? **Sudhakar Sivaji**, who is responsible for corporate planning, development, and strategic orientation, is looking for answers to these questions.

Interview Judy Born



How do you describe your job to people?

Sudhakar Sivaji: Strategy and supply chain management are tasks that have clearly defined goals. We strive to make optimal use of our Group's capabilities, generate more value for our customers, and thus also achieve our corporate objectives.

Do these goals conflict?

The market is demanding more and more flexibility and differentiation these days. Production, by contrast, hopes to achieve stability and standardization. My team and I are tasked with finding a solution that advances our customers and can be readily implemented.

What is your approach here?

At a strategic level and at the interfaces between sales, supply chain management, and production, it is absolutely essential to know the customer's value chain. How is our product processed? What is it used for? How does logistics function for the product? Why does the customer have a particular set of requirements with regard to a product?

You studied engineering. Has your practical background helped you?

Definitely, especially since my experience comes from another industry – aviation technology – and from other markets, namely India and the United States. That adds another dimension to my approach and helps me make pragmatic decisions. It keeps me from approaching issues from a perspective that focuses on production to the exclusion of sales, and vice-versa. I try to impart this to my coworkers, too.

You are also responsible for delivery performance.

How do you intend to make improvements here?

Until recently, we had only a single index for evaluating delivery performance throughout thyssenkrupp Steel, namely punctual delivery. It only indicated how much of the agreed quantities were delivered on time, independently of specific customer requirements and needs, project operations, and scheduled orders. We are now in the process of changing that. We are implementing control models for different delivery requirements and offering a range of different solutions on a customer-by-customer basis. But only – and this is the controller in me speaking – insofar as it makes financial sense. The new processes will enable us to manage delivery requirements individually and operate our plants better. We will continue to work on this transition in the years to come.

How will thyssenkrupp Steel develop over the next five years?

We are still in the middle of a process of renewal. Some things have already been done, but there is still a lot more to do. Our portfolio already enables us to react effectively to changes in the market. In the years to come, we will continue to differentiate our portfolio and will work in a much more customer-oriented way.

What about our activities abroad?

This area will also continue receive our attention. At present, ten percent of our sales are generated outside of Europe. That is approximately a million tons of steel from in and around Duisburg being sent all over the world.

Are joint ventures the only way to gain a foothold in a foreign market? And are they worth the risk of possibly losing expertise?

The pros and cons have to be weighed. Joint ventures are not the only way, but they do make entry easier, especially with regard to understanding a country's market, customer expectations, and cultural differences. Another important advantage is that the financial risk is shared. As far as expertise is concerned: The loss is unavoidable. Whether in China or India, there are enough clever people who will develop these technologies themselves sooner or later. And they may even do it better. Therefore, we at thyssenkrupp should not allow ourselves to miss these opportunities.

Sudhakar Sivaji has worked at thyssenkrupp Steel in Duisburg since 2008. He has lived and worked in Bangalore, India, as well as Phoenix, Arizona, and Berlin.



SHANGHAI



LNG tanks made of high-strength nickel steel: East Asia hits the gas

Shipyards in Shanghai can hardly complain about lack of work. They now have to manufacture 13 LNG tankers, each one 300 meters long and capable of holding up to 174,000 cubic meters of natural gas. The shipyards of Japan, China, and South Korea, too, are filled with dozens of ships destined to meet Asia's energy needs by transporting natural gas from all over the world. These tankers are difficult to build. In order to transport natural gas in a space-saving manner, it has to be frozen to minus 160 degrees Celsius and liquefied into liquefied natural gas (LNG). But temperatures as cold as this put a severe strain on the material. Normal steel would quickly become brittle and might break. That is why sheet with a high nickel content (nine percent) is used, which is significantly tougher.

It is very difficult to produce from a technical standpoint; the surface is prone to rapid scaling, i.e. an undesired iron oxide layer may form. In addition, the material must be tempered in accordance with strict temperature requirements in order to yield a material with the properties described above. "Very few manufacturers are capable of producing this kind of nickel steel," says Chris Van Beurden, Head of Export Sales at thyssenkrupp's Heavy Plate unit. "It is one of our top products."

But the material is in demand for more than just liquefied gas transport. In the future, more and more cruise ships will be using LNG as fuel, rather than environmentally damaging marine diesel. thyssenkrupp Steel's tank expertise is as popular with shipyards as it is with extraction companies. Special containers are being created in Saudi Arabia and Kuwait for crude oil that still contains a large percentage of highly corrosive sour gas. Extremely resilient sheet from Duisburg is used for these containers, too.

The auto world moves with hot strip from Hoesch Hohenlimburg

Anyone trying to get in gear today can easily avoid the hassle of shifting gears. Each year, approximately 28 million automobiles with automatic transmissions are manufactured, or 32 percent of the cars produced in the world. The global success of automatic transmissions is also due to the fact that the complicated parts are much less prone to faults than before. Precision steel strip from thyssenkrupp may be partly to thank for this. "We supply hot strip for many major manufacturers," says Barbara Timm, who works in technical customer support. "For some we are the sole supplier." Hot strip from thyssenkrupp subsidiary Hoesch Hohenlimburg is used in many important parts in automatic gearboxes, including shift forks and interior and exterior plate carriers.

The reason for this is that increasing demands are being placed on the material. The components in automatic gearboxes are supposed to become smaller, lighter, and more intricately shaped, yet increasingly stable. "It takes more than 30 steps to produce just a single part," says Timm. Normal margins of error are therefore out of the question. Manufacturers expect the steel at the beginning, middle, and end of a kilometer-long coil of hot strip to have the exact same properties. "We have set extremely narrow boundaries for ourselves as far as thickness tolerance and temperature control are concerned." As a specialist in precision steel strip, Hoesch Hohenlimburg is ahead of the competition in the area of error tolerance. That is the only way to ensure that hot strip yields the exact same results in every forming process. Barbara Timm also has a personal stake in the high-quality products that result. "When I get into my car at the end of a day, there's a gearbox with our hot strip inside."

The background of the entire page is a close-up photograph of several stacks of electrical steel sheets. The sheets are dark, metallic, and stacked in a way that creates a sense of depth and texture. The lighting is soft, highlighting the edges of the sheets.

Title

Focused efficiency at 0.18 millimeters

Half the electricity used by Denmark in a year: That's how much power Europe's transformers alone have to save by 2020, a job that calls for highly efficient electrical steel.

Text Falk Heunemann

The setting is a movie theater by the Danube River in Vienna. Attendees at the conference center put on their 3D glasses excitedly, because what they are about to see is not just another Hollywood blockbuster or animated film with three-dimensional effects. Instead, they behold a vision: the networked energy city of the future. A three-dimensional transformer is assembled step by step before their eyes in the conference center. It is the heart of the energy city of tomorrow.

The 3D animated film 'Transformer 2020' is the result of a study conducted by a partner network of leading European manufacturers in the transformer industry, a network that also counts thyssenkrupp as a member. In cooperation with customers, universities, institutes, and energy providers, the researchers designed a model of an ideal voltage transformer that is more reliable, quieter, and far more efficient than comparable models. The heart of this transformer of tomorrow is made of PowerCore®-brand, grain-oriented electrical steel and comes from thyssenkrupp Electrical Steel. "This material is a highly sophisticated steel product from a metallurgical standpoint. As a core material, it forms the heart of the transformer," says Peter Biele, CEO of thyssenkrupp Electrical Steel. "Manufacturing grain-oriented electrical steel requires a lot of experience and expertise," adds Régis Lemaître, Head of Research & Technology. The electrical steel specialist has plenty of both. The Gelsenkirchen location will celebrate its 150th birthday in 2016. And there are plants in France and India, too. More than 50 developers are conducting research at these three locations. And it is paying off. "Over the past 20 years we have lowered the power loss of electrical steel by nearly 40 percent," Biele reports.

The demand for efficient transformers will vastly increase in the future. One reason is the ongoing urbanization and industrialization process worldwide. According to the International Energy Agency (IEA), the demand for electricity will increase by two thirds over the next 25 years. In addition, a new Ecodesign Directive came into effect in the EU a few months ago. It mandates that the more than 3.6 million large and medium-sized transformers in Europe must become more efficient. By 2021, power loss must drop by 0.2 percentage points to 1.8 percent. That may not sound like much. But in practice it would result in a savings of 16 terawatt hours, or half the electricity used by Denmark in a year.

Photos: thyssenkrupp Steel Photography



Exciting exchanges: Peter Biele, CEO of thyssenkrupp Electrical Steel in a conversation (above); Andreas Jansen (below left) and Thierry Belgrand regularly discuss advances in development.

European Network

thyssenkrupp Electrical Steel is a member of TRANSFORM. The network brings together leading manufacturers in the transformer industry for the purpose of increasing the quality and efficiency of their products. One result is the forward-looking project entitled 'Transformer 2020.'

The other members of the network are GEA, HSP Hochspannungsgeräte, the Krempe Group, Maschinenfabrik Reinhausen, Nynas AB, Omicron electronics, Pfisterer, and Röchling Engineering Plastics.

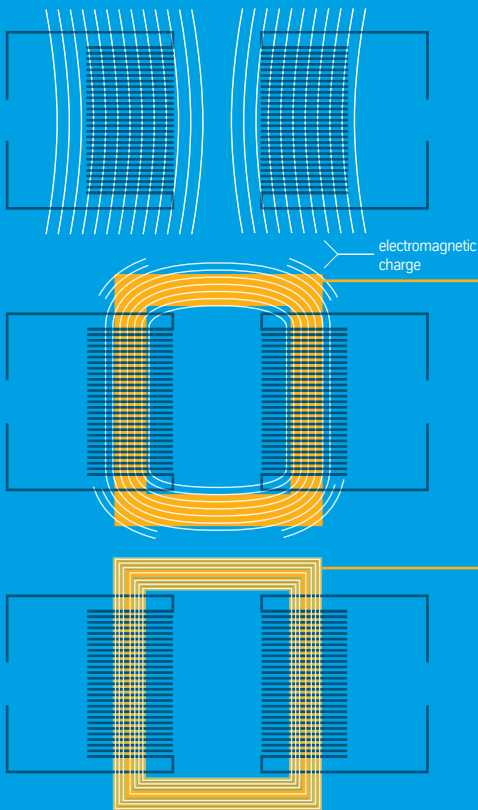
Biele praises the EU directive: "For us it is an enormous technological push." After all, this ambitious savings goal cannot be achieved without better transformer cores made of grain-oriented electrical steel. "We have been focusing on this for years, and we invested in innovative technologies at the right time." Today, thyssenkrupp Electrical Steel is one of only a small number of manufacturers in the world to produce the full range of these types of electrical steel. Thanks to the development of PowerCore® H18, it is possible to reduce not only energy consumption, but also noise levels. The electrical steel strip is now only 0.18 mm thick and makes transformers quieter. "This is also the result of highly successful cooperation with our customers," says Biele. "Because the technological infrastructure and the high level of materials expertise at thyssenkrupp are an added benefit that they value greatly."

Contact: Nicole Wiese, Sales Service,
+49 209 941 09857
nicole.wiese@thyssenkrupp.com

We make sure the voltage is right

Transformers are what makes electrical power available everywhere. Their cores contain electrical steel.

How exactly does a transformer work?



1 – The fundamental principle: induction

When alternating current is applied to a wire coil, the resulting magnetic field induces alternating current in a second coil. The voltage relation between the two circuits is defined in terms of the relationship between the wire windings. The frequency remains the same.

2 – Reinforced by an iron core

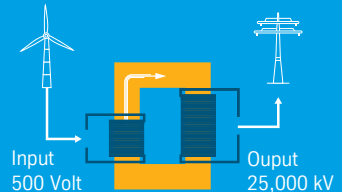
A core made of iron, nickel, or cobalt greatly reinforces the magnetic field and concentrates the magnetic current. Apart from so-called hysteresis loss, additional losses are caused by undesired eddy currents in the iron core. As a rule, the thicker the sheet, the bigger the loss.

3 – Much more efficient with electrical steel

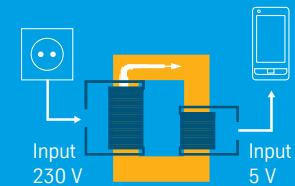
In order to minimize losses, transformer cores are made of ultrathin layers of coated sheet metal that are insulated from each other. In addition, the metal crystallites (grains) are oriented in a magnetically favorable direction to reduce hysteresis loss. This material is known as grain-oriented electrical steel.

Variants for every application

The voltage is adjusted by changing the number of wire windings in the coils.

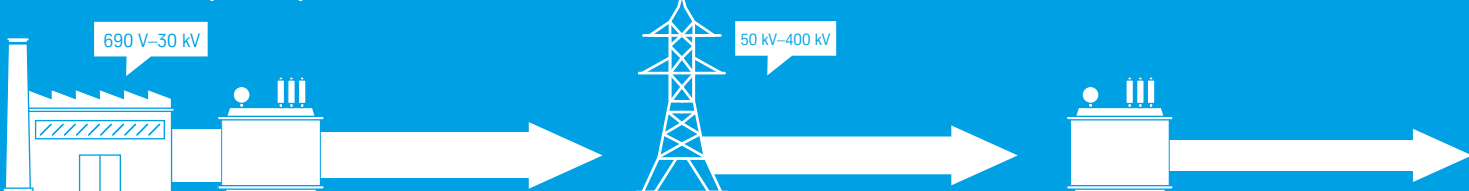


The voltage on the secondary coil increases when the number of windings is higher than on the primary coil. This enables energy from wind turbines to be fed into the grid.



In order to lower the voltage, the number of windings in the secondary coil has to be reduced. This is done in chargers and halogen lamps, for example.

The route from power plant to outlet



Depending on their size, power plants generate from 690 volts to several kilovolts (kV). The power cannot be transported at these voltages, because too much energy would be lost in the wires due to material resistance.

Different transformer substations in high- and ultrahigh-voltage networks increase the voltage up to 400 kV. This reduces the current and hence the resistance in the wires, making low-loss transportation of electricity possible.

Properties of grain-oriented electrical steel



Transformer cores are made of soft magnetic materials such as iron-silicon alloys that are easy to magnetize.



The grade of the material used in the transformer has a major influence on performance and efficiency during power conversion.



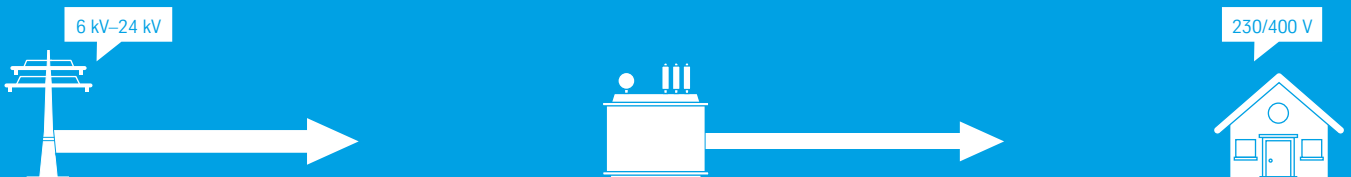
The thinner the transformer plates, the lower the number of eddy currents that occur. This reduces power loss.



Grain-oriented: A crystallographic texture and a high-performance coating reduce hysteresis losses and noise.



A power transformer is as tall as a single-family house and weighs as much as 200 mid-sized cars.



Medium-voltage networks distribute power regionally from high-voltage networks and supply key customers such as hospitals, factories and railways.

Transformer houses in residential areas reduce the voltage to a low 230 volts or 400 volts. This is safer for end users and requires only minimal insulation.



Joint success:
Julia Mura and Bernhard Osburg create new possibilities for automotive manufacturing with the introduction of TRIBOND® composite material.

The binding element

The development of **TRIBOND®** represents pioneering work by thyssenkrupp Steel in the field of steel composite materials.

Text Janine van Ackeren

Tires squeal. Metal grinds against metal. In the event of an accident, a car body should offer the occupants maximum protection. Introducing TRIBOND® by thyssenkrupp Steel, a steel for hot forming that should have car manufacturers sitting up and taking note. That's because it combines two properties that seem to be contradictory at first: It is a high-strength material, yet it absorbs the energy generated in a crash by deforming itself slightly. This property is also referred to as ductility.

TRIBOND® is therefore suitable not only for structural components such as B pillars, but also for elements that come under strain during an axial crash, such as longitudinal members and crash boxes. Its exceptional properties stem from its structure: "The TRIBOND® system, which combines high-strength and ductile steel, is suitable for the most diverse applications," says Julia Mura, Product Manager for Hot Forming Products at thyssenkrupp Steel. "This composite material is a kind of modular system. By selecting from a wide range of materials, we



Photos: thyssenkrupp Steel Photography

“We transfer the complexity from the process to the material itself.”

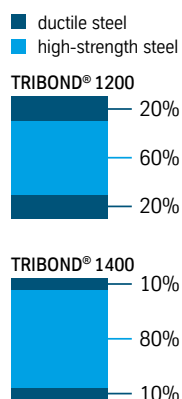
Dr. Julia Mura, Product Manager for Hot Forming Products at thyssenkrupp Steel

made by hot forming. “TRIBOND® will significantly increase the potential range of applications for hot forming in car bodies,” reports Bernhard Osburg, Director Sales Automotive at thyssenkrupp Steel. “Thanks to this layered material, we are able to offer automobile manufacturers a further solution that will help them comply with EU fleet limits that have been in force since 2013.”

Several large OEMs are currently evaluating the potential of the composite with a view to integrating the steel into their new car models. “We have already made investments to ensure that we are able to keep up with the increase in order quantities for the first models,” Osburg reports. “The production of slabs is the only truly complex part of the manufacturing process for this material. All of the other steps are the same as before.” Customers, too, can process TRIBOND® at their usual production and manufacturing facilities. And we offer yet another unique possibility: A special simulation model allows employees within the Group to conduct a crash analysis. This is a fast and easy way for them to determine whether the results meet their requirements.

But the range of applications for TRIBOND® is hardly limited to automobiles. On the contrary, the composite material can be used to advantage in almost every area in which the properties of the core are supposed to differ from those of the outer layers. Examples include wear protection, or areas that are highly prone to crack formation. thyssenkrupp Steel has recently introduced two grades to the market: TRIBOND® 1200 and 1400. However, the future will offer many more possibilities in this area.

Structure of TRIBOND® variants



can adapt its properties based on the intended application.”

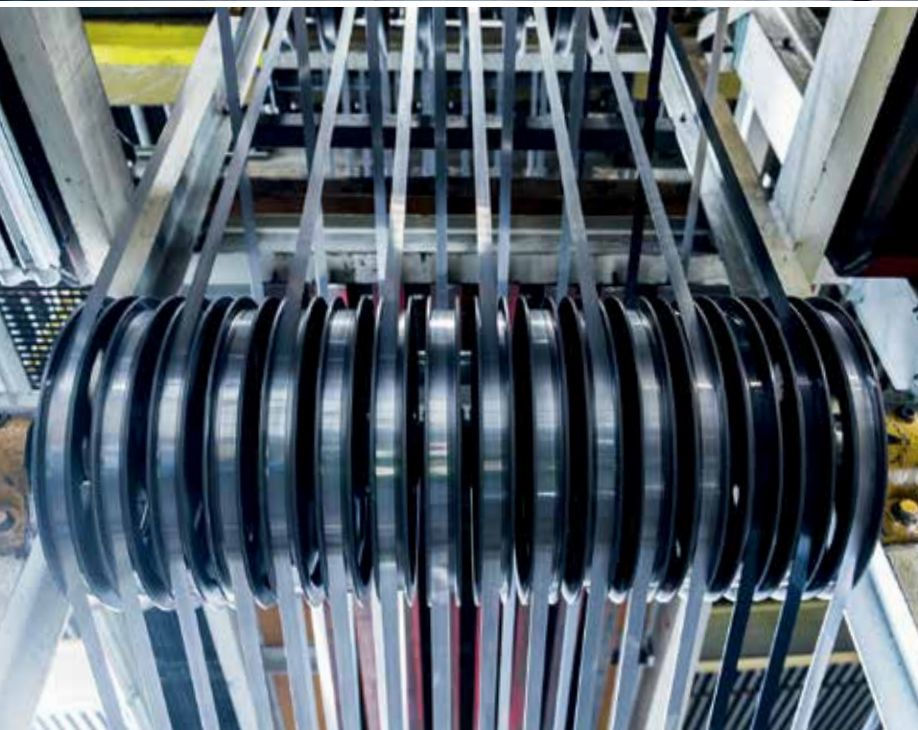
Increased process reliability

Until now, it was only possible to achieve high strength and ductility in a single steel via complex procedures, such as tailored tempering. This process requires setting a strength gradient by controlling the temperature during hot forming. But this approach presents a challenge: Operators have to have full control of the die, and afterwards they have to assume that the process has gone according to plan. “With TRIBOND®, we are able to preset the ductility to the required level during the production of the steel,” says Mura. “This means that we transfer the complexity from the process to the material itself. The customer is therefore ensured a much higher degree of product safety.” It is the only steel composite material of its kind in the world for hot forming. In addition, customers benefit from its exceptional lightweighting potential. Parts from the product family weigh up to ten percent less than comparable parts

Contact: Dr. Julia Mura, Product Management Automotive, warmumformung@thyssenkrupp.com



Spoiled: Strips of steel and plastic are constantly wound into rolls without a moment's pause.



Continuous operation: Steel strips roll rapidly through Rainer Kammer's production shops. Barbara Dornbusch ensures a steady flow of supplies from Duisburg.

Strapped down and all secure

Merchandise has to be packaged securely prior to transportation. **Signode** in Dinslaken makes steel and plastic strips for this purpose.

Text Marion Starke

The packaging tape shimmers like strands of tinsel that might decorate a Christmas tree the height of a skyscraper. The tape is made of steel, rolled flat and finely cut, with a wax finish. The festive atmosphere vanishes with a muffled thunderclap. The background is alive with hums, squeaks, and hisses. “That’s the cutting machine,” explains Managing Director Rainer Kammer in the production hall of Signode System GmbH, a member of the Signode Industrial Group. He is the picture of calm as he says proudly, “We will soon be celebrating our sixtieth anniversary at this location.” Beside him is Barbara Dornbusch. She works in Sales Industry at thyssenkrupp Steel in Duisburg and has been responsible for Signode for six years.

The system manufacturer not only makes packaging materials such as strapping tape, seals, and stretch wrap, but also designs and produces equipment to apply these products. “Signode’s greatest asset is its expertise in the areas of material development and equipment construction,” says Dornbusch. Approximately 150 employees roll, cut, and pack an average of 28,000 tons of steel each year in a production area measuring 27,000 square meters. Add to that more than 7,000 tons of plastic straps and 70 million seals. The products are used in a multitude of industries, from automotive and pharmaceutical, to

wood, metal, and furniture, and even graphic design. The main sales markets are in Eastern and Western Europe.

A truck rumbles up in the production shop. A cargo crane swings into action and sets to work unloading a coil; around 30 are unloaded here each week. “They arrive here fresh from Duisburg,” says Dornbusch. “Part of the material will be returned to us in a few days.” The reason for this is that the coils, which are delivered to Signode as starting material for steel packaging tape, are secured with Signode stripping. “In other words, we buy back the steel once it has been processed.” In addition, the used steel strips are recycled along with other steel scrap and reprocessed into coils yet again, a well-rounded process.

Steel as the binding element

In order to hold together a coil weighing between 18 and 25 tons, the packaging tape must be extraordinarily tough and resilient. The technical term for binding up a coil is ‘strapping.’

A coil has to be strapped quickly in the plant, because the hot strip mill binds new materials together permanently.

Signode began producing packaging tape in 1956. The business relationship with Thyssen, the company’s name at the time, began that same year and continues to this day.

But Kammer does not stockpile large quantities. thyssenkrupp Steel sends as much material to Dinslaken 20 kilometers away as is needed for processing the following week. The proximity of the two locations is a major advantage, especially when things go wrong. In August 2015, Signode’s cold rolling mill broke down. “The rapid reaction time and the short distance to Duisburg saved us,” says Kammer. Without further ado, a thousand tons of cold-rolled strips were rolled in Bochum and slit to 388 millimeters at the Steel Service Center in Krefeld. “We ourselves would have had problems, had Signode been unable to deliver. After all, we need the tape for our coils,” says Dornbusch. This goes to show what good cooperation is made of: communication, commitment, and expertise.

This customer-supplier relationship is years in the making. Signode Germany moved from Hamburg to Dinslaken in 1958 to be closer to customers and suppliers. For the steel group it was an interesting concept, because now the two companies would become both supplier and customer. And this connection is still bearing fruit today. In the summer of 2015, thyssenkrupp delivered the 2.5-millionth ton of steel.

Contact: Barbara Dornbusch, Sales Industry
+49 203 415 19805
barbara.dornbusch@thyssenkrupp.com

Now we can even make baking powder

An innovative testing plant belonging to thyssenkrupp Steel and Industrial Solutions can make **coke oven gas into baking powder**.

Text Judy Born

Anyone looking to make pig iron needs coke. Coke is produced by heating coal to more than 1,000 degrees in a furnace without air. Solid carbon and ash melt together and coke is the result. This process is referred to as coking. Hot gases are formed along the way. This coke oven gas contains a wealth of valuable materials that can be processed further. One of them is ammonium bicarbonate, also known as baker's ammonia. It is used, among other things, as the basic ingredient in baking powder.

Granted, the plant in Schwelgern is not yet able to produce raising agents for the housewives of Westphalia. But it's almost there. A testing facility just went into operation at the Schwelgern coking plant, and it managed to obtain baker's ammonia from coke oven gas. The complex process grew out of an initiative from Holger Thielert, an engineer at thyssenkrupp Industrial Solutions, and the managing director of the coke plant, Peter Liszio. Not only do coke plants need to be clean and environmentally friendly, they also have to be as productive and lucrative as possible. "What could be better than producing something new and marketable from gas that

arises as a byproduct?" Thielert asks. In constructing plants for Industrial Solutions and Steel, a wealth of experience has been gained regarding recycling and resource conservation. Both business areas worked closely with the Technical University of Berlin to develop these innovations in coking technology. Research is conducted, tests are run, and solutions are rejected here. The work goes on until theory is confirmed in practice. "That's usually when we step in," says Liszio. The two specialists, Thielert and Liszio, have known each other for decades. They started their careers at thyssenkrupp at almost the

"That's how cooperation between the business areas works."

Peter Liszio, Managing Director,
Schwelgern Coking Plant



Winning the bake off:
ammonium bicarbonate
from coke oven gas



Kindred spirits: Holger Thielert (left) and Peter Liszio are always looking for something new.



Photos: thyssenkrupp Steel Photography

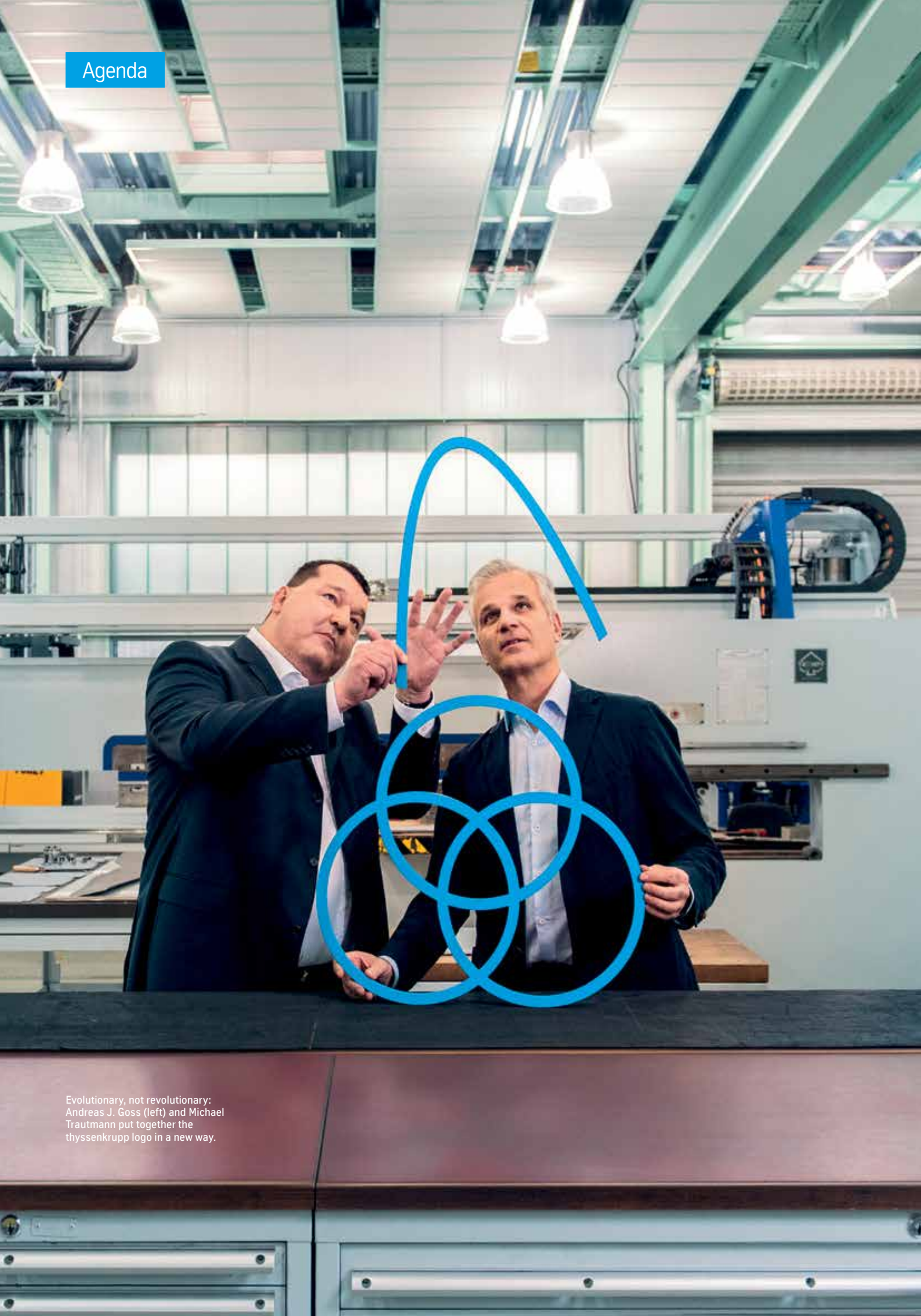
same time, and both are fond of thinking outside the box. Many of their ideas have been proven in practice over the years, and a successful business model has been built out of their numerous testing facilities. The best example is the coking plant itself. “This plant clearly shows how good interdisciplinary work can function,” says Liszio. And what works at Schwelgern also works elsewhere in the world. The coking plant is part of the integrated steel mill in Duisburg and is one of the location’s showcase facilities. And that makes it an ideal calling card for the Industrial Solutions business area, one that helps sell their plants worldwide.

For their latest project, Thielert and Liszio set out to make something useful out of coke oven gas. The outcome of their focused research work in this area has been the extraction of ammonium bicarbonate. This compound is used by the chemicals industry as an ingredient in fertilizer and in the production of

foam material. And as already mentioned, it also serves as the basic ingredient in baking powder. However, additional ingredients have to be added before it can be used in the kitchen. Sodium bicarbonate is one such ingredient. “We are stopping at ammonium bicarbonate, because that’s enough as far as our purposes are concerned,” says Thielert. “Our approach was to offer it as a chemical for fertilizer. The product does not meet the food regulation requirements yet. But it is possible.”

When a new idea is proposed, the first concern is whether it can be done; that much has been proven. The second is whether it pays off. Construction costs, profitability, and possible sales markets will be evaluated in the months to come. “If a plant like this pays off, I would be glad to set one up here,” says Liszio. A reference site would also help employees from Industrial Solutions sell the plant. “And if it is built here in our home market, all the better.”

Agenda



Evolutionary, not revolutionary:
Andreas J. Goss (left) and Michael
Trautmann put together the
thyssenkrupp logo in a new way.

“The external expression of an internal change”

Andreas J. Goss, CEO of thyssenkrupp Steel, and Michael Trautmann of the advertising agency thjnk explain our new brand.

Interview Falk Heunemann

Mr. Trautmann and Mr. Goss, what was wrong with the old brand?

Trautmann: Everything has its time. The old way of writing the name ThyssenKrupp with an uppercase T and K, the old, unconnected logos in a circle, and the dark blue color were the right symbols prior to the merger. They served to signify that two large steel companies with long traditions had come together. However, thyssenkrupp has merged since then. And it is for this reason that we have worked together to develop a brand to demonstrate that the company is a modern technology group that has grown together.

Are you satisfied with the end result, Mr. Goss?

Goss: Absolutely. The new brand is not just an attractive look, but the external expression of an internal culture change that has taken place in the Group. It is modern, clear, and points to our future. And in point of fact, we worked out the basis for it ourselves. We interviewed more than 6,000 stakeholders (customers, employees, owners) and experts and conducted highly contentious discussions about what actually makes us who we are and how we want to be perceived.

Trautmann: That's true. In the history of our agency we have never cooperated on a branding project that was prepared so effectively and thoroughly by the customer.

Then why not a completely different logo, a completely new name?

Goss: That was out of the question. We wanted evolution, not revolution, so as to combine our tradition with change. On the one hand, it shows that we are conscious of our qualities and our 200 years of history.

On the other, it indicates that we want to become better, for example with regard to customer relations and closeness to customers.

Trautmann: It is important that the public recognize thyssenkrupp. As an agency, we cannot simply come in and announce that we are going to design something completely new. Instead, we have to pay attention to the values that set the company apart.

Why was this necessary now?

Goss: The time had simply come, and it was part of the Group's Strategic Way Forward. We have stabilized ourselves after a difficult phase and have once again earned the trust of customers, shareholders, and employees. We have developed a new mission statement and formulated a new customer promise externally. Both of these will lead us into the future. The new brand is a logical step in this process.

Trautmann: Look at effective brands like Coca Cola. They have remained true to themselves internally, despite having constantly developed their look, because they too are subject to changes in fashion. Anyone interested in staying attractive in the long term has to readjust again and again. That holds both for companies with consumer business and B2B companies.

There is also the new slogan 'engineering.tomorrow.together.' What does it mean?

Goss: It says who we are in a way that is concise, clear, and comprehensible. Engineering means that we are a technology partner for our customers. Tomorrow stands for our relation to the future.



Michael Trautmann (left) and Andreas J. Goss at the Interview.



“Anyone interested in staying attractive in the long term has to readjust again and again.”

Michael Trautmann

► We don't satisfy ourselves with what works today or worked yesterday; instead, we also think about the markets of tomorrow. Together means we don't work in isolation; we think in conjunction with our customers and with everyone involved in the production chain. **Trautmann:** A slogan like this has the inestimable advantage of expressing a company's promise in just a few words. It provides guidance for all employees and serves as an orientation for customers. In the case of thyssenkrupp, it expresses three things at one and the same time: what the company does (engineering, in other words, finding solutions), why it does it (tomorrow, thinking about the future), and how it does it (together).

What do customers think of the new appearance?

Goss: The new brand and slogan and the new promise to customers do nothing for customers in and of themselves. Everyone in the company now has to bring this triad to life, to implement our claims in reality. And we will do it, too, because our credibility is at stake.

Trautmann: InCar®plus is a good example. In 2014, more than 40 automobile innovations were developed here, both across organizational boundaries within the Group and in cooperation with customers. So before it was even formulated, the slogan engineering.tomorrow.together was already being lived.

What else will people see of the changes, apart from the fact that a new logo will appear on products and stationery in the future?

Goss: A great deal. For example, we want to intensify cooperation with customers, contribute our technological expertise to



“The goal is to create a new self-image, one that is already being lived in the company.”

Andreas J. Goss

People

Michael Trautmann

and his advertising agency thjnk developed the new branding for thyssenkrupp. He is the founder and CEO of the Berlin-based agency group with locations in Berlin, Düsseldorf, Hamburg, Munich, and New York. Customers include Audi, Commerzbank, Ikea, McDonalds, Rewe, and RWE.

Andreas J. Goss

has served as CEO of thyssenkrupp Steel since 2014. Prior to that he worked in the company as Chief Financial Officer. And before coming to work at thyssenkrupp, the business economist fulfilled a number of managerial roles in the Siemens Group for 18 years.

networks to an even greater extent, and work on our shortcomings even more intensively in order to be rid of them once and for all, for example improving punctuality for deliveries or reducing time-to-market for new products. Our goal here is to create not just a new label, but also a new self-image, one that is already being lived in the company.

A whole series of brand names that customers have gotten used to will now be discontinued, for example Rasselstein. Why is that?

Trautmann: When a company focuses its energy on just a few brands, the chances of impressing them in the minds of decision-makers is much greater. At the same time, the effort and expenditure is easier for the company to manage.

Goss: We want to use the new brand architecture to present thyssenkrupp as an overall group with multifaceted expertise. This has not always been recognizable for the customer, due to the more than 180 brands used by the company. We will proceed very carefully with the new organizational structure, exercising sound judgment and making decisions on a case-by-case basis. The name Rasselstein, for example, has a long tradition and will be preserved. But in the future, the customer will no longer buy their tinsplate products 'from Rasselstein,' but will purchase a Rasselstein product from thyssenkrupp.

How soon will the new look be implemented?

Goss: Our goal is not to repaint the trucks and replace the nameplates overnight, regardless of the cost. Rather, our intention is to allow ourselves as much time as necessary for the process. But the biggest changes will become noticeable within the course of a year. One thing is clear: We want to be recognized and evaluated based on our brand, our slogan, and our promise. And we are ready for that.

Photos: thyssenkrupp Steel Photography

Dates

2016

February



DACH+HOLZ 2016,
2–5 February, Stuttgart,
Hall 7, Booth 7.211

The leading trade fair for the roofing and wood construction industry is an absolute must for every professional craftsman, from carpenters, roofers, and plumbers to architects, planners, and engineers. thyssenkrupp Steel will be showcasing its organic coated PLADUR® materials with numerous decorative and functional surfaces. PLADUR® StandingSeam, a product developed especially for hand-crafted metal roofs, is the focus of its trade fair presentation. More than 500 exhibitors will present their products and services in 70,000 square meters of space at DACH+HOLZ International 2016.



Tube 2016
4–8 April, Düsseldorf,
Hall 3, Booth C28

International experts keep abreast of the latest developments in their field at the tube and pipe industry's international trade fair. The focus is on the tube trade and on forward-looking trends involving machines and facilities for manufacturing and processing tubes and accessories. At a booth shared with other subsidiaries, thyssenkrupp Steel will present new and innovative steel grades for the manufacture of steel tubes and pipes.

April

Bauma 2016
11–17 April, Munich,
Hall A6, Booth 550

Every three years, this international trade fair unites all things renowned and reputable in the international construction sector. A driving force for global innovation, it serves as a marketplace for the industry and presents an exceptional number of innovations. thyssenkrupp Steel is represented in the heavy plate section, where it will present special structural steel XAR® and tempered steels N-A-XTRA® and XABO®.



May



CWIEME 2016
10–12 May, Berlin,
Hall 4.2, Booth E20

CWIEME is considered the leading international trade fair for coil winding, isolation, and electrical manufacturing. Suppliers and globally active manufacturers from the automotive, energy, electrical, and electronics segments have been meeting here for 20 years to exchange information. The trade fair also features an accompanying conference program. thyssenkrupp Steel experts specializing in electrical steel will present grain-oriented and non-oriented product solutions for the electrical industry at a joint exhibition booth.

As Head of Marketing, Achim Stolle is responsible for publications and events geared towards customers and business partners.
+49 203 524 1005, achim.stolle@thyssenkrupp.com

CREDITS

Published by:
thyssenkrupp Steel Europe AG
Kaiser-Wilhelm-Strasse 100
47166 Duisburg, Germany

Tel.: +49 203 520
Fax: +49 203 522 5102

Editorial staff:
Kilian Rötzer (legally responsible)
Communications
—
Christiane Hoch-Baumann (hob)
(Editor in Chief)
Marketing
Tel.: +49 203 522 4515
E-mail: christiane.hoch-baumann@thyssenkrupp.com

Photographic department,
layout, and production:
C3 Creative Code and
Content GmbH
Heiligegeistkirchplatz 1
10178 Berlin, Germany

Printing:
thyssenkrupp Steel Europe AG
Digital/Print Media
compact is printed on
FSC-certified paper.

Please contact us to share your comments
and suggestions:
compact.tkse@thyssenkrupp.com

compact^{steel} near you

A major appearance for the new brand: This time, the agenda discussion was not only recorded on paper and as a series of photographs; audio and video of the event were also recorded. The techniques used in the process resulted in Duisburg quickly being transformed into a television studio.

A video report on the new brand is available online at:
www.thyssenkrupp-steel.com/magazin



Competition

At what altitude was this picture of the Ötztal Alps taken?

This steel structure is located at Tiefenbachkogel in Sölden. If you know how high the mountain is, write to us!

One winner of an iPad mini 3 will be chosen at random from all the correct entries.



Send your answer to: thyssenkrupp Steel Europe AG, Heading: Competition compact^{steel}, 47161 Duisburg, Germany, or by e-mail to: compact.tkse@thyssenkrupp.com. **All entries must be submitted by 29 January 2016.**
The winner will be chosen at random from the correct entries.
Employees of thyssenkrupp Steel and their dependents are not eligible. The judges' decision is final.
Note: Your personal data will be used for the purposes of the competition only.