



**Pull-out**  
Two-page infographic  
on hot and cold forming

# compact

steel

# A smart solution

smartform<sup>®</sup> is an innovative process that enables high-strength steels to be formed reliably and cost-efficiently

[Page 8](#)



Hot forming in the auto sector: We have the materials and the expertise

[Page 14](#)

Visit to the steel mill: The Volvo XC40 is packed with high-tech steel from Duisburg

[Page 24](#)



### Focus: Forming

When it comes to technologies and materials for cold and hot forming, thyssenkrupp Steel is an innovative partner to the automotive industry.

08

### Component production

Less material, greater benefits: The many advantages of the hot-dip galvanized flat product scalur®+Z.

30



### Looking good

Beautifully decorated tinplate cans have become bestsellers among design-conscious end consumers.

20



### An all-round success

thyssenkrupp Steel is implementing its patented concept for a lightweight steel wheel in China.

23



### A trip to the mill

A car made with steel: The new Volvo XC40 paid a visit to the Duisburg site.

24

Photos: cover: thyssenkrupp Steel Europe Photography | Photos: pages 2-3: thyssenkrupp Steel Europe Photography (2), Jonas Friedrich, Getty Images

“We’re sending a strong message to our customers: The path is clear to construct a new hot-dip galvanizing line at the Dortmund site.”

**T**his year, thyssenkrupp has made a number of important decisions. Here in the Steel division, we paved the way for the planned joint venture with Tata Steel by signing the corresponding agreement this summer. Next up are the audits to check compliance with competition law. Moreover, our parent company, thyssenkrupp AG, decided at the end of September to separate its operations into two individual stock corporations. So we’re taking decisive steps to secure the future of both the Group and the joint venture.



**Andreas J. Goss**  
CEO thyssenkrupp  
Steel Europe AG

The Steel division has made some groundbreaking investments this year: As a result, our new ladle furnace in the melt shop will go into operation this fall. We can use it to manufacture high-alloy steel grades that will provide our customers with additional opportunities for differentiation; for example, in the area of ultra-high-strength structural components for vehicles or industrial applications. We’re also building an additional hot-dip galvanizing line at the Dortmund site: In doing so, we’re sending a strong message to our customers,

demonstrating that we’re pursuing innovation and creating jobs. In the future, we will use this line to serve the growing demand from our automotive customers for high-quality, hot-dip galvanized materials. We’ve also reached a milestone when it comes to technological development: our new, patented smartform® forming technology. Our customer Volkswagen will soon be using this method to mass-produce ultra-high-strength, cold-formed components.

We’re also looking ahead to the future of steel production through our collaborative project Carbon2Chem. The goal here is to convert the process gases released during production into chemical products. We’ve already become the first in the world to manufacture methanol from blast furnace gases under real conditions, an important step towards sustainable steel production. This year’s Euroblech in Hanover, Germany, will serve as the perfect forum to discuss all these developments and innovations. The motto is ‘Empowering you,’ which echoes our greatest key objective: advancing our customers.

“The pace of innovation is increasing: We developed over half of our 2,000+ steel grades within the last decade.”

#### Credits

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

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

#### Editorial staff:

Kilian Rötzer (legally responsible)  
Communications  
Marcus van Marwick  
Head of Brand & Customer Communications

Christiane Hoch-Baumann  
Brand & Customer Communications (Editor in Chief)

#### Photographic department, layout, and production:

C3 – Creative Code and Content GmbH  
Helligegeistkirchplatz 1  
10178 Berlin, Germany

#### Printing:

thyssenkrupp Steel Europe  
Digital/print media  
compact is printed  
on FSC-certified paper.

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

# Gateway to digitization

An astonishing 2.5 million vehicles pass through the thyssenkrupp Steel facility annually. Gate 6, located on Hoffsche Strasse in Duisburg, is one of the most important vehicle entry and exit points from a logistics standpoint, which is why it was chosen to be the first of seven gates to undergo upgrades. Along with major structural changes, a digital gate control system will provide for greater transparency and fast handling from early in the morning to late at night.

9.8 km<sup>2</sup>

is the total area of the mill site in Duisburg-Nord. That is roughly twice the size of Tegel Airport in Berlin.

5

lanes lead in and out of gate 6. They can be used for vehicles entering or leaving the facility, based on demand.

1,000 trucks

arrive each day at the facility to collect steel for delivery. If you add in all of the other vehicles from suppliers bringing in materials for the mill and plant, this figure is roughly twice as high.

# Knowledge & value

## Site anniversary



### Anniversary in southern Spain

Not far from Valencia, the thyssenkrupp Galmed galvanizing line produces ultra-high-quality galvanized sheet, which is mainly supplied to automotive manufacturers in southern Europe and their suppliers. After a temporary shutdown a few years ago, the approximately 130 employees celebrated their 25th anniversary this summer. It is in no small part down to them that production here at the site has returned to the highest levels of quality and output. "We are getting the site in shape for the future by manufacturing zinc-magnesium products, which are in strong in high demand," says André Matusczyk, CEO of the Automotive business unit at thyssenkrupp Steel. Investments in coating technology and process automation should further contribute to securing the plant's position in the future.



thyssenkrupp Steel – like!

The Steel division's Facebook page keeps visitors up to date on what's new in the world of steel! Let's become friends on <https://www.facebook.com/thyssenkruppSteel>.

## Precision strip put to best use

With its own **Application Technology** unit **thyssenkrupp Precision Steel** is delivering even more value to its customers.

The declared aim of the new unit in Hohenlimburg is to provide customers with strategic support in the development of new components. This is achieved, above all, by providing the material characteristics of precision strip grades for cold forming. Another important aspect includes the identification of the material characteristics of hot rolled grades, which is carried out on site by a team of five. In addition to welding and brazing systems, the unit now also has a hydraulic press for fine blanking and deep drawing. The most important element of the

Application Technology unit is the specimen store. It is vital for performing tests – both for in-house product development and for customers. In addition to the technical know-how of the precision strip specialists, close proximity to customers and direct communication among all parties involved also contribute to success.

### Web

For information on this topic, visit [www.thyssenkrupp-steel.com/en](http://www.thyssenkrupp-steel.com/en) and navigate to Precision Steel under Company > Business units.

### Close to our customers:

More than half of the annual production volume in Hohenlimburg is delivered within a radius of only a few kilometers.

### Market launch:

A new grade from thyssenkrupp Precision Steel is now being used in airbag gas generators. The customer implemented the new product at their site within a few weeks after a successful test run in the Application Technology unit.

## Facts and figures

**72** individual grades

of the Precision Steel business unit are being given a new name. The precision strip specialists from Hohenlimburg are thus putting their quality and brand promise into concrete terms. In the future, all products will be marketed under the brand name 'precidur®'. For example, HSM 380 will be called 'precidur® HSM 380' after the change. The official launch of the new product brand will be announced at the Euroblech trade fair in Hanover.



On the way to a sustainable future, steel is not the problem, it can be a key to the solution."

**Andreas Goss**, CEO of thyssenkrupp Steel, on the occasion of the launch of the "In4climate. NRW" initiative in September 2018. The initiative sees science and industry partners working together to further reduce greenhouse gases.

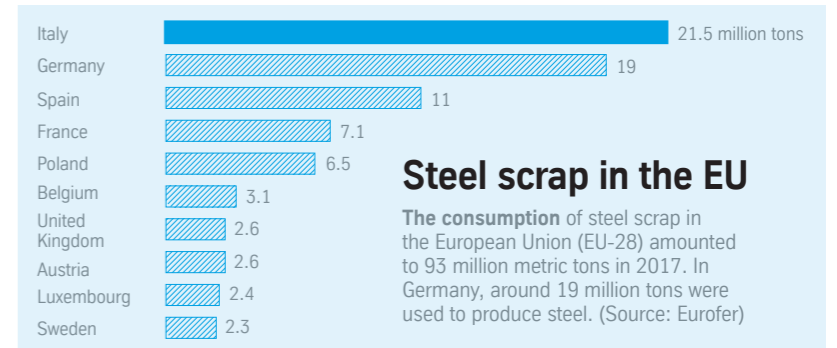


## Steel finder

### Sought and found

The thyssenkrupp Steel division has digitized its product range and compiled its entire portfolio in a dedicated database. The 'steel finder' offers several filter options, and the hit list provides a precise technical description of each product. This allows customers to put together an industry or application product range that is fully tailored to their own needs. Better yet, the tool delivers quick, variable, and reusable results. The steel finder can be accessed at [www.thyssenkrupp-steel.com/en](http://www.thyssenkrupp-steel.com/en).

## The industry in brief



## Three questions for...



**Alexandra Gies**, a thyssenkrupp Steel, is in charge of meeting corporate standards.

1

### What is the abbreviation IATF 16949 all about?

IATF stands for International Automotive Task Force, an association of major carmakers. IATF 16949 is a revision of ISO/TS 16949, the preceding standard that has established itself as a global quality standard in the automotive industry. By gaining this certification, we have reached an important milestone that ensures our continued ability to make supplies to this industry. Ultimately, it's our high-quality products that make us stand out from the competition and remain a supplier over the long term.

2

### What is the difference between the new and the old standard?

The IATF has rephrased, extended, or added many requirements for suppliers. This primarily concerns documentation and risk analysis. Everything we do must be traceable. And because we can do that, we have successfully passed the audit.

3

### How do you ensure that all requirements are being met?

This is the task of the multipliers at all our locations. For a company of our size and varied portfolio, this is a huge undertaking. Colleagues must ensure that every employee in the individual companies knows what to look out for. Every action and activity performed must be verifiable retroactively – regardless of the system or the process step involved. And this must be internalized, because if we do not regularly prove compliance with these standards, we could lose orders.

## Dates

### architect@work

7/8 Nov. in Berlin and 5/6 Dec. in Stuttgart

The event, which is organized both nationally and internationally, addresses urban planners, engineers, private and municipal property developers, architects, professors, and designers. Visitors to the annual event learn about innovative applications, products, and services for various types of buildings. thyssenkrupp Steel will be presenting its ideas for facade design, among other things.

#piadur® #steeltechnology4.0

### bauma 2019

8 to 14 April in Munich

A must-attend event for everyone involved in the construction machinery industry: The international trade fair, which is regarded as a global innovation driver, only takes place once every three years. It is the key hub for learning and spreading industry news, so it goes without saying that the Heavy Plate business area of thyssenkrupp Steel will be presenting its innovative grades for yellow goods here.

#processoptimizer #steelxperts

### CWIEME 2019

21 to 23 May in Berlin

The leading trade fair for coil winding, insulation, and electrical production provides a platform for suppliers and manufacturers from the automotive, energy, electrical, and electronics sectors. The Automotive and Electrical Steel business units will jointly represent thyssenkrupp Steel.

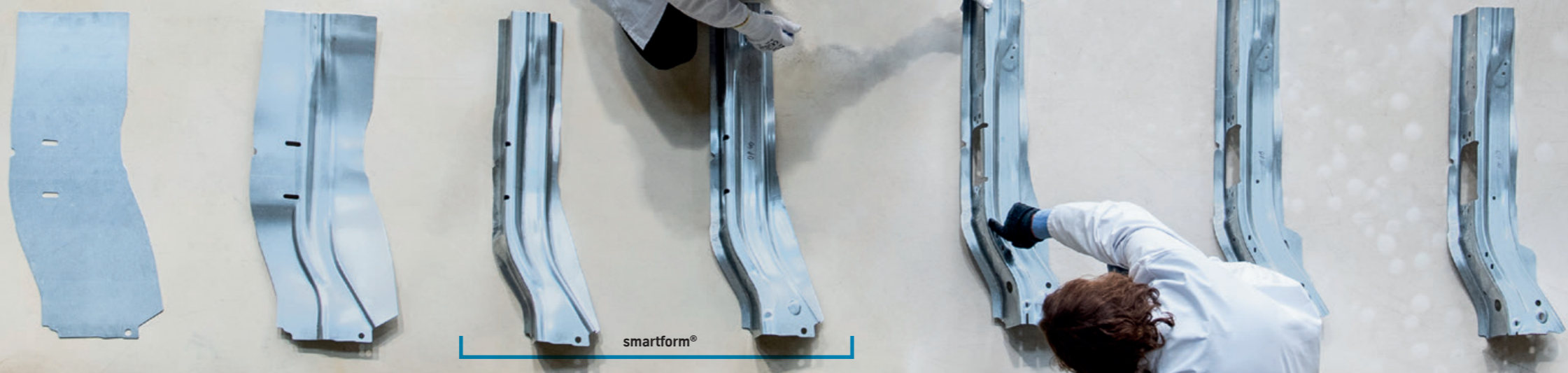
#mobility\_of\_the\_future #electrified

Photos: thyssenkrupp Steel Europe photography | Illustration/infographic: C3 Visual Lab

# Smarter forming

thyssenkrupp Steel's innovative and patented **smartform**® technology now allows ultrahigh-strength steels to be processed reliably by **cold forming** in a dimensionally stable way with almost no springback

From start to finish: René Groß (left) and Ferry Grumptmann assess the individual steps of component production at the VW plant in Zwickau.



**The individual steps of the smartform® process:**

**Step one:** The blanks are cut precisely to make sure they are optimally shaped while minimizing cutoff.

**Step two:** The blank is then fed into the cold forming press to preshape the base.

**Step three:** Next, the preform is created by forming the blank into a 'U' shape. This is the actual start of the two-stage smartform® process.

**Step four:** Sizing is the final step. Compressive stress superposition reduces springback, and the component already takes on its final shape.

**Steps five to seven:** The final three steps in the process complete the component, including final trimming, perforation, and preparing the welding flanges for later integration into the chassis.

# 9,000

**longitudinal members** pass through the transfer press each day at the VW plant in Zwickau. Logistics then delivers the finished components to all corporate locations of the automobile manufacturer.



Text Judy Born | Photos Rainer Kayzers

**O**n this late summer day, there are certain points where the sun streams in and reflects off the shiny white floor. First-time visitors are surprised to see such a bright, spacious, and clean hall, which seems more like an oversized laboratory rather than a production facility for auto parts. At least by the looks of it. But the constant sound of rhythmic pounding that causes the air to vibrate makes it clear where you are immediately: at the Volkswagen Sachsen press plant in Zwickau.

### Distribution throughout the group

Components for Volkswagen's modular transverse matrix (MQB, modularer Querbaukasten) are produced here, at the Mosel location just outside the city, and are then delivered to every European production facility for the group brands Seat, Škoda, and Audi. Only the parts required to manufacture the Golf and Golf Variant remain in Zwickau itself. "At the moment, we are producing the longitudinal members for the Golf platform," says Ferry Grumptmann, who is responsible for individual parts planning and overall planning. If you add up the number of left- and right-side members, a total of up to 320,000 components leave the plant each month. "A true high-volume component," Grumptmann

adds. This enormous production volume was one of the reasons why the Volkswagen group's technology planning and development production processes were moved from Wolfsburg to Zwickau two years ago. "The aim was to test the development of sizing deep drawing without trimming," says René Groß, Head of Maintenance at the Zwickau press plant. "This method was specifically developed for forming high-strength steels by cold forming." It was then refined by thyssenkrupp Steel into the patented smartform® process, which is suitable for manufacturing components that require a high degree of dimensional accuracy from steels with strengths beyond 600 megapascals (MPa),

### The advantages of smartform® at a glance:

**Consistent component quality** thanks to almost completely springback-free forming of ultra-high-strength steels.

**Geometric freedom** and maximum process reliability when cold forming high-strength steels.

**Amount of material used** reduced by an average of 15 percent and a improved material utilization per coil (depending on the component).

**Significant cost optimization** and time saving in tool design, tool construction, and in mass production.



Views and insights: A component is stamped out of steel blanks (left). A bird's eye view of the transfer press (below).



“smartform® means a high level of dimensional accuracy and a reduction in the amount of material used.”

Hans-Joachim Sieg, Technical Customer Support, thyssenkrupp Steel

thus opening up new lightweight construction potential. Cold-rolled, dual-phase steels from thyssenkrupp Steel expand the range of applications in cold forming, display high resistance to deformation, high absorption capacity, and improved cold forming properties.

However, they also increase the challenges placed upon the component production process chain. "As a part of the InCar® plus project, we already presented a cold forming process that in particular compensates for unavoidable springback problems. It was initially applied to the production of longitudinal members," says Hans-Joachim Sieg, a technical customer support advisor at thyssenkrupp Steel responsible for working with the Volkswagen group on issues surrounding materials. "With conventional deep drawing, the required material comes from the thickness," says Sieg. "The thinner the material gets, the higher the stresses in it. As a result, it springs back as soon as the component is removed from the tool."

### smartform® for cold forming

The smartform® process basically consists of two steps: the production of a preform similar to the finished component, and then control of the dimensional accuracy in the sizing process. In the smartform® process, the material is compressed during sizing rather than being drawn and made thinner. "It's a brilliant idea from thyssenkrupp Steel. Simply put, rather than drawing it, the material is now being compressed," says René Groß. In the smartform® process, the blank is cut to almost the same size

## “smartform® is the hottest thing that cold forming has to offer.”

Eva Maria Kolodziej, Key Account Manager for Volkswagen at thyssenkrupp Steel, is impressed by smartform®.

### 1 How did the smartform® technology come about?

Automotive manufacturers these days are using ever-stronger materials. These materials present technical challenges during processing. Previously, there was no satisfactory solution, but thanks to smartform® this has changed.



Eva Maria Kolodziej is responsible for the entire customer relationship between the Volkswagen group and thyssenkrupp Steel.

### 2 What are the benefits of using smartform®?

The sheet thickness of the component can be thinned out and the blank cutting process can be optimized, meaning less material needs to be used. The result is a weight-optimized component with greater dimensional accuracy at lower cost. In other words, smartform® is the hottest thing that cold forming currently has to offer.

### 3 How important is it to work together with customers?

The highly complex materials we produce as a premier manufacturer make it extremely important for us to involve our customers in the development process. The earlier we do that, the sooner we can understand one another, allowing us to advise them on which product is most suited for which component. Or it might be that we need to adjust something on our side, a grade or a process, for example. Both sides get something out of it – we learn from the customer and they get an optimized product.

### 4 Is this how smartform® was introduced at Volkswagen?

Here again, the cooperation was outstanding. Volkswagen very quickly saw the potential in the process and worked with us to become the first customer to implement it. We still had a lot to learn as the technology is so new, but together we managed to get the process ready for mass production in just over two years.

### 5 How important are dialogue and consultation for the cooperation?

Consultation is a tradition at thyssenkrupp Steel. It is incredibly important for a long and successful customer relationship. We have been working in partnership with Volkswagen for decades, and recommending the right high-tech materials or a production process as early as the pre-development phase for components is a part of our everyday work.

Inspection at the pressing plant: Ferry Grumptmann (left) and René Groß inspect the quality of a longitudinal member.



› as its final geometry before it is formed, reducing the number of trimming operations in the process chain, and, naturally, the amount of material used. According to Hans-Joachim Sieg, this saves an average of 15 percent in comparison to conventional types of forming, depending on the size and complexity of the component. “We have a lower working weight, less waste, and lower disposal costs,” adds Groß. This will also reduce energy consumption and investment costs of mass production over the long term. “That’s exactly what we are testing at the Zwickau plant right now.”

smartform® is suitable for various vehicle structure components, meaning it’s also suitable for U-shaped profiles such as the longitudinal members. “We’re not just the ideal partner because of the component’s shape and application, but also because we need a lot of them here and we have experience with high-strength materials,” says Groß. There is also the prospect that thyssenkrupp Steel can supply even stronger grades of steel in the future. “This is no doubt a highly attractive proposal.”

As regards smartform®, this process has already proven that it generally works in the way required by VW.

#### The road to mass production

A test tool was initially designed and then a prototype was created together with thyssenkrupp Systems Engineering on the basis of the geometries of the longitudinal members to be produced. “It was impressive to see how good the component was that came out of the press even in the first forming test,” says Grumptmann. “We succeeded in reducing the amount of final trimming needed on the blanks in two critical places as part of this cooperation, enabling us to then develop a method for mass production.” At this point, it also became clear that smartform® should be factored in at the design stage of the component in order to make use of all of the process advantages it offers. “The aim in the future should be that all component geometries that allow the use of smartform® are actually produced by smartform®,” says Groß. In the next step, the

#### Experts

##### Ferry Grumptmann

is a trained tool maker and graduated from Zwickau University of Applied Sciences with a degree in mechanical engineering. He first worked as a designer at Audi in Ingolstadt before moving on to become a team coordinator. He has worked for VW in Zwickau as a press plant planner since 2010.

##### René Groß

has qualifications as a master metalworker, as an engineering technician, and as a technical business manager. He heads the maintenance department at VW in Zwickau and also supports the development process for new tools.

forming process must demonstrate its reliability and suitability for mass production. There is already a wealth of experience with the process on hand thanks to several thousand components having already been produced.

“It’s still too soon to say whether all of our expectations will be fulfilled in the long term as well,” says Ferry Grumptmann, who is also responsible for cost control and meeting delivery deadlines. Of course, Grumptmann is also setting his sights in the future on a high level of dimensional accuracy, higher quantities, lower maintenance costs, and a reduction in the amount of material used. “However, if the process works as well as it suggests it will, I have no concerns.”

#### Contact

Eva Maria Kolodziej, Automotive business unit,  
+49 203 524 0464, eva-maria.kolodziej@thyssenkrupp.com

**Hot forming** is the go-to process for manufacturing lightweight, impact-resistant components for the automotive industry. During a factory tour in **Kassel**, we got a glimpse behind the scenes of our customer **Volkswagen's** operations.

Text Judy Born | Photos Rainer Kayzers

**N**ordrandbau is the name of the imposing brick building complex where ten five-meter-high letters on the roof spell out the name of the company that operates here: Volkswagen. Since the 190-meter-long lettering was mounted on the roof of the kilometer-long building in 1964, it has become a landmark of business history in the town of Baunatal, south of Kassel, Germany.

After its main plant in Wolfsburg, the VW location in Baunatal is the automotive company's second-largest production site – except that rather than entire vehicles, this site manufactures components for all of the group's other plants. The site in Kassel covers approximately 2.9 square kilometers. "It takes just over half an hour to walk from here to the southern end," we're told at the gate, illustrating once again just how impressively expansive the

compound is. Once we've passed through the multi-story Nordrandbau with its numerous offices and crossed countless small roads within the complex, we find ourselves in front of Shop 2. "Welcome to the most versatile manufacturing facility in this complex," says Ilda Hujdur by way of an introduction. "We make just about everything here." She leads us past exhaust system manufacturing, the electrocoating unit, and the press plant. Hujdur is a VW production engineer in hot forming production, where she is responsible for quality and dies. "Kassel was originally focused entirely on transmissions; the location opened in 1958 to prepare engines and transmissions for the Beetle." 60 years later, more than half of all vehicles produced by the Volkswagen Group include a transmission made in Baunatal.

**Pioneer in the automotive industry**

Volkswagen is considered one of the pioneers of steel vehicle construction. There are numerous reasons in favor of the material: First and foremost is its potential as a cost-effective material for lightweight construction. Steel's long history and fail-safe processes are also important, allowing for solid, reliable processing – and ultimately, steel can be recycled without loss of quality. The automobile manufacturer has been using hot-formed steels since 2004; these materials' extreme strength also makes them eminently suitable for use in lightweight construction and even for the most complex component geometries, depending on the process. Hot-formed steels made a significant contribution to breaking from the trend of increasing >



Speed and precision: Ilda Hujdur (VW Kassel) and Dr. Jürgen Schramm (thyssenkrupp Steel) know why stable processes for hot forming are so important.

# Some like it hot

Sleek shells: Placed on top of one another, the two components will later serve as the cross beam for the footwell.





## “Steel manufacturers need to know our processes.”

Ilda Hujdur is a production engineer in hot forming at Volkswagen and explains the most important aspects of the technology.

### 1 Why do you use hot forming in Kassel?

Hot forming provides both impact resistance and lightweight construction. To that end, we employ steel from the MBW® family produced by thyssenkrupp; it receives its high strength when formed, allowing hot-formed components to be designed with thinner dimensions and consequently reducing the weight of the chassis.



Ilda Hujdur has worked at VW in Kassel for four years. The production engineer is responsible for quality and dies.

### 2 What happens during the hot forming process?

First, the steel blanks are heated to temperatures of 880 to 950°C in a roller hearth furnace. They are subsequently formed in the press and simultaneously cooled while the die is closed. This rapid cooling changes the steel's microstructure, making it particularly strong.

### 3 Which components is hot forming best suited to?

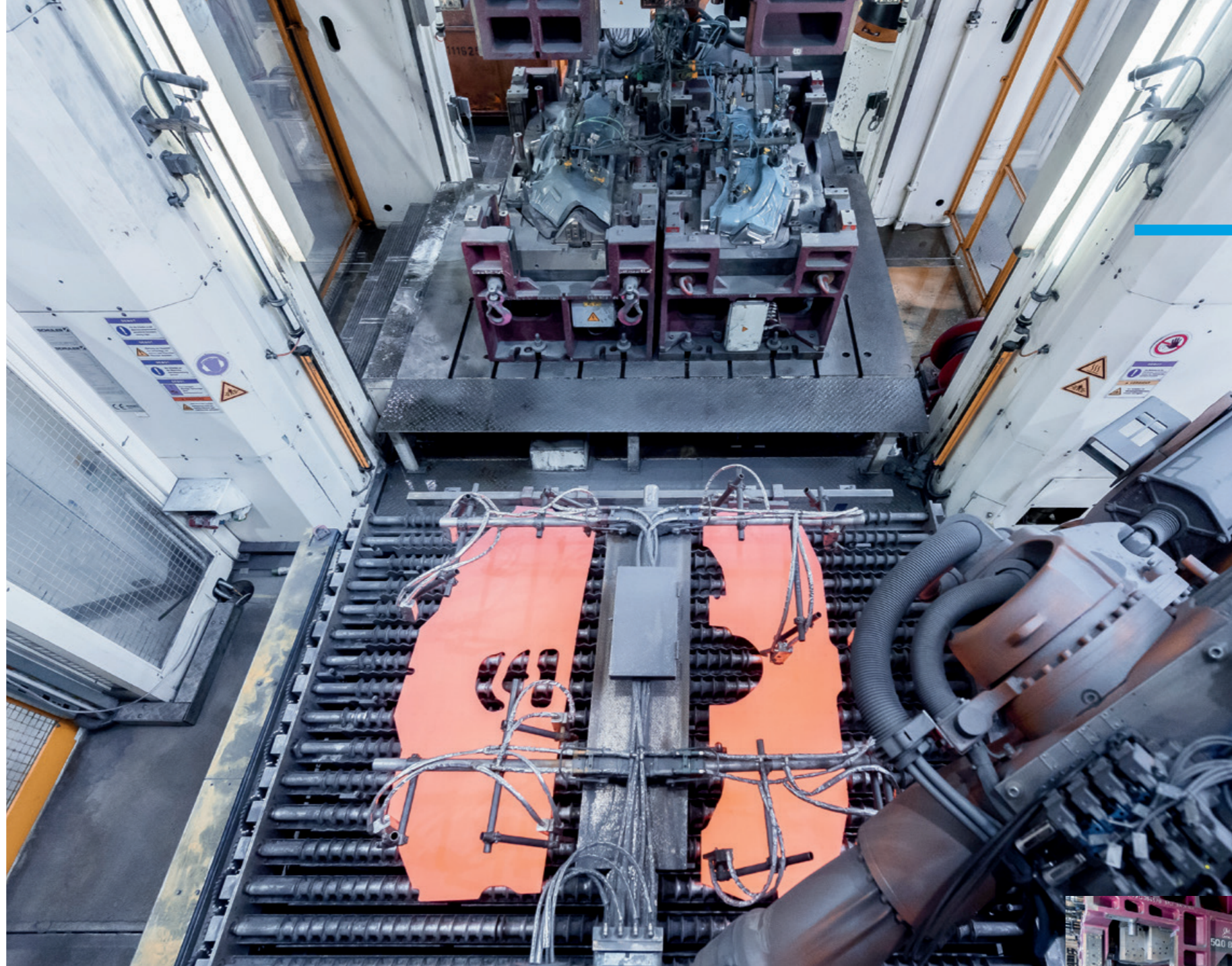
Hot forming is best for highly complex structural components in vehicles that are relevant to impact resistance, such as B-pillars. The high final strength of the material allows for the construction of pillars that are comparably thin and, consequently, very light, but still impact-resistant. What's more, they are cost-effective in comparison to other materials. We can also create different strength zones in our B-pillars in certain dies, allowing them to meet various needs – different resistance to deformation in different areas.

### 4 In your view, what constitutes a good starting material?

To achieve the best results, steel manufacturers need to be intimately familiar with the customer's hot forming process and know the specific requirements for any given component. VW strives for the optimum in terms of time and quality, so we determine – in advance – the precise properties that any steel to be used must have. We then search the existing portfolio for suitable materials and figure out how best to combine the different types of steel in the chassis.

### 5 Do you feel like you receive good advice and support from thyssenkrupp?

Oh yes, they provide an extremely high level of expertise, and here at our location, we really value their willingness to maintain a candid, trusting partnership.



weight in vehicle construction. “Above all, they are still indispensable for the structural components that are key to vehicle safety,” Hujdur says.

Lighter vehicles mean lower fuel consumption, which, in turn, means lower CO<sub>2</sub> emissions. The best example is the VW Golf 7; its chassis alone is 23 kilograms lighter than its predecessor's. Components made of hot-formed steel from thyssenkrupp played an important part in weight reductions of this nature. “MBW® 1500 is standard for these applications today; it was one of the decisive developments in the area of cost-effective lightweight steel construction,” says Dr. Jürgen Schramm, Head of Product Management for Coated and High-Strength Steels at thyssenkrupp Steel in Duisburg. And development continues, with steels of even higher strengths being created:

Photos: thyssenkrupp Steel Europe Photography

Because thyssenkrupp Steel's precise goal is to provide products with exactly the properties needed to meet the specific requirements of customers' intended applications. “Lower weights and optimized costs and processes are the key considerations here,” Schramm says.

In order to fully tap the potential for lightweight construction, the material must be suitable for martensitic microstructure transformation. That is the only way to achieve the high level of strength required to reduce materials and weight while maintaining the same level of stability. And naturally, the steel needs to be readily formable. “This is made possible by the high temperatures in the process; MBW® allows for the manufacturing of highly complex components,” Schramm says. “If we consider the growing prevalence of hybrid and electric vehicles, we can expect demand in this area to rise.” >

### How long has hot forming existed?

The development of hot forming for automotive manufacturing began in 1984. That was the first time a side impact beam was manufactured using this technology. Coated manganese-boron steel was used for the first time in 1999.

Incidentally: The patent dates back to 1974. The technology was originally used in the production of wear-resistant components (such as spades) for agriculture.



Under pressure: The dies in Shop 2 press multiple components per minute. To achieve this, they need to be overhauled regularly.

# 64

thousand components are produced in the forming dies at Volkswagen in Kassel every day. Depending on the system and the component, up to four blanks per stroke can be hot formed simultaneously.



**Contract work: The (currently) 11 systems in Kassel produce hot-formed components for all Volkswagen plants in Europe.**



Steel is the dominant material in automotive manufacturing, and it will stay that way.”

**Dr. Jürgen Schramm**, Head of Product Management for Coated and High-Strength Steels, thyssenkrupp Steel

› Thanks to their very high resistance to deformation, hot-formed components are ideal for the stringent safety requirements surrounding batteries. And in terms of electric vehicles, Volkswagen already has a platform for mass production with its Modular Electrification Toolkit (MEB). Hot forming also has a role to play here: Starting from the end of the year, a whole series of structural components for the MEB will be produced in Kassel. “We want to expand on that, because the MEB will contain twice as many hot-formed components as standard toolkits,” Hujdur says. That’s good news for Duisburg, because when it comes to electric vehicles, thyssenkrupp is well-positioned. “Steel is in high demand not just as a lightweight material for chassis, but also as electrical steel, an indispensable basic material for electric motors,” Schramm says.

Hot forming may still have been considered a niche technology in 2004, but the VW plant in Kassel developed the technology for mass production at a very early stage. Currently, there are 11 hot forming lines in operation, with two more planned, making it the group’s largest hot forming site. Approx-

imately 64,000 components are produced here every day, some using just one die, while others require three dies at the same time. Currently, Ilda Hujdur doesn’t see an alternative to hot forming: “At least not if we want to work cost-effectively.”

In the expansive Shop 2, growing numbers of work units have relocated around hot forming. As we tour the facility, we pass cutting and laser tools. “In terms of workflows, this all makes sense,” Hujdur says. “First, we cut the blanks, then we form them and use a laser to finish the contouring.” The continuous nature of the process is impressive to behold. The pressed components roll out of hot forming and into laser automation constantly and without interruption; afterwards, they are packed up. A driverless transportation system picks up the package from there and drives it to the shipping facility. As of recently, parts can also be welded on site and shipped out as complete components, such as finished side members.

#### Reliable manufacturing

Efficient production processes and intelligent use of resources make all the difference – on both a large and small scale. For thyssenkrupp Steel, this means getting customers involved in the development process for new products and technologies as early as possible and understanding their production processes.

“As a manufacturer, we would like to have the largest possible process window in the future,” says Hujdur, referring to more durable materials, efficient processes, and an optimum use of materials. Corrosion protection also plays a major role, particularly in battery housings. thyssenkrupp Steel is already working on new solutions in that area. “We are constantly refining our portfolio,” says Dr. Jürgen Schramm. “Steel is the dominant material in automotive manufacturing, and it will stay that way.”

#### Contact

**Dr. Jürgen Schramm**, thyssenkrupp Steel,  
+49 203 524 0221, juergen.schramm@thyssenkrupp.com

Steel

When automotive know-how makes dreamwork out of teamwork, then that’s ...

# HOT

FORMING EXCELLENCE FOR YOU

Hot forming excellence for you: That’s our commitment and our promise to help you master the big challenges in automotive engineering – with all our experience as pioneers of hot forming and as partners to the automotive industry. For example, our comprehensive range of MBW® and tribond® grades have properties that can be used to reduce weight cost-efficiently. And as development partners we work together with our customers to find tailored solutions. For more information go to [www.hot-forming-excellence.com](http://www.hot-forming-excellence.com)

engineering.tomorrow.together.



thyssenkrupp



Ortiz, white tuna in oil, Spain

This specialty from the Basque region is still traditionally caught by hand with a fishing rod, which protects the environment and marine reserves.

# Stylish steel

Visuals are important. The cans shown here – **tinplate** in its most pleasing form – prove just how beautifully liquid and solid **food can be packaged.**



L'Estornell, olive oil, Spain

Did you know that the acidity of an olive increases as soon as it is picked? Therefore, the organically grown fruits of this low-acid oil from Catalonia are ground within 24 hours of harvesting.



Pinhais, sardines in tomato sauce, Portugal

Since 1920, the company based just outside of Porto has been supplying the whole country with canned fish. The fisherman mending a net represents courage and the strength to face the forces of nature day after day in order to catch the best fish.

Leatherwood honey, Tasmania, Australia

Situated in the Indian Ocean, this Australian state shares the 42nd parallel with the southern tip of Chile and New Zealand, among others. When the Tasmanian elm flowers for almost two months, bees collect the nectar for this spicy and savory honey.



**D**o you know Peter Durand? He's the one you should thank the next time you open a tin can. More than 200 years ago, the Brit came up with the idea of preserving food in tin cans and had this invention patented in

1810. Only three years later, the world's first can factory commenced production in London. In the 19th century, the world was in upheaval and the navy and army were the main buyers of food preserved in sheet metal. The idea was to prevent soldiers from going hungry in the field. However, because the can opener was not invented until around 50 years later, opening the cans initially presented the brave men with great difficulties. They resorted to using hammer and chisel or their rifles' bayonet. Today, a slight pull on the tear tab is usually all it takes to get to the food.

Tinplate cans have become an indispensable part of our everyday lives. Around 90 percent of the tinplate produced in Germany, including that of thyssenkrupp Packaging Steel, is used to manufacture packaging. Packaging steel is efficient, highly optimized, and sustainable. Moreover, thanks to being easy to fill, airtight, stackable, and safe to transport, tins are also highly practical. They can be produced in many sizes and shapes and are ideal for increasing product sales – provided the steel quality >

# Rim redux

Through the use of **hot forming**, thyssenkrupp Steel has succeeded in reinventing **the wheel**. The new product is to be put on the road in collaboration with Chinese steel wheel manufacturer Jingu.

**A** wheel is a wheel is a wheel. The creative possibilities for manufacturing a car wheel, on which the tire is later pulled, are limited. And yet, as part of the InCar®plus research project, engineers of the Duisburg-based steel group have developed a concept for designer wheels made of steel that will break new ground both technologically and visually. “We have applied the hot forming process, which is the standard in body construction and allows for significant weight savings, to the wheel,” says David Pieronek, who is responsible for wheel research and development at thyssenkrupp Steel. “In the forming stage, more complex geometries than usual can be produced through hot forming while still achieving high strengths at the end of the process.”

“In the future, we can produce innovative designer wheels made of steel.”

David Pieronek, Application Concepts

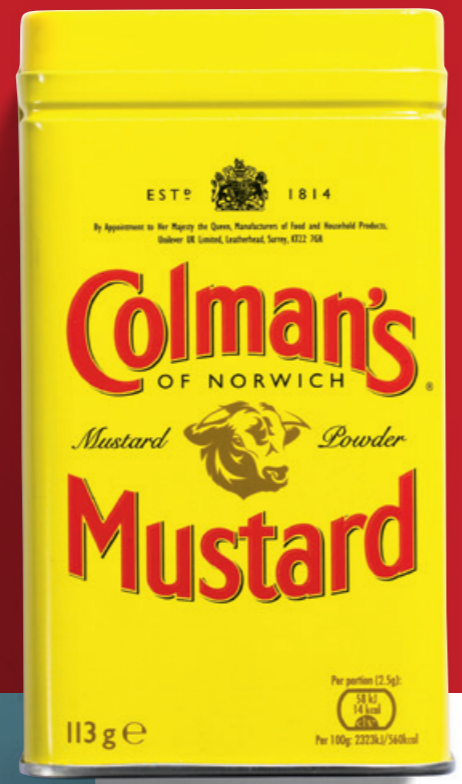
This is of critical importance as the wheel has to be strong enough to withstand high loads and is constantly in motion. The use of hot forming also has another major advantage: The material’s lightweight design allows thinner materials to be used. Looking at the entire process chain, it has been possible to generate lightweighting potential of 20 to 30 percent compared to conventional steel wheels. “Nowadays, wheels are mainly designed from a functional perspective, but they also need to be cost effective and perform well,” says Pieronek. That’s why they only weigh as much as is absolutely necessary. “When it comes to aluminum wheels, looks are all important - the wider, more bombastic and more flamboyant the better.” But this also means more weight.

**The modular design wheel**  
thyssenkrupp Steel uses a modular design to get the lightweight steel wheel looking good. It is constructed from a uniform base carrier comprising the rim and an additional design shell. The wide spoke rim of the outer shell raises the appearance of the steel wheel to a whole new level. Dr. Yu Sun, head of Regional Business Development at thyssenkrupp Steel, and project manager Matthias Hein were able to win no less than China’s market leader

**Contact**  
David Pieronek, Application Concepts  
+49 203 524 5526,  
david.pieronek@thyssenkrupp.com



Photos: Jonas Friedrich | Rendering: C3 Visual Lab



Colman's Mustard, mustard powder, United Kingdom

Since 1814 Colman's, based in eastern England, has been producing its world-famous mustard in the well-known bright yellow packaging. The powder is ideal for seasoning delicate dishes.

Gallo, tuna in oil, Spain

Steamed and preserved in olive oil and salt, the fish in this can comes from the Bay of Biscay, or, more precisely, the Cantabrian Sea. The animal insignia, which represents the brand Gallo ('rooster'), is the visually most striking feature on the packaging.



and appearance are right. As is always the case in the world of commerce, only things with a pleasing look and feel will sell well. At best, steel cans are treated as collector's items, as is often the case with oil and fish preserves from southern Europe. If you think of canned fish here in Germany, herring is the first thing that comes to mind. In Portugal, on the other hand, it's the sardine. The fishing association therefore considers this fish to be the 'true ambassador' of the country. As consumers are becoming increasingly conscientious about where their daily food comes from and how it is produced, local products are making a comeback. This also includes the fish in steel packaging, which is canned without coloring or preservatives in top-quality olive oil, ready to be served at the dinner table. According to manufacturers, the can guarantees the preservation of the healthy fatty acids of the fish and stores important minerals.

In addition to preserving foodstuff, cans are also a highly sustainable means of packaging. Thanks to their magnetic properties, tinplate cans can be recycled quickly, nearly fully, and at little cost. But given the many beautiful designs, wouldn't you rather keep it?

**Contact**  
Carmen Tschage, Packaging Steel business unit,  
+49 2632 3097-2764, carmen.tschage@thyssenkrupp.com

# How our high-tech steel gets on the road

Swedish carmaker Volvo sends its new SUV XC40 on a journey to its roots in the steel mill of thyssenkrupp. 'Die Autozeitung' magazine accompanied it.

Text Judy Born | Photos Daniela Loof and Rainer Schroeer



**New Swede on the block:** The XC40 is Volvo's smallest and most compact SUV.

**A** brand-new car parked right in front of the blast furnace is a rare sight indeed. Frankly speaking, it shouldn't be there in the first place, but it sure makes for a spectacular shot! Inside the blast furnace, coke and iron ore are melting at temperatures of up to 2,000° Celsius to form the liquid gold of the Ruhr region: pig iron. Each day, more than 30,000 metric tons are produced at thyssenkrupp Steel in Duisburg alone.

Before the melting process is completed, the photographer directs the vehicle to the perfect spot. An important detail in the final picture is the tapping process in the background with red, glowing pig iron flowing out of the furnace. In the basic oxygen furnace (BOF) melt shop, the iron is then turned into steel, which, in turn, is the base material that makes up a

major portion of the Volvo SUV on display here. And not only the Volvo: Steel, in its many varieties and shapes, forms the material backbone of the entire automotive industry. The question of whether and why this will remain so in the future was also raised by 'Die Autozeitung' magazine, which was producing an article on the new Volvo XC40 on the premises of thyssenkrupp Steel in Duisburg. They picked the ideal backdrop since the business ties between the Duisburg-based steel group and the Swedish car brand go back several decades.

Thanks to this close relationship, the vehicle is allowed to go places that are normally strictly off limits to non-employees. "We basically supply Volvo with everything we have in our portfolio," says Sebastian Deumlich, a member of the Volvo key account team at thyssenkrupp Steel. "From galvanized deep-drawn steels and bake-hardening steel through to micro-alloyed and multiphase steels. But the list also includes uncoated materials and materials coated with zinc-magnesium."

## Steel – a recycling marvel

The blast furnace is suddenly very busy. A fresh batch of red-hot molten iron is ready for further processing. Every four to six hours, a tapping takes place, which makes things extremely hot for the smelters at the furnace door. Directly at the outlet, temperatures can reach up to 800 degrees. Those who are not absolutely essential keep their distance.

The XC40 doesn't seem to mind the temperature. Is it because the car senses the kinship shared with this place? Not very likely. And neither does it suspect that parts of it will return to this plant after it has served its term: In addition to iron ore and coke, pig iron also contains a large share of 'old iron,' i.e., steel scrap. During production, up to 30 percent of this is fed into the BOF melt shop alone. It is used for cooling during the blowing process.

The reason for this is that before pig iron can become steel, it must be cleansed of unwanted by-products such as carbon, phosphorus, silicon, and sulfur. This is done in the converter by blowing in oxygen. As a result, the substances oxidize and then form so-called slag puddles on the surface of the molten metal, which are then removed. The process generates an enormous amount of heat, which is reduced by adding steel scrap.

Next, the purified molten steel is formed and cut into solid steel blocks, called slabs, on the casting-rolling and continuous cast-



**Hooked:** Where coils averaging 25 tons are moved on a daily basis, a car of about 1.8 tons is practically a featherweight.

ing lines. As impressive and spectacular as steel production is, the true magic of many grades and qualities happens much later in the production process – when the slabs are hot-rolled and cold-rolled into carbon steel flat products on the processing lines.

## Its versatility is what makes steel so special

thyssenkrupp's range with more than 2,000 steel grades differ in their strength, elasticity, and corrosion resistance, in the way they can be formed, which coating they receive, and much more. The full potential of steel can only be exploited when knowledge of material properties is combined with expertise in processing.

The core component that ensures the continuous development of the company's steel portfolio is the in-house application technology center. It allows the steel maker to simulate and compare a wide variety of production techniques, check and optimize steel grades, and optimize products in close cooperation with customers and in line with their requirements.

Duisburg's high-tech materials are found both in the interior and exterior of the Volvo XC40, including the side panel, doors and dashboard, tailgate, cov- >

The XC40 doesn't seem to mind the temperature. Is it because the car senses the kinship shared with this place?

Not very likely. And neither does it suspect that parts of it will return to this plant after it has served its term. In addition to iron ore and coke, pig iron also contains a large portion of 'old iron,' i.e., steel scrap.



Given Volvo's high safety standards, we consider it an honor that our material is built into their models."

Sebastian Deumlich, Volvo Key Account team, thyssenkrupp Steel

ers, cowl, as well as cross and longitudinal members. "A colorful mix, although we are admittedly particularly proud of the parts used in the outer paneling," says Deumlich. "These are the premium components in every car."

#### Safety made in Duisburg

Crash-relevant parts also play a very important role. "Volvo is renowned across the world for its high safety standards. It is therefore an honor for us whenever materials from us find their way into a Volvo, either directly from us or via suppliers." In the case of the XC40, these are first and foremost high-strength, hot-dip galvanized dual-phase (DP) steel and hot-formed, hot-dip aluminized steel. The DP steels are used, for example, in the cross and longitudinal members, while the hot-formed grades are used for the B-pillar.

The new Volvo XC40 is built on the Compact Modular Architecture, or (CMA) platform, and is the smallest SUV in the Swedish vehicle fleet. It is also the youngest generation in the Volvo family and has already been named Car of the Year 2018, even though it has been on the market for less than a year. The newcomer is so successful that the original planned production figures have already been increased. "That's good for us, too," says a pleased Deumlich, "because it means that we will also be able to increase our delivery volume." The material is wound into coils and shipped



In the spotlight: Autozeitung photographer Daniela Loof positions the XC40 for some beautiful shots (above). Together with author Markus Schönfeld and Mark Stagge (on the right, thyssenkrupp Steel), she examines the motif and takes center stage herself.

from Duisburg to the rest of the world, including the Swedish production sites in Gothenburg and Olofström. A few production steps later, the individual components are assembled in Ghent, Belgium, where they roll off the assembly line as the Volvo XC40. It is a long journey from iron ore to high-quality steel grades, such as those produced by thyssenkrupp Steel. That's also what the 'Autozeitung' team takes home after having spent a day driving nearly 50 kilometers across the approximately 9.8-square-kilometer factory site in Duisburg to gather information for their article. The whole process involves many production steps and a high degree of expert knowledge.

And something else, too, becomes clear on this day: Steel, even though it was invented thousands of years ago, is and will remain one of the most versatile and modern materials of our time, thanks to properties such as low cost, ease of processing, light weight, high crash safety, and the fact that it is almost 100 percent recyclable.

#### Contact

Sebastian Deumlich, Automotive business unit,  
+49 203 524 0797, sebastian.deumlich@thyssenkrupp.com

## Steel in the car: Four reasons for using material from thyssenkrupp

### Versatility

Finding solutions for the various demanding automotive applications is a matter of course for the researchers and developers at thyssenkrupp Steel. There is still much to discover about steel, one of the most innovative materials around.

### Standard

Certified and regularly inspected, thyssenkrupp Steel meets the high service and quality standards of the automotive industry.

### Safety

Steel from thyssenkrupp bolsters safety concepts (not just from Volvo), especially when it comes to crash-relevant components, and has been a reliable partner for carbon steel and top performance for decades.

### E-mobility

Electrical steel from thyssenkrupp Steel can be used for any drive system, from seat adjustment motors through to motors for e-mobility. The portfolio also includes cold- and hot-forming high-strength steels used for the battery housing.

# Less is more

scalur®+Z stands for maximum efficiency in component production. The hot-dip galvanized flat product offers the **very close thickness tolerances** while also providing a number of advantages.

# 1

## Multi-talented

The key property of scalur®+Z is its extremely close thickness tolerances down to +/- 0.06 mm over the entire length and width of the strip - much lower than with conventional hot-dipped galvanized flat products. Thanks to its ultra-flat profile, scalur®+Z offers significant advantages when it comes to further processing. The slit strip is ideal for use in the production of profiles due to its very straight longitudinal edge (camber).

Less weight, same load - bearing capacity: scalur®+Z makes cargo lighter and reduces the empty weight of containers by up to 20 kilograms.



The ultra-flat profile of scalur®+Z provides a number of advantages during slitting.”

Roger Hannig,  
Technical Customer Support,  
thyssenkrupp Steel

# 2

## Savings on many levels

Opting for scalur®+Z allows customers to achieve savings on several fronts. First off, they save on materials. That's because, based on the steel grade and coil weight, they receive up to 110 additional meters of coil by ordering thinner coil compared to conventional hot-dip galvanized flat products. The result is a reduction in set-up times as well as downtimes during production, since the coils need to be replaced less frequently. The customer thus saves materials and time. scalur®+Z also offers significant lightweighting potential due to the up to 20 percent reduction in component weight and through the use of higher strength scalur®+Z grades.



# 3

## A product with many uses

The hot-dip coated flat product scalur®+Z is ideal for applications that demand stricter tolerances. Due to its low camber, scalur®+Z is used in the construction sector for example in the profiling of facade elements. The structural steels scalur®+Z S390GD, S420GD, and S450GD, for example. These structural steels were certified in Germany for use in construction following approval by the Materials Testing Institute. Components such as runners help ensure that drawer units move smoothly. The logistics sector is another key area of application for the product, primarily in the construction of containers; container bottoms made from scalur®+Z are up to 20 kilograms lighter. Factoring in the average number of containers on a cargo ship, that saves a considerable amount of weight. scalur®+Z also has many applications in lightweight automotive construction, such as in electric motor housings or in longitudinal members and shock mounts.

## Contact

Roger Hannig, Industry business unit  
+49 203 52 41154, roger.hannig@thyssenkrupp.com  
Günter Topp, Industry business unit,  
+49 203 52 40440, guenter.topp@thyssenkrupp.com

Photo: Gettyimages, thyssenkrupp Steel Europe photography

## Interview New hot-dip galvanizing line for Dortmund



Tekin Nasikkol  
is General Works  
Council Chairman at  
thyssenkrupp Steel.

Heribert Fischer  
is Head of Production  
at thyssenkrupp Steel.

“Mr. Nasikkol, what does the launch of the new line mean for employees?”

It means a lot: employees have been living under a shroud of uncertainty for some time. That is now lifted. The construction of a new line is an investment in the future of our company. It is a sign that, the forthcoming joint venture is about more than just cutting costs and jobs. With the new line, we will not only be able to maintain our current workforce, but will also likely be adding more than 100 new jobs. That's a positive signal, one that was needed. The fact that the hot-dip galvanizing line is being built in Dortmund demonstrates a clear commitment to the steel industry here in the Ruhr. The region is developing into Europe's biggest center of excellence for hot-dip galvanized products – and this investment is making a key contribution.

“Mr. Fischer, what are the reasons for building a new line in Dortmund?”

There is growing demand for high-quality hot-dip galvanized products in the automotive sector. We see this as an opportunity to continue to improve on our position in this market segment. Our company was the world's first steel producer able to offer all standard surface coatings in use in the automotive industry for exposed panels highly popular zinc-magnesium products are also to be produced on the new line, which is being built alongside the existing FBA 8 line. Another factor that worked in favor of Dortmund was the fact that one of our research centers is located at the Westfalenhütte facility – and innovative technologies are essential to maintaining the international competitiveness of our industry.



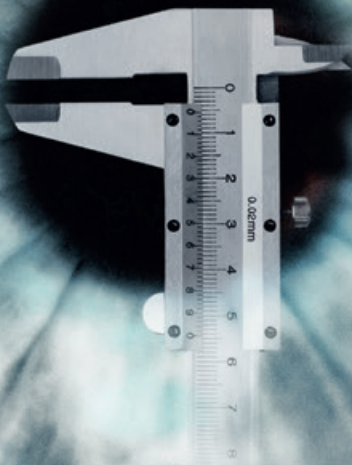
Steel

# Because your standards are exacting: scalur<sup>®</sup>+Z

Experience  
scalur<sup>®</sup>+Z:

**EuroBLECH**

October 23–26, 2018  
Hall 17 | Booth E33



A hot-dip galvanized flat product of unprecedented precision – that's scalur<sup>®</sup>+Z. Depending on the sheet thickness ordered, we achieve very close thickness tolerances as low as  $\pm 0.06$  mm. That is lower than with comparable conventional hot-dip galvanized sheet and offers you considerable advantages. It increases your output by minimizing material input and reduces set-up times, resulting in fewer manufacturing downtimes and faster production. So if you have to set more stringent tolerance requirements, for instance for stampings, profiles or telescopic rails, what's the best material for you to use? Precisely: scalur<sup>®</sup>+Z. Further details at [www.thyssenkrupp-steel.com/en/scalurz](http://www.thyssenkrupp-steel.com/en/scalurz)



engineering. tomorrow. together.

thyssenkrupp