

Steel is the material for mobility

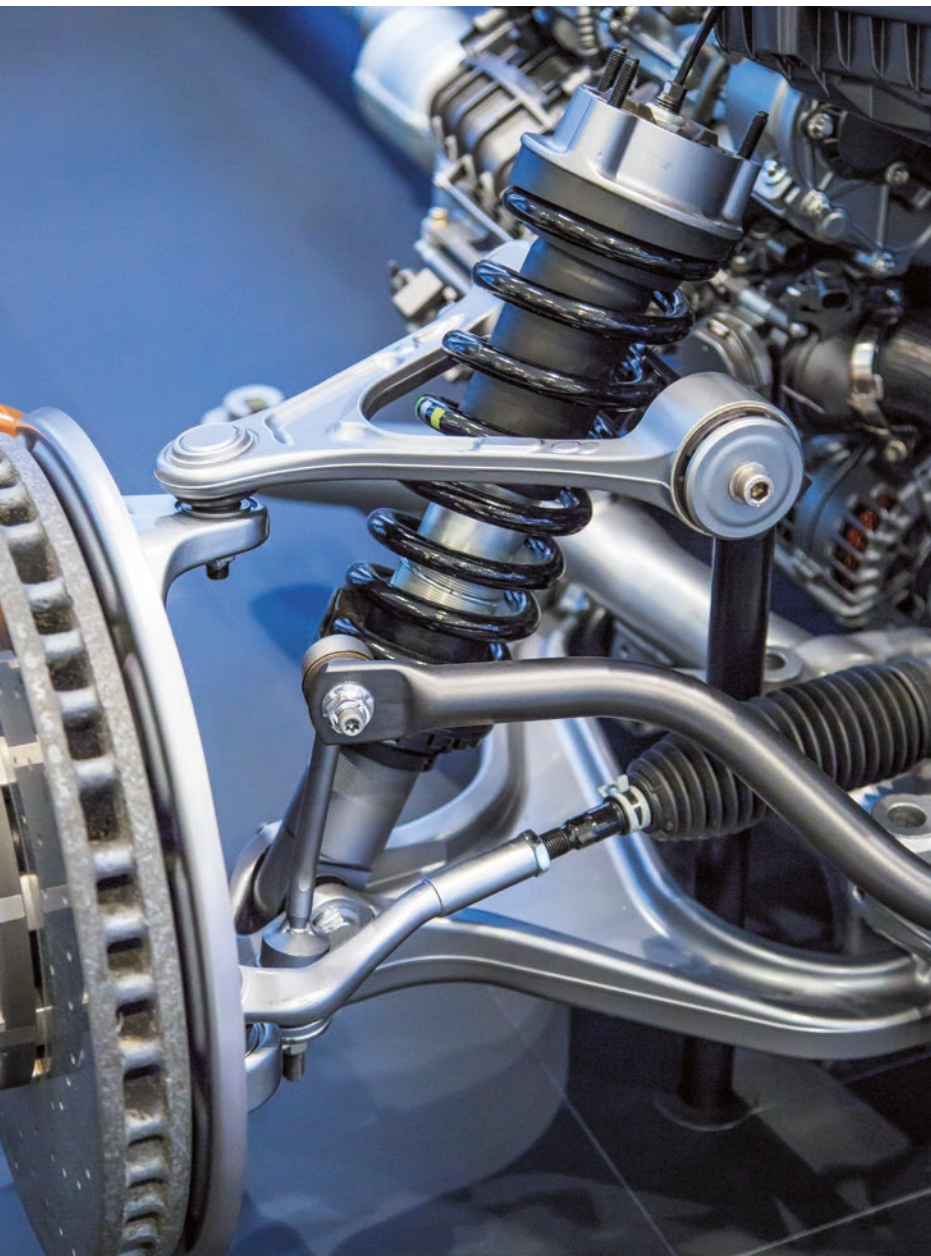
The automotive industry is undergoing fundamental change. OEMs are evolving from mere vehicle producers to mobility service providers and are facing, amongst others, completely new competitive challenges. In these turbulent times, thyssenkrupp Steel supports the automotive industry once again as a reliable materials supplier and produces high-quality materials for the vehicles of the future. The examples on the following pages show what innovative steel products from thyssenkrupp Steel can do for the automotive industry.



In the chassis, steel is the material of choice

The demands made on **chassis components** have risen constantly over the past few decades, and e-mobility will speed up this rise. thyssenkrupp Steel has a wide range of new steel products to provide the best possible answer to customer requirements both now and in the future, for conventional cars and electric vehicles.

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The job of the suspension system is to transfer dynamic movements and various forces to the car body. Key chassis components include control arms, subframes and stabilizers. As the link between the powertrain and the road

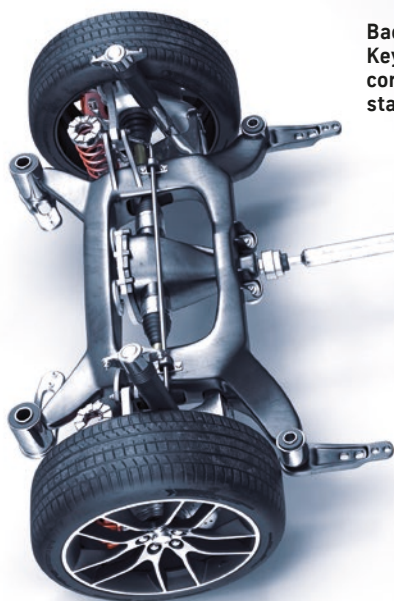
they have to ensure good road holding in every situation – in all weathers and road conditions. Chassis components are subjected to permanent vibrations and oscillations, have to cushion impacts from the road, handle load changes, and cope with potholes and curbs.

The electrification of the powertrain presents additional challenges to chassis technology. The weight of batteries – anything up to 700 kilograms – places a burden on the chassis, while their high costs place a burden on vehicle manufacturers. As the heaviest and most expensive individual component, the battery needs to be accommodated safely in the floor of the car. Economical lightweight solutions are called for that do not sacrifice safety. And there is also a need to make the best possible use of the limited packaging space in the chassis and ensure optimum fatigue strength. With no front engine, the subframes must increasingly serve as an additional crash load path.

The right material in the right place

With its range of proven and new high-performance steels for modern chassis designs, thyssenkrupp Steel ensures the right material can always be used in the right place. The company has been supporting OEMs and component

As a longstanding partner to the automotive industry, thyssenkrupp Steel offers customers a wide range of high-performance steels for chassis applications.



Backbone of the design:
Key chassis components include control arms, subframes and stabilizers.



The selectrify® initiative

thyssenkrupp's selectrify® initiative – and here in particular the battery housing – is a prime example of cost-effective weight reduction in efficient, safe and climate-friendly electric cars. The scalable selectrify® battery housing consists of an enclosure with a frame, a connection profile, upper and lower support arms, underride guard and cover. At approximately the same weight, the steel design is up to 50 percent cheaper to make than comparable aluminum solutions and causes up to 50 percent fewer CO₂ emissions over the complete life cycle. The selectrify® battery housing proves that lightweighting, safety and fire protection can be combined – and at the same time allow high cost savings.

Advantages at a glance:

selectrify® steel battery housing: Up to 50% lower CO₂ emissions

No. 1 for fire protection

Greater safety, higher range

Up to 50% lower production costs

suppliers for decades as an expert materials supplier and can offer everything a good chassis needs: primarily hot-rolled, high-strength steel sheet that can be formed into lightweight, safe parts of increasingly complex shape so as to meet dimensional requirements for parts and assemblies. In addition thyssenkrupp Steel is driving the development of coated hot-rolled steels in thicknesses of 2-3 mm that are ideal for corrosion-critical rear axle parts.

Wide range for individual needs

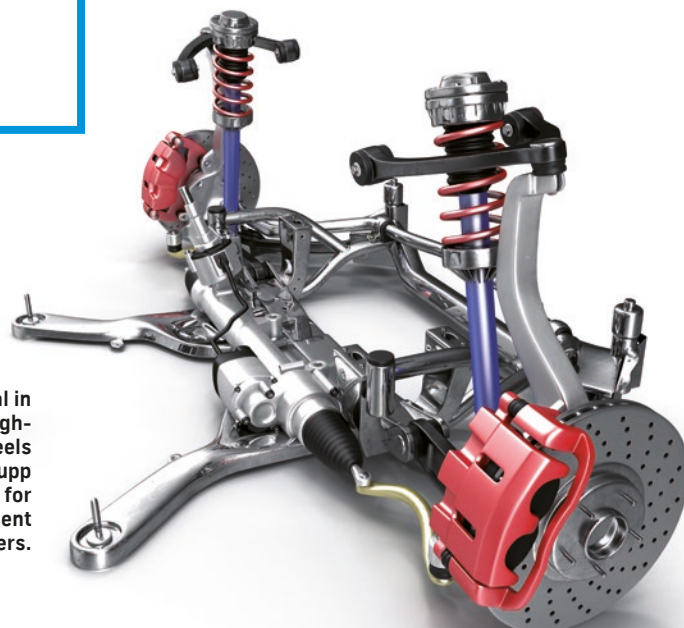
The fact is: the development of low-cost, lightweight, high-strength chassis parts must always be based on what application the customer has in mind and how they want to implement it. And of course the materials philosophy of OEMs also plays an important part. With its expert materials knowledge and decades of expertise in chassis solutions, thyssenkrupp Steel can meet all requirements. For example, various steel grades of the same strength class from thyssenkrupp Steel can be used for one part. That comes as no surprise, because strength is not the only criterion for material selection. Depending on customer requirements and part complexity, properties such as hole expansion, deep-drawing or bending capacity may be of key importance. How well a material can be cut and its suitability for welding will also play a role.

Ultimately, the differences between individual materials may be extremely fine, so a decision for or against a material will depend largely on which properties are of greatest importance to the customer. Depending on use

and requirements, for pressed chassis parts thyssenkrupp Steel offers two general material groups: multiphase steels and microalloyed steels. For tube applications, e.g. in stabilizers, manganese-boron steels are also available.

Steel materials offer huge potential

Multiphase steels offer the auto industry the opportunity to utilize cost-efficient lightweighting potential. The use of higher-strength steels allows parts to be made from thinner material, which in turn makes the parts lighter. Multiphase steels are ideal for demanding shapes such as those required in chassis applications. This is because the sheet displays excellent local forming properties despite its high strength. And although this material group has been tried and tested over the years, there is no shortage of new developments – such as the bainitic steel **CH-W® 660Y760T**. This high-performance material is ideal for cold-formed parts with high hole expansion requirements such as control arms.



The right material in the right place: High-performance steels from thyssenkrupp Steel are ideal for OEMs and component suppliers.

› **Manganese-boron steels** score highly on two points in tubular automotive applications: they are light yet affordable. Manganese-boron steels display good processing properties and after heat treatment can achieve high strengths – ideal prerequisites for products made from precision steel tubes. Starting materials of this type from thyssenkrupp Steel – such as **tubor® 26** or **tubor® 34** or **precidur HLB 34** – are used in the chassis among other things for stabilizers.

Overview of grades

thyssenkrupp brand names
vs VDA standard

Brand	VDA 239-100/based on
precidur® HSM 315 HD – precidur® HSM 700 HD*	HR300LA – HR700LA
precidur® HBS 600 – precidur® HBS 1000 HE	HR660Y760T-CP – HR700Y950T-CP
precidur® HLB 8 – precidur® HLB 41	
perform® 420 – perform® 700	HR420LA – HR700LA
perform® 500 HD	
FB-W® 300Y450T – FB-W® 460Y580T	HR300Y450T-FB – HR440Y580T-FB
CP-W® 660Y760T CH-W® 660Y760T*	HR660Y760T-CP
tubor® 26 – tubor® 34	

* not available in America and Japan

New member of the steel family

In addition to working continuously to improve its proven standard and premium grades, thyssenkrupp Steel is also focused on developing new high-performance materials. **perform® 500 HD** is the first material in the new perform® HD product family aimed specifically at chassis parts or parts with complex shapes, high strength and dimensional accuracy, such as in car seats. This grade is characterized by guaranteed close mechanical tolerances and good hole expansion characteristics. At the same time, a new alloying concept ensures that forming properties are uniformly improved over the entire coil length. For processors this means lower production costs as a result of lower scrap and reduced downtimes for tool setting.

High-ductility, **microalloyed fine-grain steels** from precidur® hot-rolled precision steel strip produced in Hohenlimburg are also used for demanding chassis parts. Premium materials such as **precidur® HSM 700 HD** are particularly suitable for the manufacture of parts with complex forming geometries and open up new design options for automotive lightweighting. As an additional advantage, they offer the same extremely tight shape and thickness tolerances as cold-rolled materials, which means very high process reliability during part manufacture.

Individual processing strategy determines choice of material

The wide-ranging strengths and fine differences between the material groups underline once again that when it comes to the chassis, the individual processing strategy is of key importance for the choice of material. Depending on the requirements profile it is perfectly possible to use different steels and different material strengths in the front and rear axles. In this respect, the versatility of sustainable steel from thyssenkrupp Steel knows virtually no bounds.

Whatever the specific requirements of the auto industry, one thing is always true: thyssenkrupp Steel drives developments in high-performance steel materials. Examples include the high-strength precidur® HD grades and the new ultrahigh-strength **bainitic steels precidur® HBS 800, HBS 900 and HBS 1000 HE**. These products achieve extremely high tensile strengths and yet can be formed and stamped by conventional means.



Hard-wearing:
Chassis components
are subjected to
permanent vibrations,
have to cushion
impacts and handle
load changes.

Web

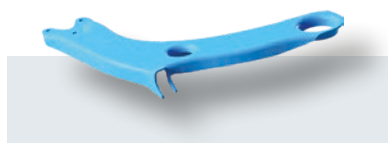
Link to hot strip:
www.thyssenkrupp-steel.com/en/hot_strip_in_motion

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Connecting, supporting, holding: The right materials for perfect performance

Every chassis part makes particular demands on its material depending on its function and the stresses it is exposed to. By reference to selected components, steel^{compact} shows how broad thyssenkrupp Steel's range is.



Control arm – the right direction

The control arm is a moving link between the front or rear wheel and the body. In the event of a crash it may deform but it must not break. To connect the control arm to the body frame, the high-strength sheet material of the control arm is widened by flange forming. This forming process places high requirements on the material with regard to edge cracking. In general, the susceptibility of a material to edge cracking under high expansion loads is simulated in so-called hole expansion tests. The good hole expansion capacity of the material used is therefore of key importance for the cost-efficient, defect-free manufacture of highly stressed parts.

Suitable materials:

Microalloyed steels

- precidur[®] HSM 500 HD – HSM 700 HD
- perform[®] 420 – perform[®] 700

Multiphase steels

- precidur[®] HBS 800 – HBS 1000 HE
- FB-W[®] 300Y450T – FB-W[®] 460Y580T
- CP-W[®] 660Y760T
- **NEW:** CH-W[®] 660Y760T



Subframe – a part with many variants

Subframes are structural components that support the wheel suspensions and ensure stiffness that translates into better ride stability. Numerous parts are connected to the subframe, such as all control arms and stabilizers as well as the powertrain, chassis and body. As a result subframes are highly versatile parts that perform many tasks. For example, in addition to high stiffness they must also meet particular requirements for natural frequency and crash behavior. At the same time costs need to be kept as low as possible: OEMs and suppliers would prefer these welded components – often in many variants – to comprise as few parts and have as few welds as possible so as to minimize production expense. The good news: thyssenkrupp has a wide range of suitable steel grades to meet these requirements.

Suitable materials:

Microalloyed steels

- precidur[®] HSM 500 – HSM 700
- precidur[®] HSM 500 HD – HSM 700 HD
- perform[®] 420 – perform[®] 700
- **NEW:** perform[®] 500 HD

Multiphase steels

- precidur[®] HBS 800 – HBS 1000 HE
- FB-W[®] 300Y450T – FB-W[®] 460Y580T
- CP-W[®] 660Y760T
- **NEW:** CH-W[®] 660Y760T



Stabilizers – cornering without bending

Stabilizers are the chassis parts that connect the wheel suspensions of an axle with the body structure. As a suspension element, stabilizers reduce vehicle roll during cornering. So the material must be able to withstand repeated bending and torsion loads – and these requirements are rising as vehicle weights increase.

Suitable materials:

Manganese boron steels

- precidur[®] HLB 8 – HLB 34
- tubor[®] 26 – tubor[®] 34

Front control arm

Microalloyed steels

precidur® HSM 500 HD – HSM 700 HD
perform® 420 – perform® 700

Multiphase steels

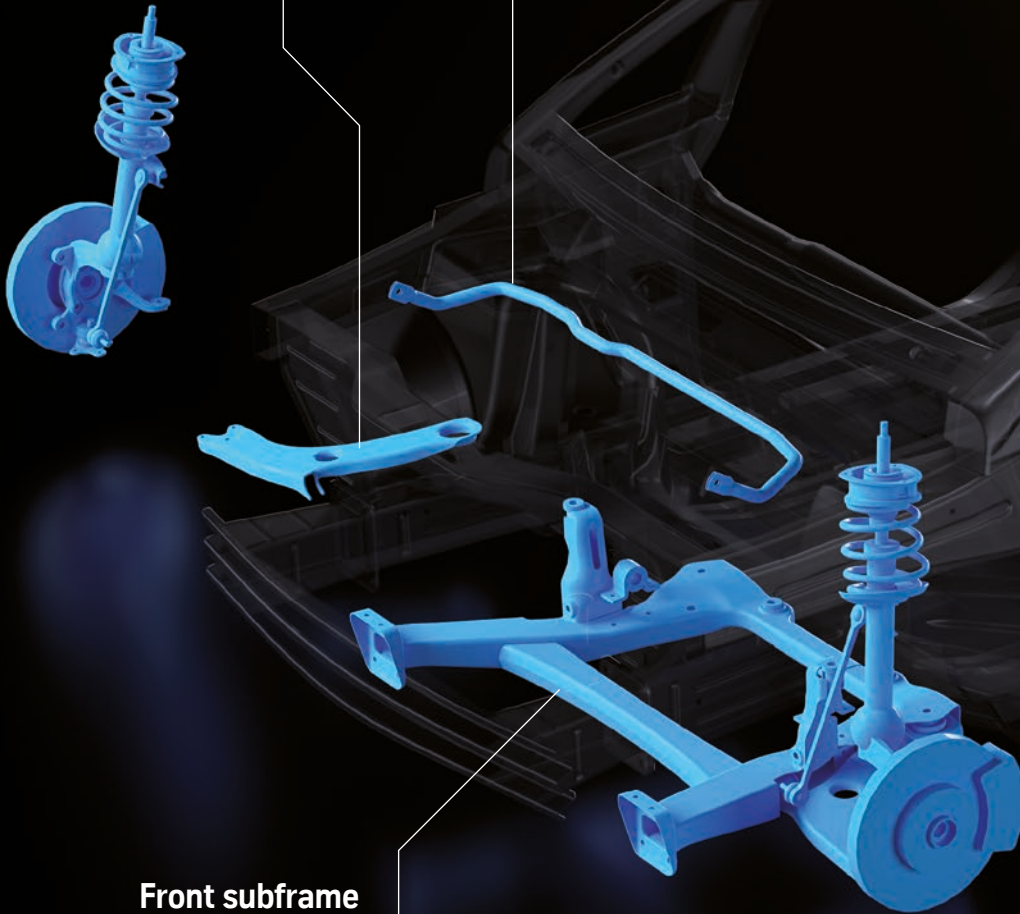
precidur® HBS 800 – HBS 1000 HE
FB-W® 300Y450T – FB-W® 460Y580T
CP-W® 660Y760T

New: CH-W® 660Y760T

Stabilizer

Manganese-boron steels

precidur® HLB 8 – HLB 34
tubor® 26 – tubor® 34



Front subframe

Microalloyed steels

precidur® HSM 500 – HSM 700
precidur® HSM 500 HD – HSM 700 HD
perform® 420 – perform® 700

New: perform® 500 HD

Multiphase steels

precidur® HBS 800 – HBS 1000 HE
FB-W® 300Y450T – FB-W® 460Y580T
CP-W® 660Y760T

New: CH-W® 660Y760T

Rear subframe

Microalloyed steels

precidur® HSM 500 – HSM 700
precidur® HSM 500 HD – HSM 700 HD
perform® 420 – perform® 700

New: perform® 500 HD

Multiphase steels

precidur® HBS 800 – HBS 1000 HE
FB-W® 300Y450T – FB-W® 460Y580T
CP-W® 660Y760T

New: CH-W® 660Y760T

Rear control arm

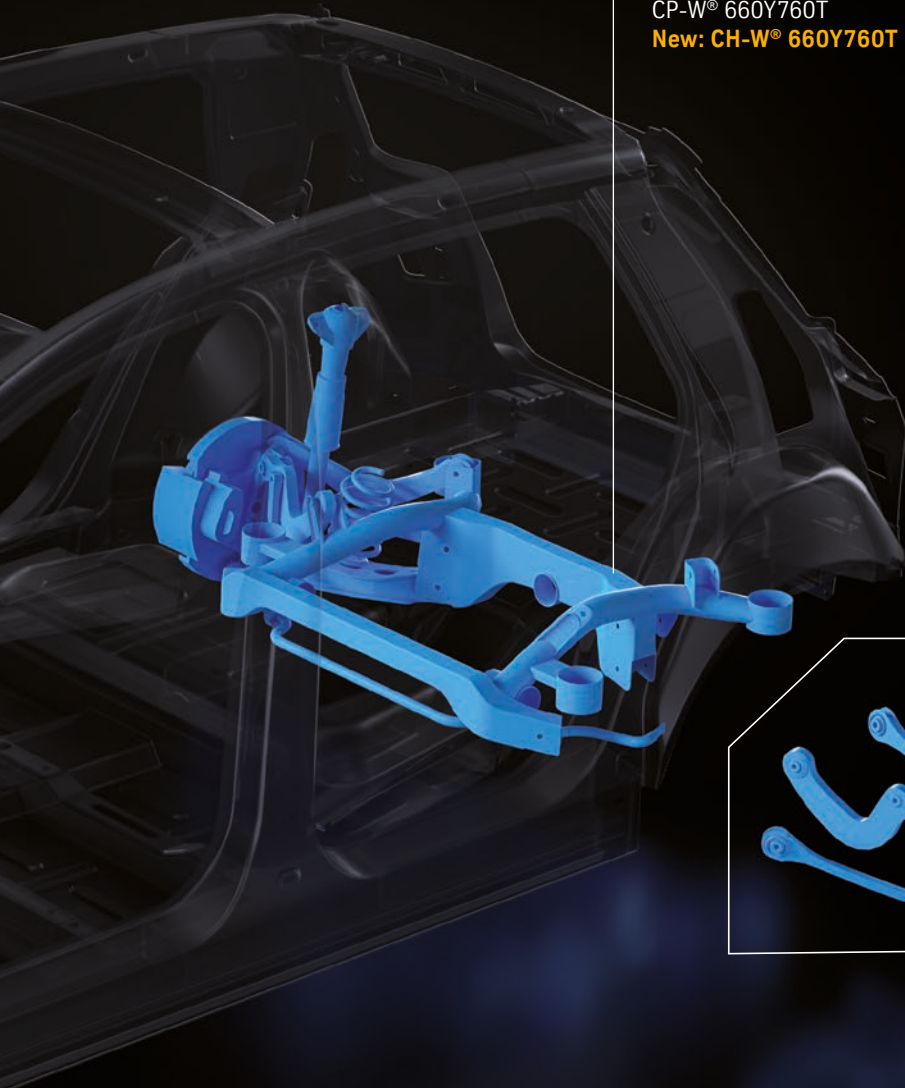
Microalloyed steels

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CP-W® 660Y760T

New: CH-W® 660Y760T



The right material in the right place

When it comes to the chassis, thyssenkrupp Steel brings its full expertise to bear. Several steel grades from various material groups are available for the same part. The extensive portfolio offers the right material for every requirement.