sidenor steel

FORGING INNOVATIVE STEELS FOR UPCOMING AUTOMOTIVE DEMANDS

Summary

2017 Main Data

"Sidenor is a market leader in the European special steel long product industry and a reference point for heavy forgings and castings worldwide"

Annual Sales (Tonnes)

746.000

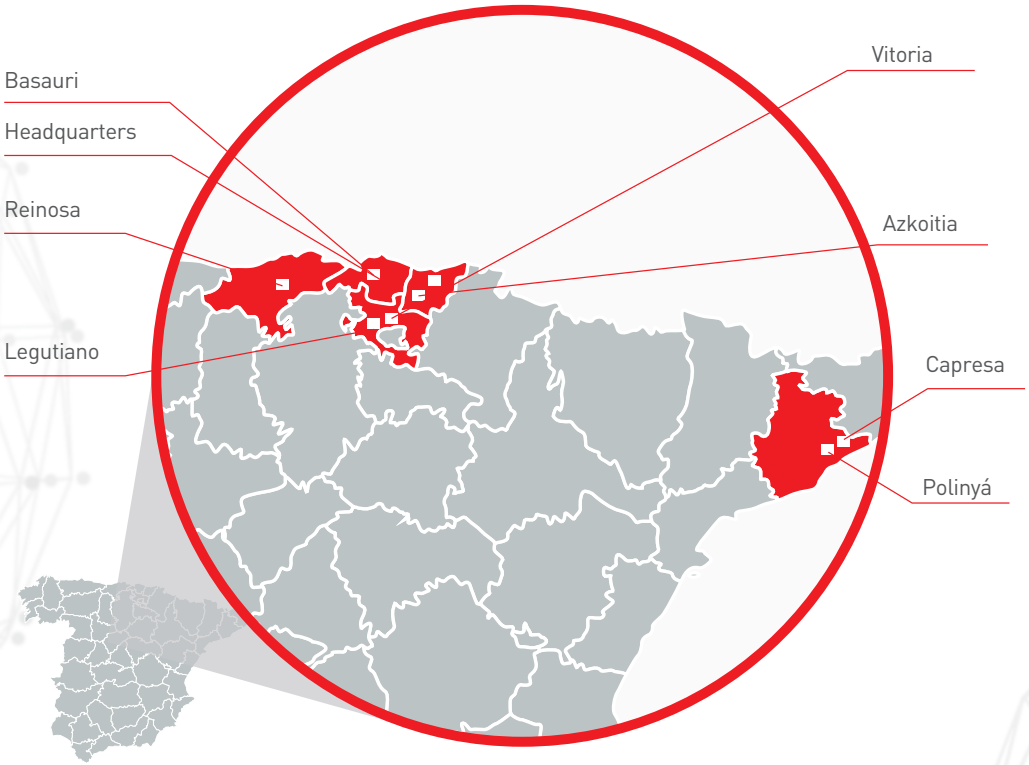
Revenues (mill€)

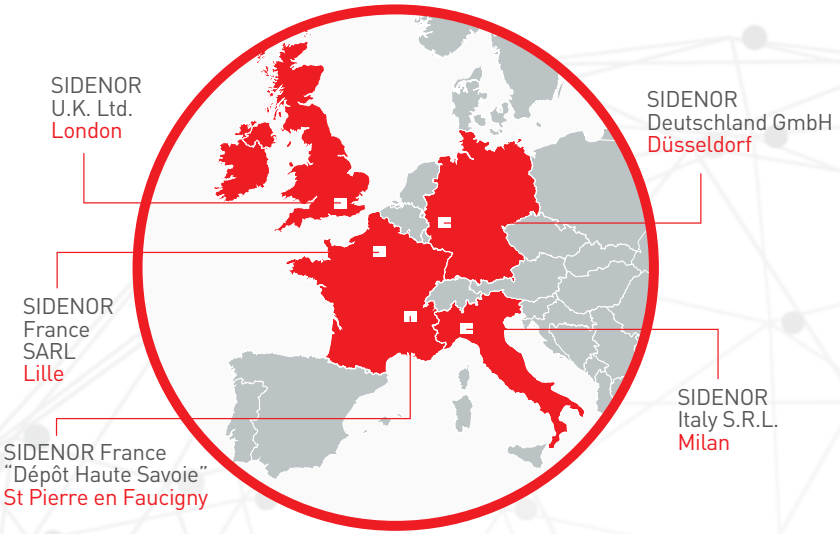
722

Employees

2.319

Manufacturing Centres





Research and Development in Special Steel

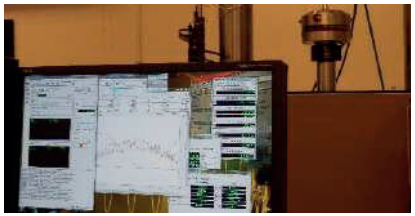
"Our mision is to **Create, Develop, Transfer and Protect Sidenor Technology** in order to reach innovative solutions in the production and use of steel materials and steel components"

R&D Laboratory to support Research Activities along the whole production chain

STEELMAKING | METALWORKING | PRODUCT

INDUCTION VACUUM MELTING & CASTING FURNACE

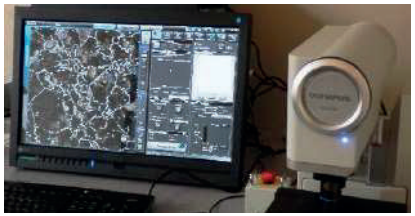
THERMAL-MECHANICAL SIMULATOR



FATIGUE TESTING

FIELD EMISSION ELECTRON MICROSCOPE

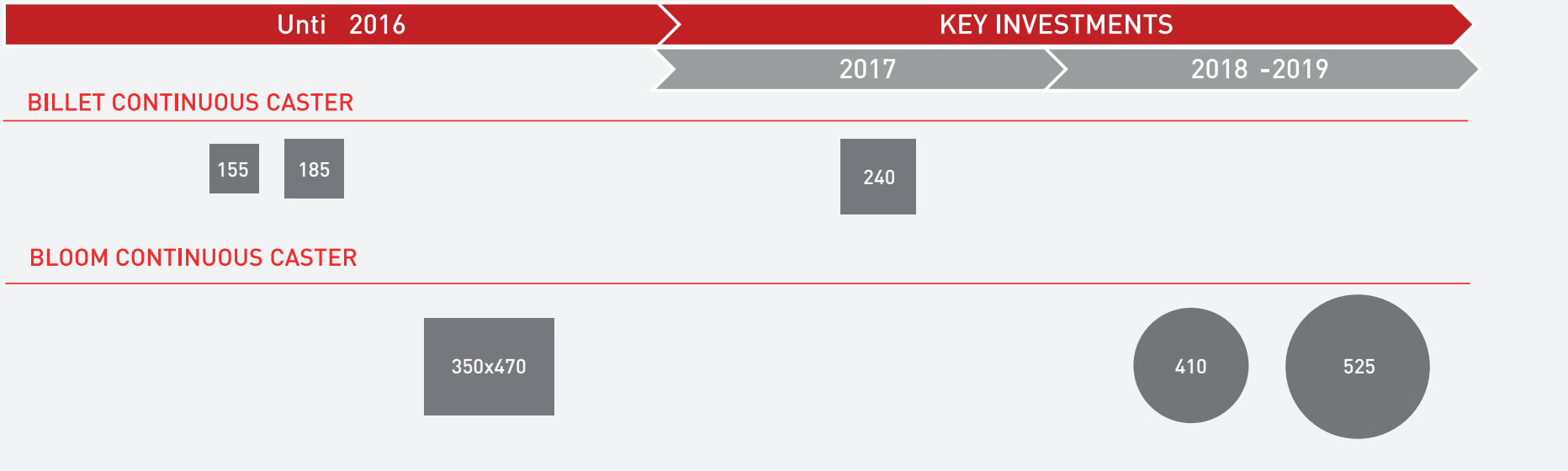
DILATOMETER



OPTO-DIGITAL MICROSCOPES

Intermediate Product Range

"In the spirit of continuous improvement of its processes, facilities and product portfolio, Sidenor decided to invest in the Continuous Casters. The new formats will allow the company to reach new market shares and offer new products and specific solutions for individual customers"



Product Portfolio: SBQ

Products

HOT ROLLED BARS
- Rounds
- RCS
- Flats

WIRE ROD
- Coils

FORGED BARS
- Rounds
- RCS
- Flats

BRIGHT BARS
- Drawn
- Turned
- Ground

DRAWN WIRE

Applications Automotive

- Crankshafts
- Gears
- Common Rails
- Leaf Springs
- Coil Springs
- Bearings
- Shafts
- CVJ's
- Steering Racks
- Steering Pinions
- Shock absorbers
- Fasteners

Applications Non-Automotive

ENERGY (OIL & GAS)

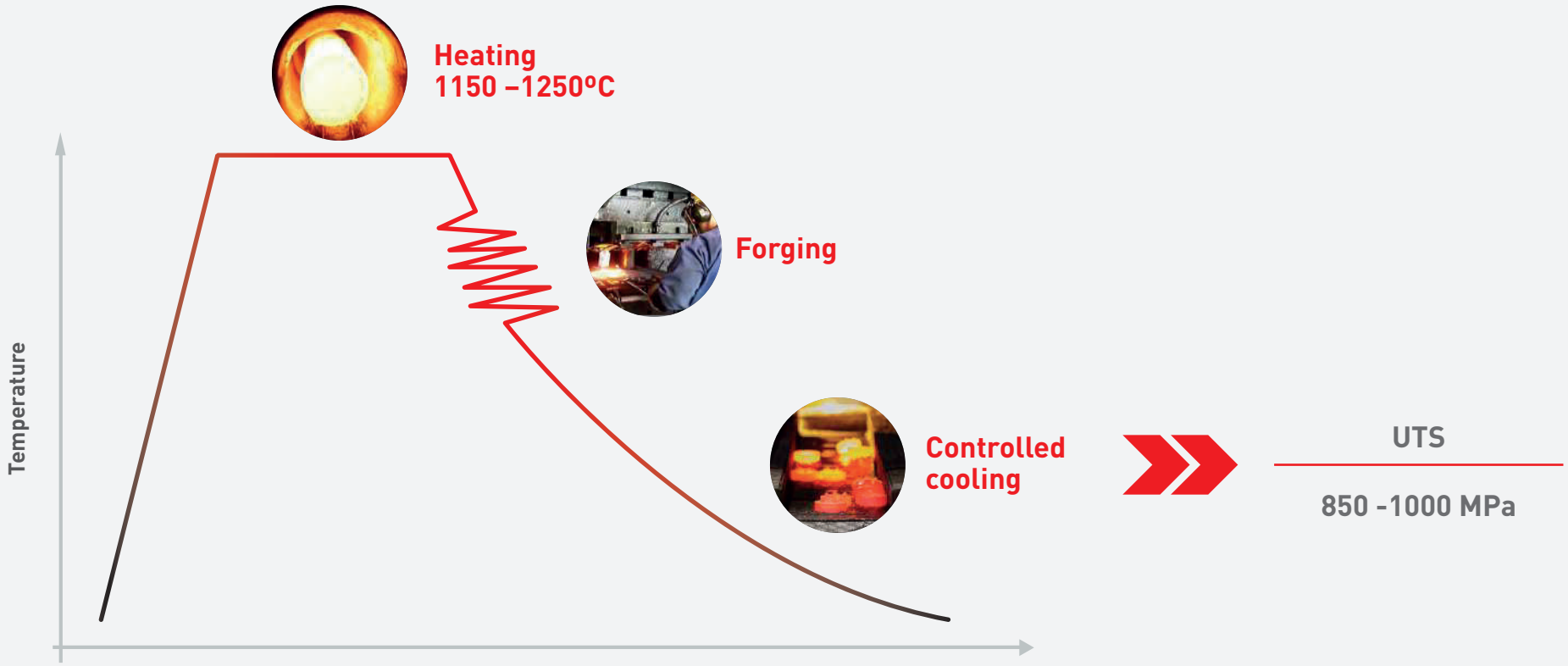
ENERGY (WIND POWER)

RAILWAY

OFF HIGHWAY EQUIPMENT

Forger´s Influence on Mechanical Properties

Hot forging steps

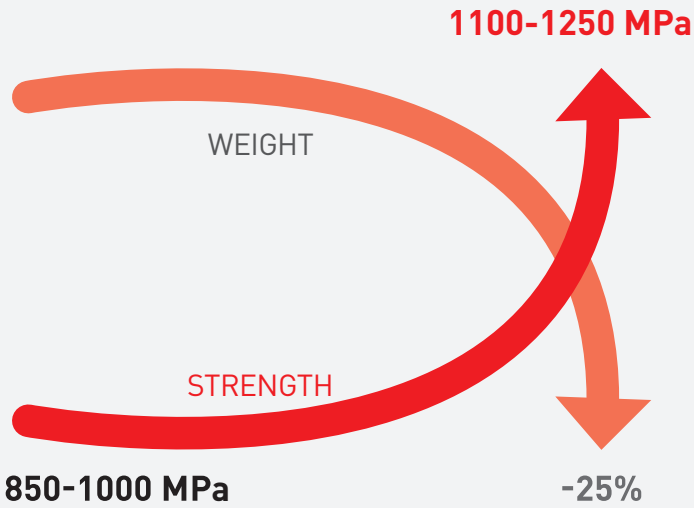


Weight Reduction is a Must

- Weight reduction of forged components saves fuel consumption, reduces emissions and helps to fulfill EU Directives.
- An increase of steel strength allows weight lightening in similar proportion.

LIGHTWEIGHT FORGING INITIATIVE
FORGING & STEEL INDUSTRY

STUDY OF INDUSTRIAL LIGHTWEIGHT DESIGN POTENTIAL WITH 24 PARTNERS	STUDY OF INDUSTRIAL LIGHTWEIGHT DESIGN POTENTIAL WITH 28 PARTNERS	"LIGHTWEIGHT FORGING" RESEARCH NETWORK	STUDY OF INDUSTRIAL LIGHTWEIGHT DESIGN POTENTIAL WITH 39 INTERNATIONAL PARTNERS
PHASE I PASSENGER CAR	**PHASE II** LIGHT COMMERCIAL VEHICLE		**PHASE III** HYBRID CAR / CONV. CV
2013 - 2014	2015 - 2016	2015 - 2018	2017 - 2018

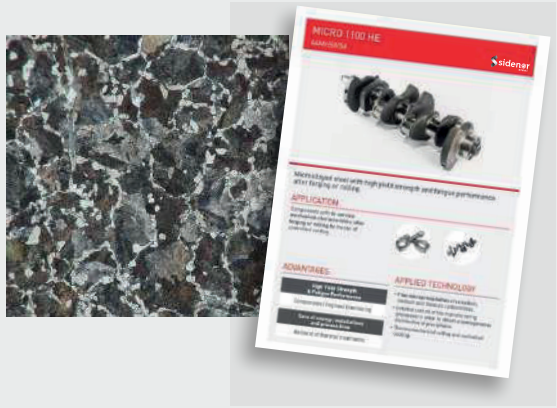


Sidenor Solutions for Ligthweighting

SIDENOR gives solutions to present and future customer´s demands and challenges by means of own product developments:

MICRO 1100 HE

- Microalloyed Steel with high yield strength and fatigue performance after forging or rolling



- Ferrite-Pearlite

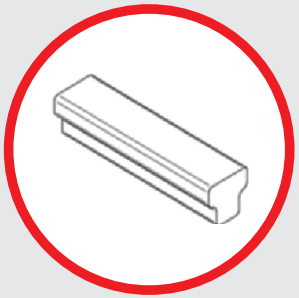
HARDMAX

- High yield strength and good compromise strength-toughness

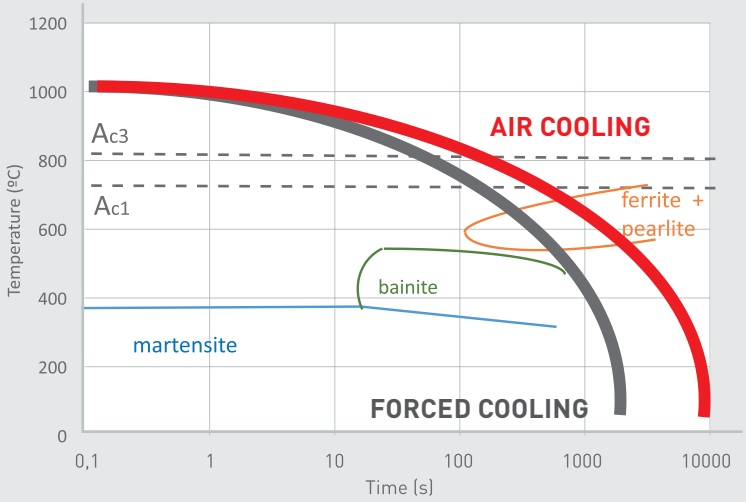
- Bainite-Martensite

MICRO 1100 HE

Trials at different heating temperatures and cooling rates

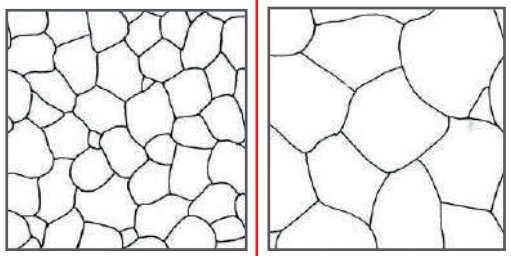


FINAL MICROSTRUCTURE: FERRITE-PEARLITE



HEATING TEMPERATURE

1150ºC

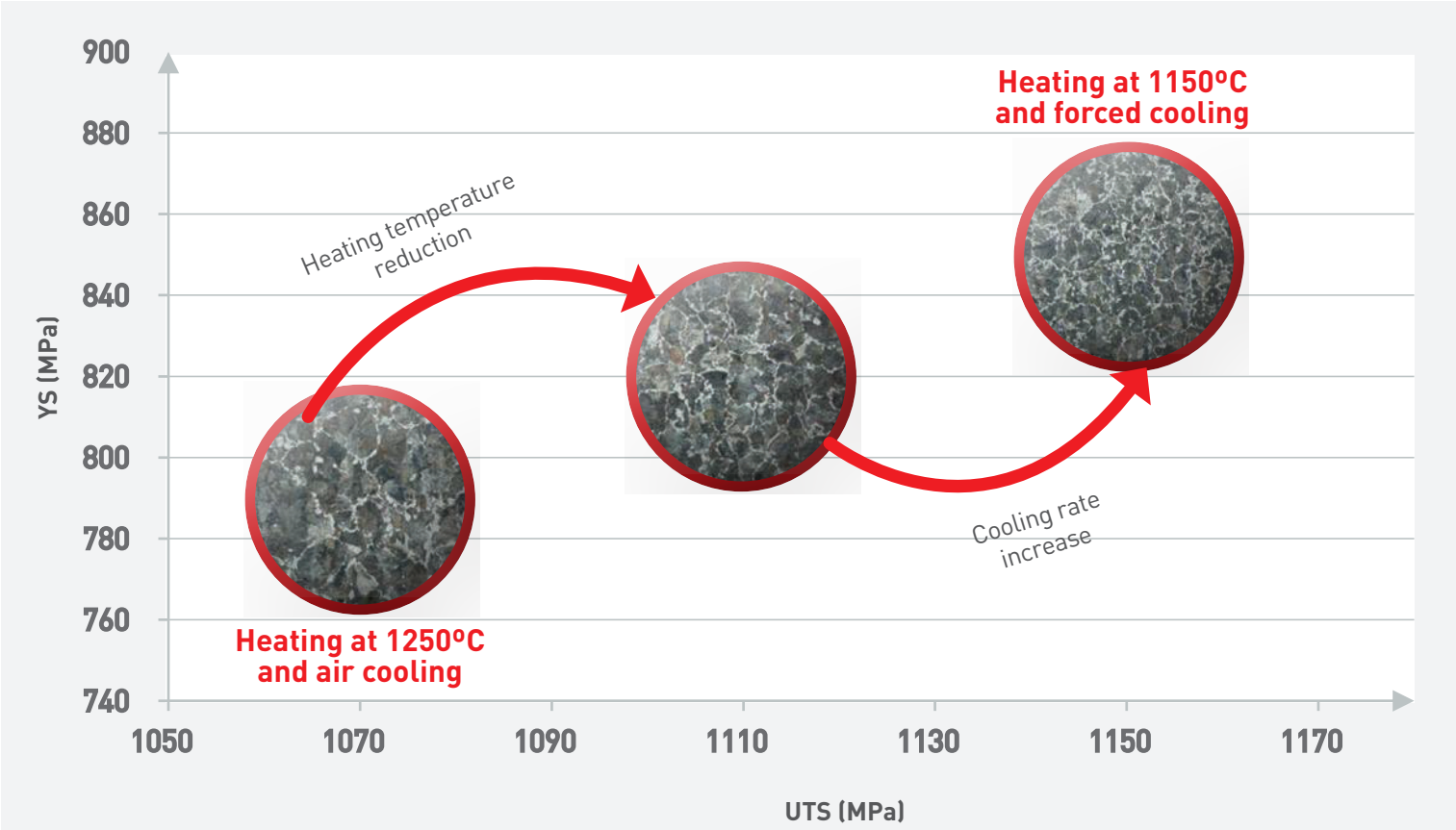


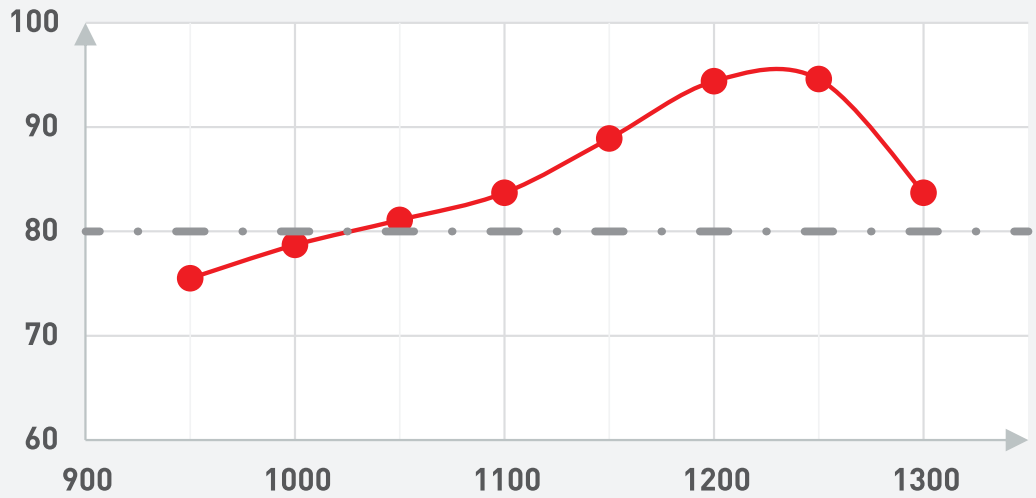
1250ºC

MICRO 1100 HE

Selecting optimum conditions

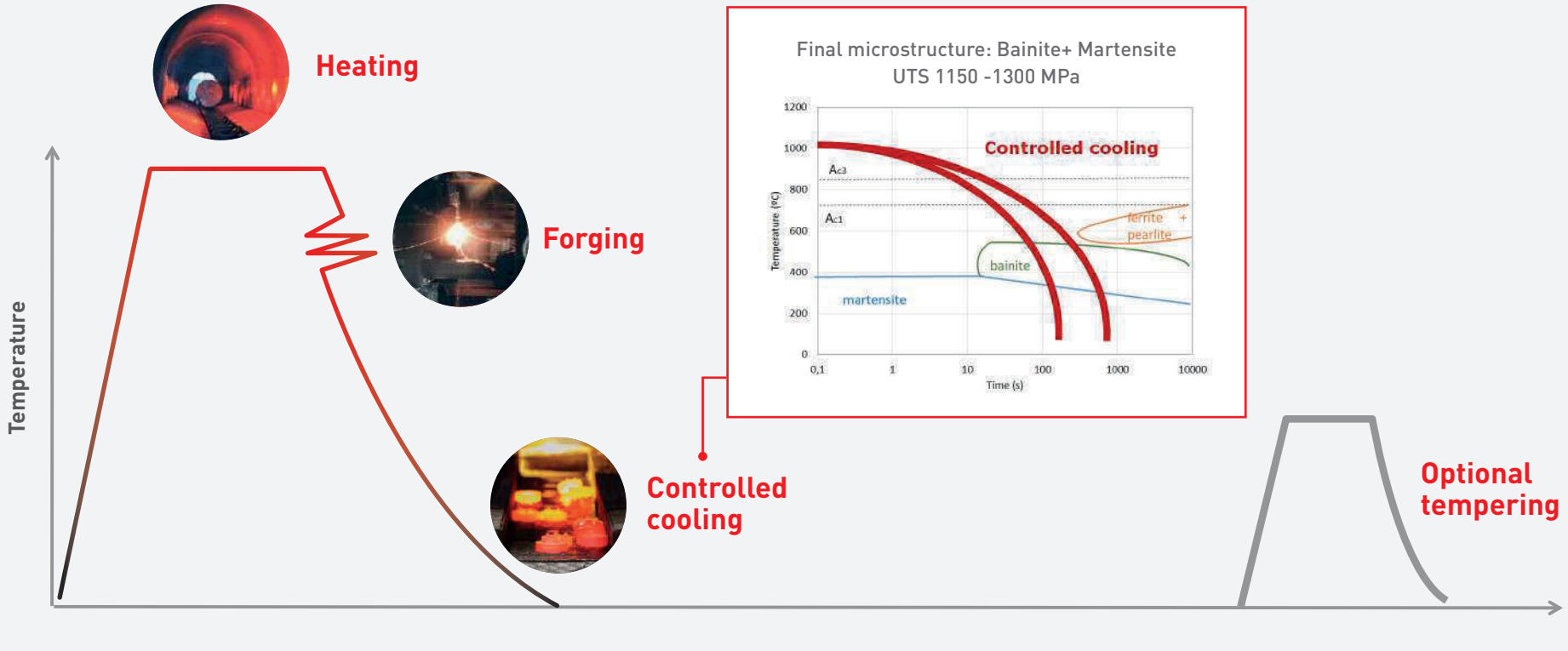
Different conditions of heating and cooling have been analyzed.



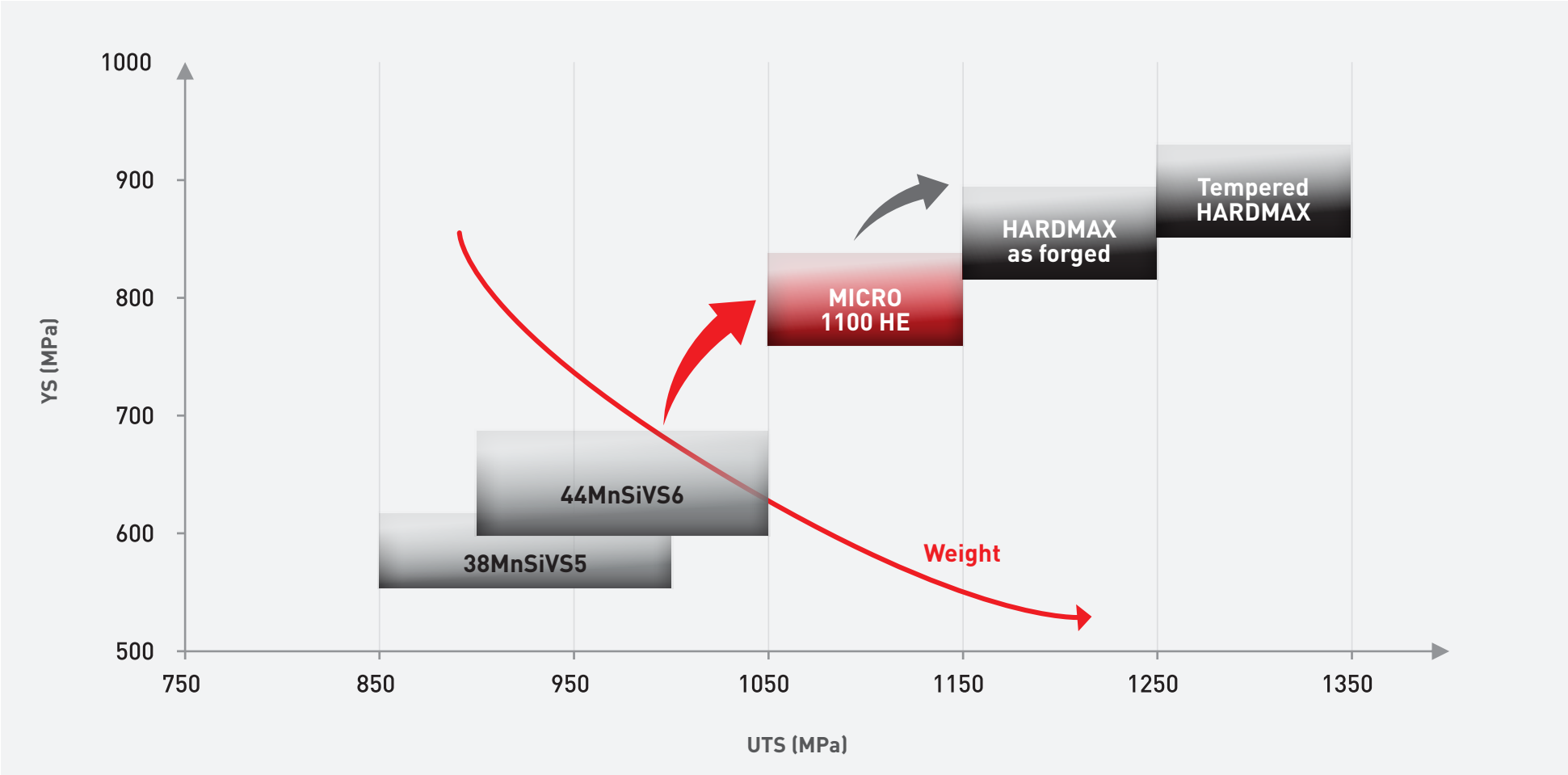

100
90
80
70
60
900
1000
1100
1200
1300

Tailoring Mechanical Properties

Manufacturing process

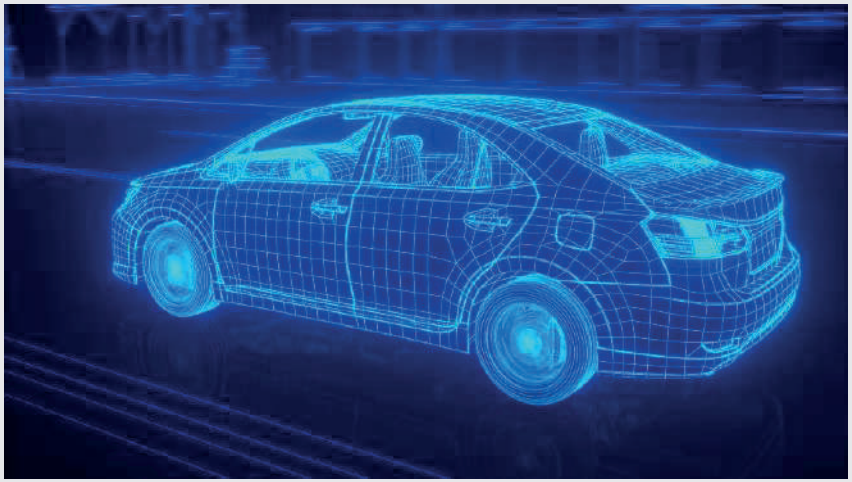


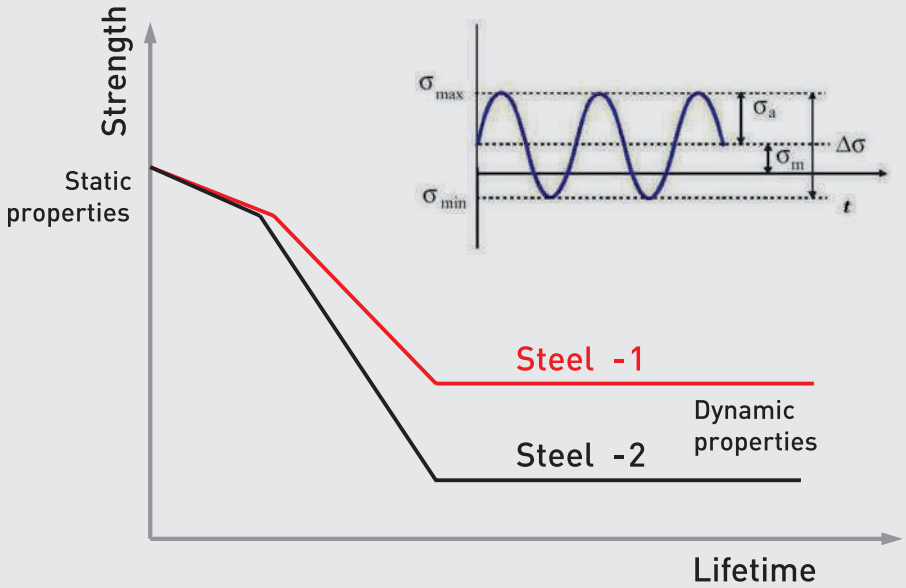
Comparison MICRO 1100 HE - HARDMAX



Is UTS the only critical factor?

- A vehicle is a dynamic system with variable loading.
- Forged components mainly must cope with dynamic loads.
- Fatigue performance is, as least, as important as tensile strength as design factor.





Outcome

Higher strength, higher fatigue limit: Same ratio?

- Excellent fatigue performance
- Homogeneous Ferrite-Pearlite microstructure
- Good machinability
- Applicable to hot forged parts:
  - Forged components of high mechanical requirements and good response to machining

- High tensile strength (~ 1250 MPa)
- Excellent fatigue performance
- Mainly Bainitic microstructure

- Forged components with higher mechanical requirements than microalloying steels

Final remarks

- **SIDENOR** has a strong R&D capability in developing new products for automotive market.
- **MICRO 1100 HE** & **HARDMAX** are two lightweighting solutions offered by SIDENOR.

MICRO 1100 HE

For MICRO 1100 HE, the forger can modify final mechanical properties of components, selecting **forging temperature** and **cooling rate**.

HARDMAX

HARDMAX is the **bainitic solution** for components with high mechanical requirements. An additional tempering allows to adjust the required properties.

- **Fatigue is a design criterion** for automotive components and its relationship with tensile strength is not always linear.
- SIDENOR continues working to offer the customers a wide range of products for their current and future demands.

Thank you very much

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