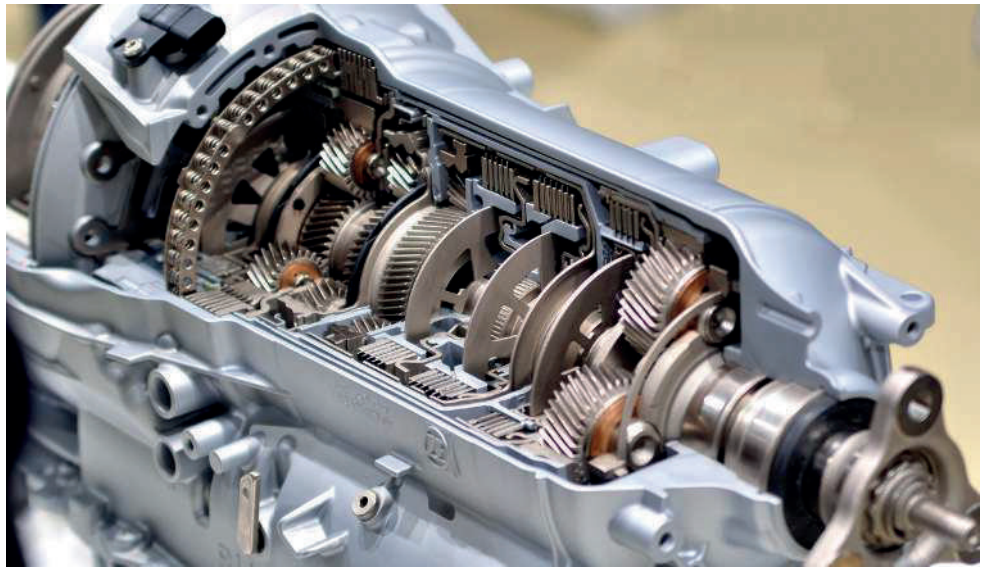
ISOCEM®: New Generation of Case Hardening Steels

Competitive, flexible, ecological and predictable/reliable manufacturing processes

sidenor steel

Steels for Transmission Components

- Components such as shafts, gears and pinions must combine:
  - **High Surface Hardness** to guarantee wear resistance
  - **Toughness Core**
- Low carbon MnCr, CrMo or NiCrMo alloyed steels are carburised and quenched
- During carburising some **distortions are generated** and must be corrected by costly finishing operations

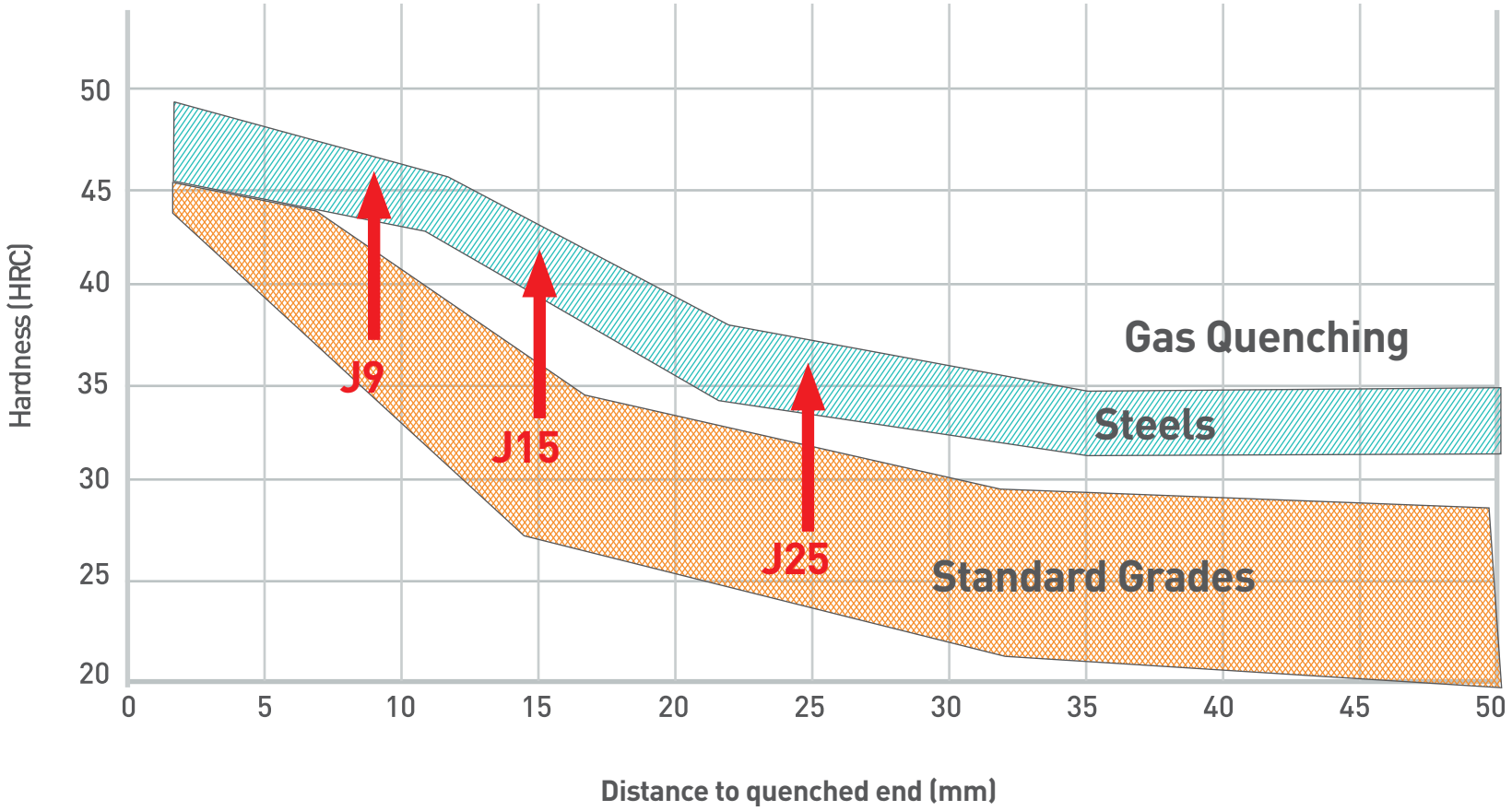


ISOCEM® Applications

- Cost effective new case hardening steels designed for:
  - High hardenability
  - Substitute high alloy grades (Cr-Ni-Mo) with same properties
  - Excellent response in gas quenching process
  - Reduce distorsions after quenching process

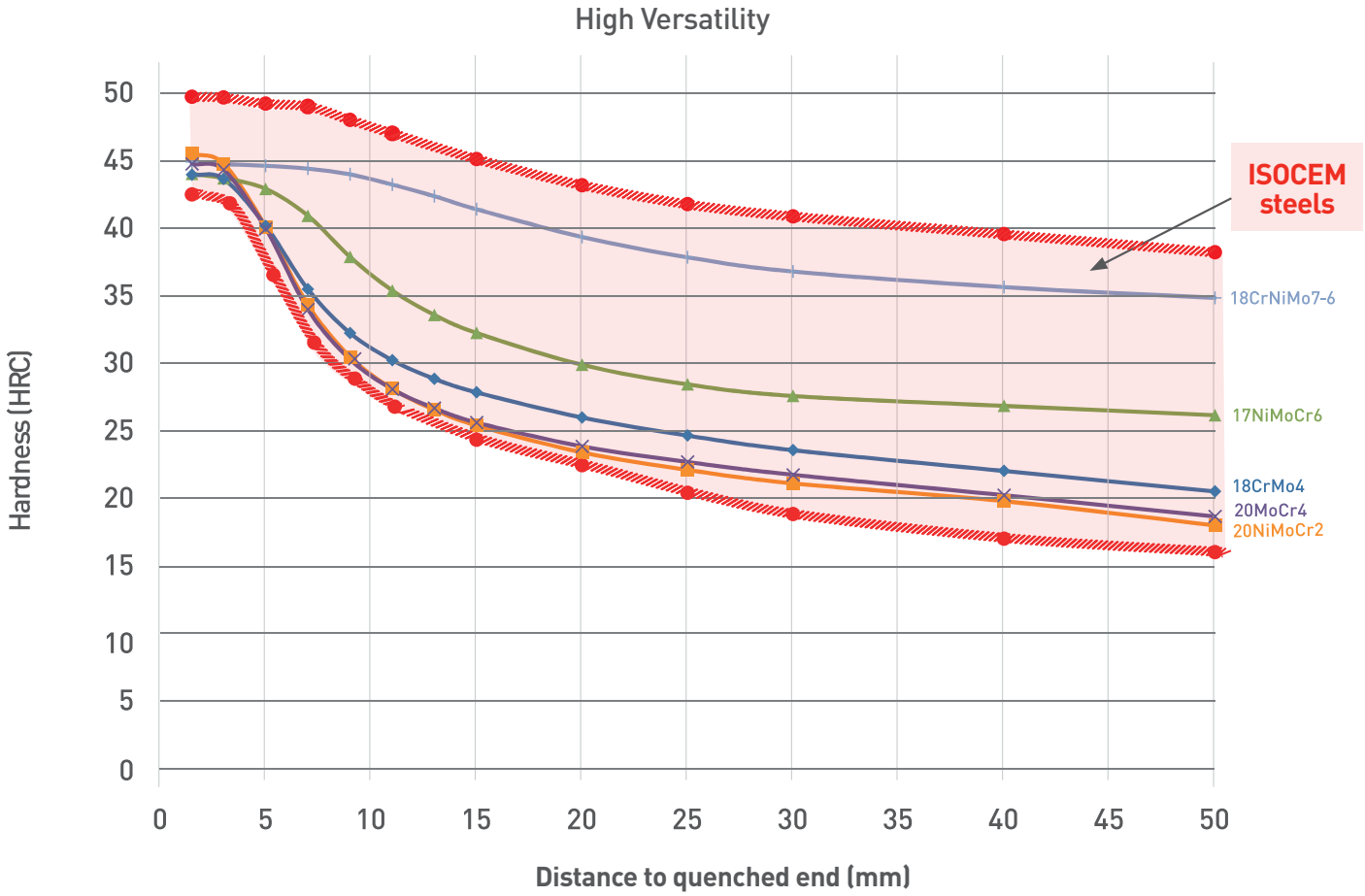
High Hardenability

- Steels with **adapted hardenability** that ensure final properties in gas quenching processes



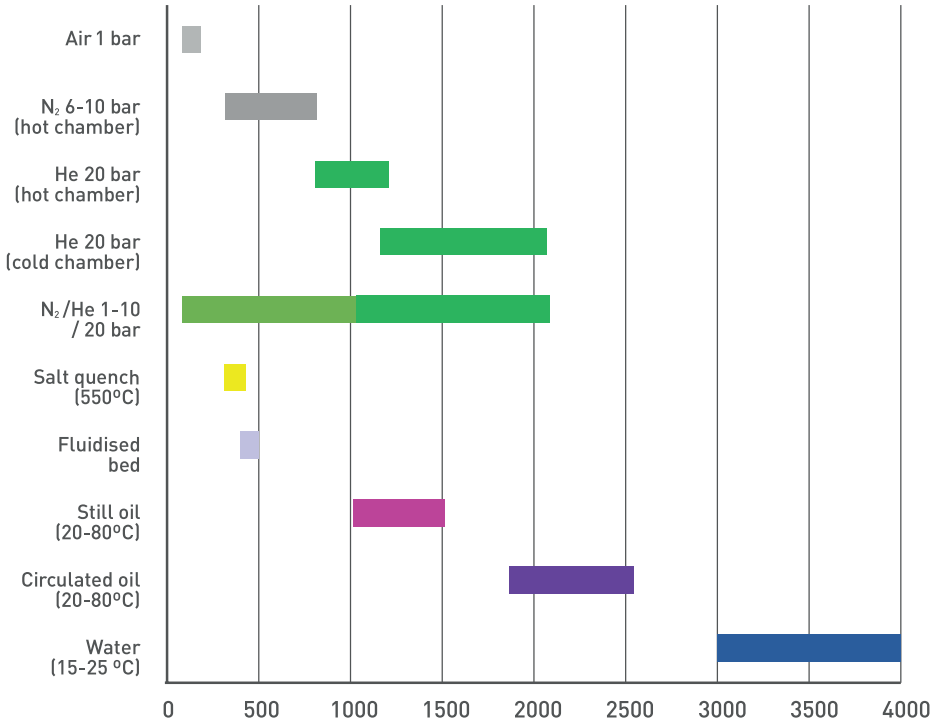
ISOCEM vs. High Alloy Grades

- Depending on the hardenability requirements, **ISOCEM®** steels are designed to obtain the aimed hardness profile and minimize distortions

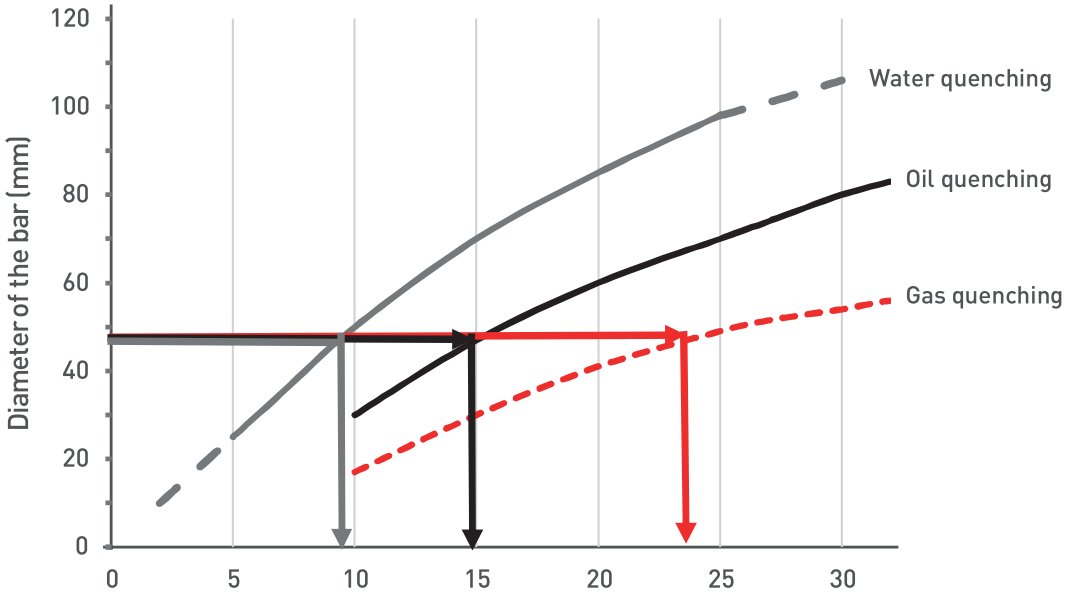


Quenching Severity

- Gases (N_2 at high pressures) have a lower severity factor than oil or water
- Gas quenchable steels need higher hardenability than oil quenchable ones



Heat Transfer Coefficient α for different quenching media (W/m2-K)

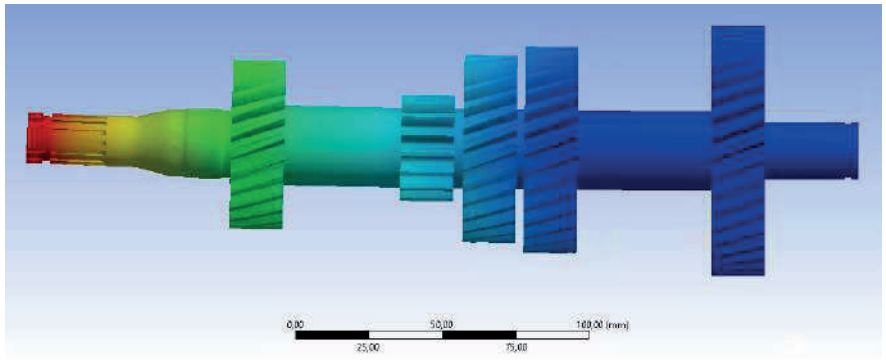


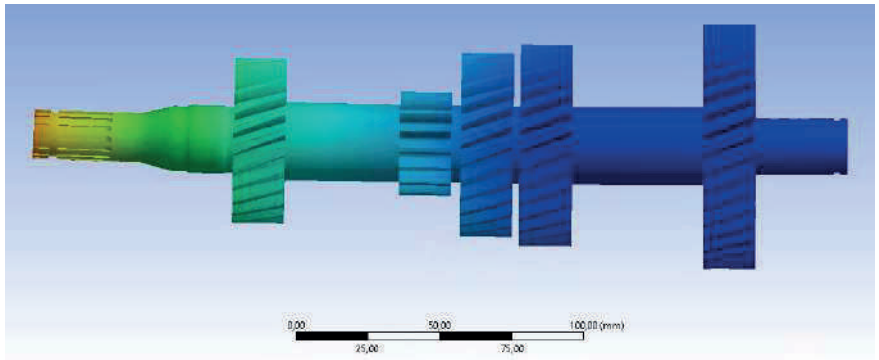
Distance to the quenched end (mm)

Source: ASM Handbook, Volume 4A, Steel Heat Treating Fundamentals and Processes

Distorsion

- **Microstructure homogeneity** reduces distortions during quenching processes





High Distortion

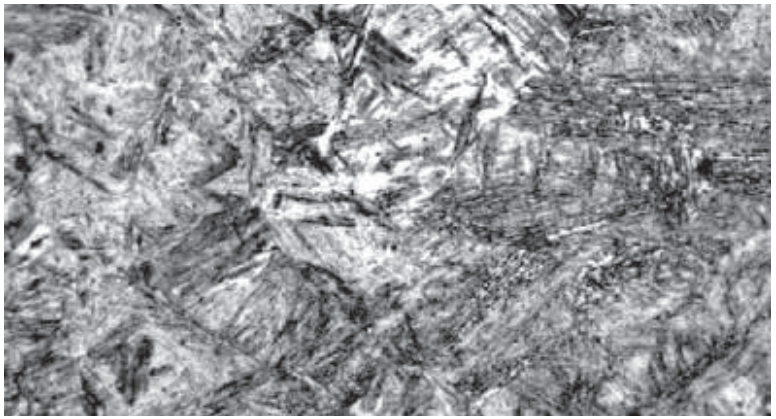
Homogeneity **Low Distorsion**

SIDENOR Solution for Case Hardennig

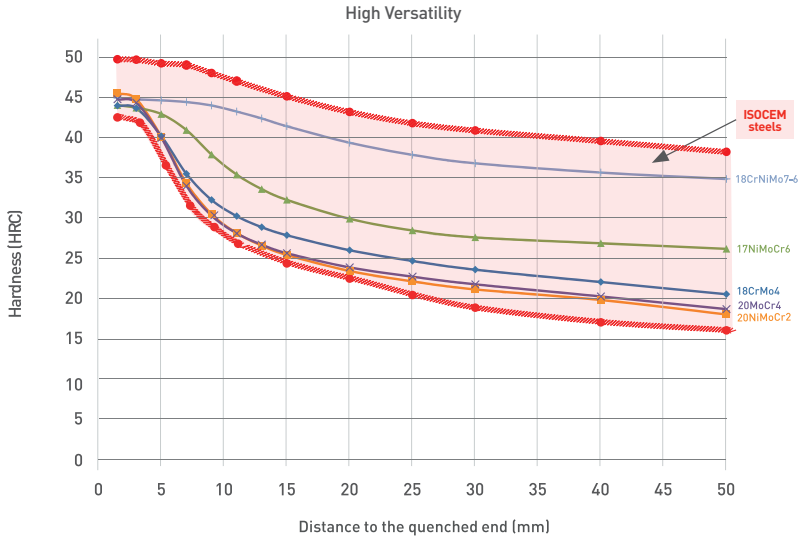
GRADE	% wt	C	Mn	Si	P	Cr	Ni	Mo	V	Others *
CrV	min.	0,15	0,50	-	-	1,10	-	-	0,01	Bi, S
	max.	0,27	1,00	0,35	0,030	2,00	0,50	0,07	0,50	Ca

*Optional additions for machinability improvement: MECAMAX® technologies

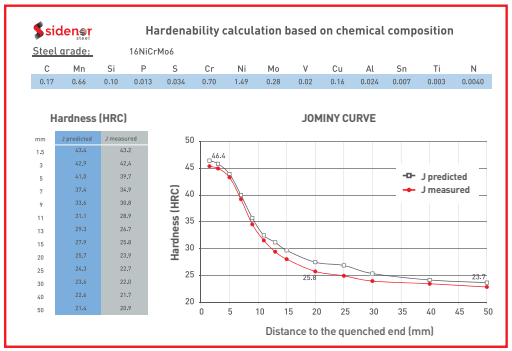
- **ISOCEM®** is a **competitive CrV alloyed steel**, giving **similar properties** to a high-priced conventional oil quenched steel
- **Hardenability is tailored** to ensure the mechanical properties (core hardness and case depth) when using low severity cooling fluids
- **High microstructure homogeneity** reducing distortions during quenching processes

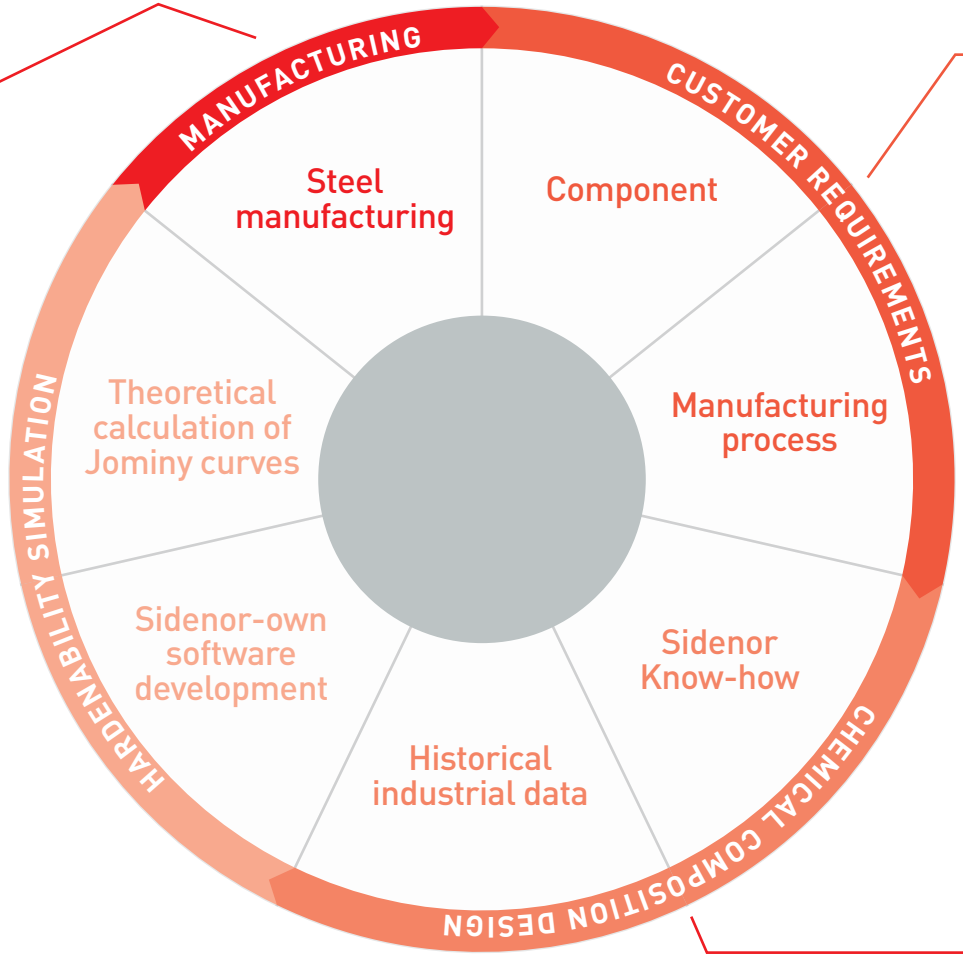


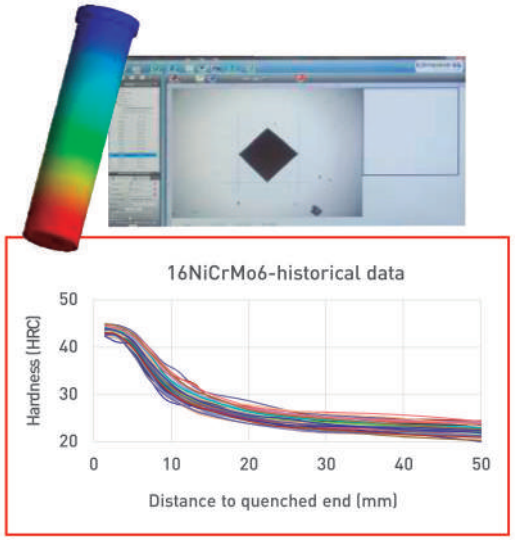
Microstructure in core
Martensite 100%



Hardenability Simulation







Application Field of ISOCEM® Steels

- **Replacement of high alloyed grades** ensuring performance
- Case hardened components **quenched with low severity quenching fluids** (high pressure gases, oils...)
- Components that exhibit **distortions** after the heat treatment

Additional Features

- SIDENOR customers can obtain **additional profits** from **ISOCEM®** steels combining them with other technologies:
  - **NANOCEM** for **High Temperature Gas Carburizing**
  - **MECAMAX®** to **enhance Machinability**

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