MATERIALS CENTER LEOBEN
FORSCHUNG GMBH

We innovate Materials

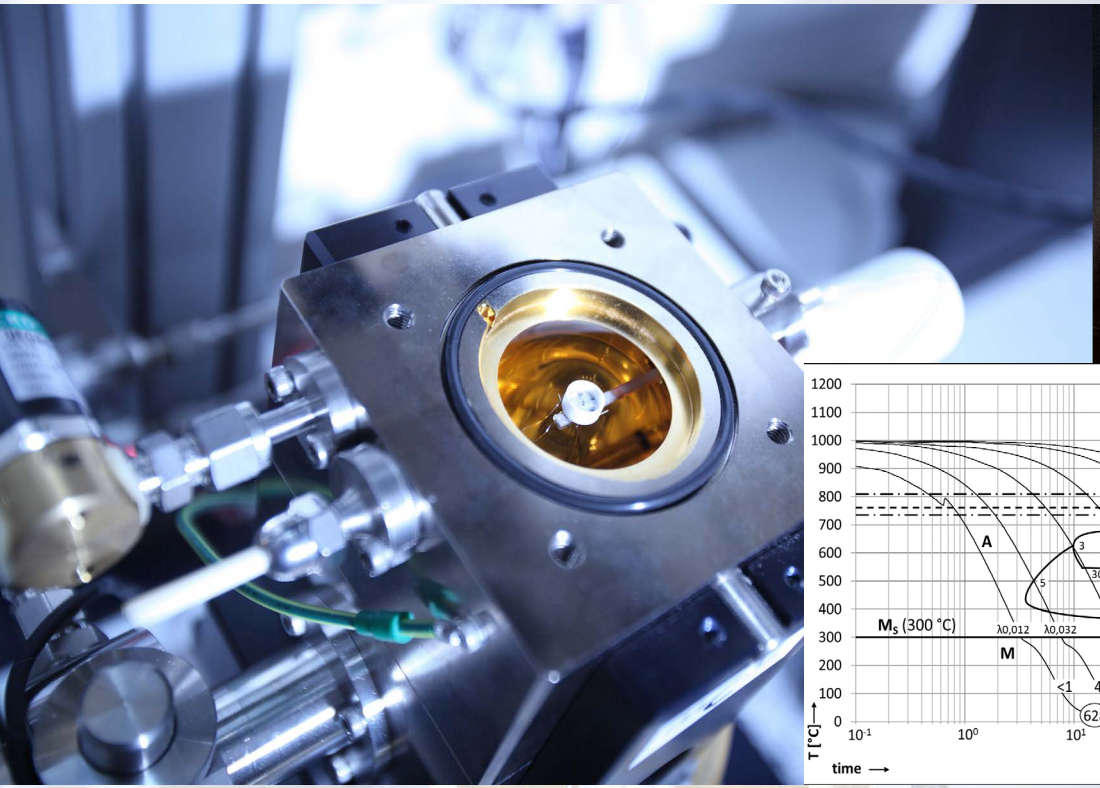
thermal analysis and heat treatment

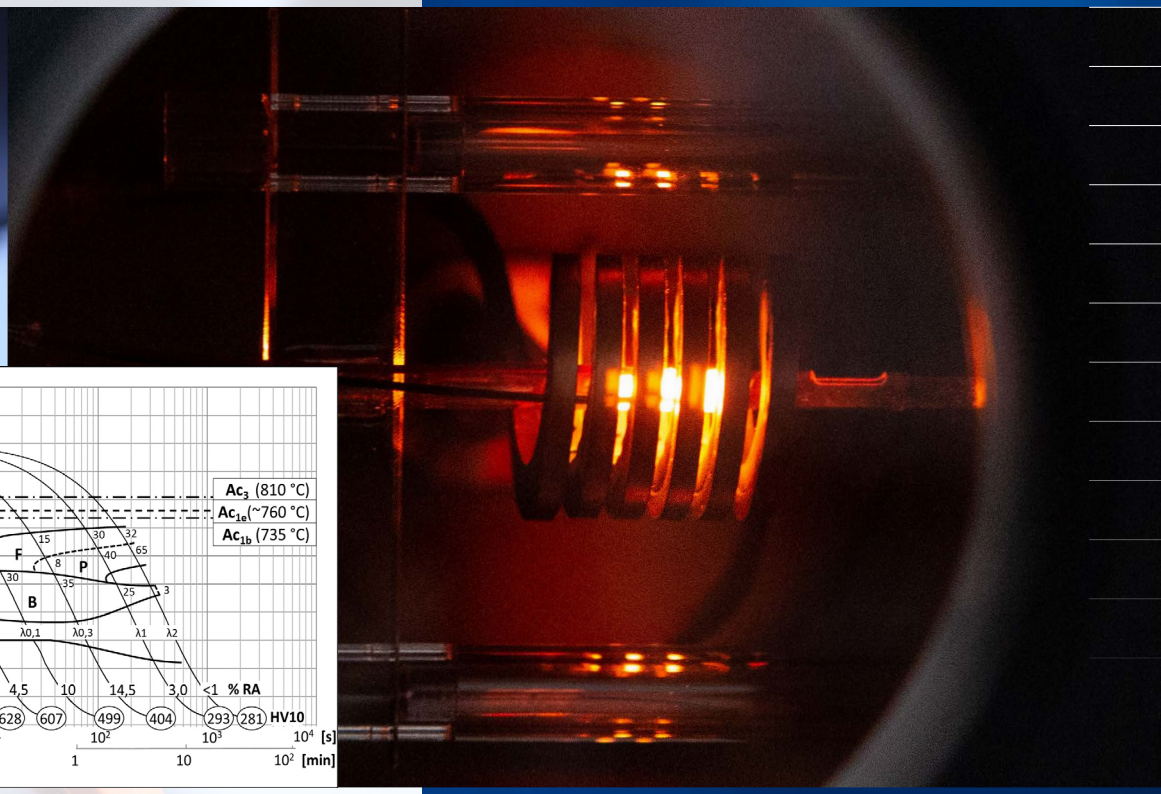
- recording ZTU / ZTA charts
- determination of thermophysical properties
- vacuum and inert gas heat treatment
- inductive heat treatment
- recording of BxH curves
- FE simulation of hea treatment processes
- consulting and process development

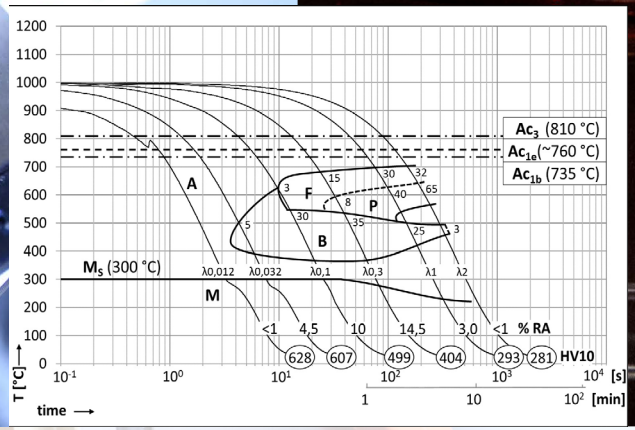
ISO 9001 CERTIFIED ISO 9001

COMPETENCE & RELIABILITY

recording ZTU / ZTA charts







customized recording of transformation diagrams of steels

our focus / competences

- investigation of steels, in particular high-alloy, multiphase stainless steels
- Physical simulation of heat treatment processes by means of quench dilatometer
- Determination of time-temperature transformation diagrams as well as time-temperature austenitization diagrams

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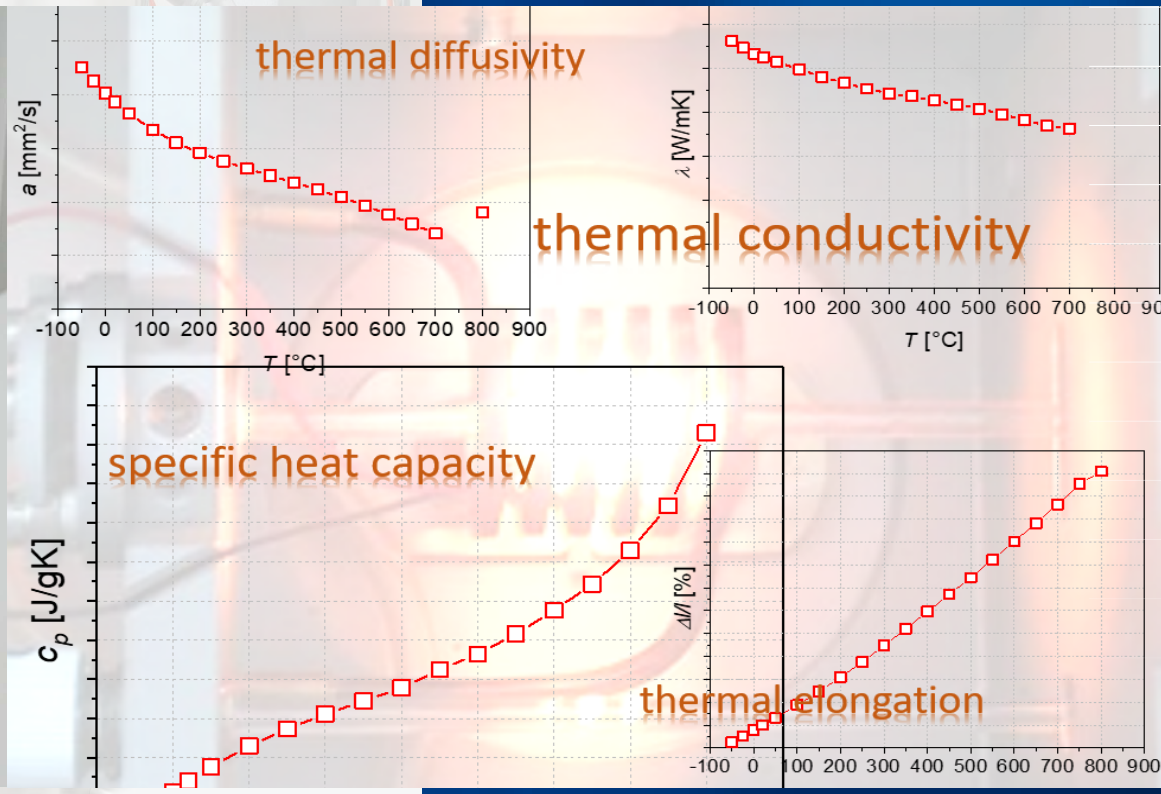
determination of thermophysical properties



determination of the basic thermophysical properties of metallic and ceramic materials or their composites

our focus / competences

- determination of thermal diffusivity (-60°C to 1200°C) acc. to EN 821-2
- measurement of the thermal length change of solid bodies (-150°C to 1200°C) acc. to DIN 51 045-1
- measurement of the specific heat capacity (-150°C to 1100°C) acc. to EN 821-3 (*)
- measurement of the dynamic modulus of elasticity (20°C to 900°C) acc. to EN 820-5 (*)
- calculation of the temperature-dependent thermal conductivity
- measurement of electrical resistance/conductivity (20°C to melting point of metallic samples) (*)

**in coorporation with the Österreichisches Gießerei-Institut (ÖGI)*

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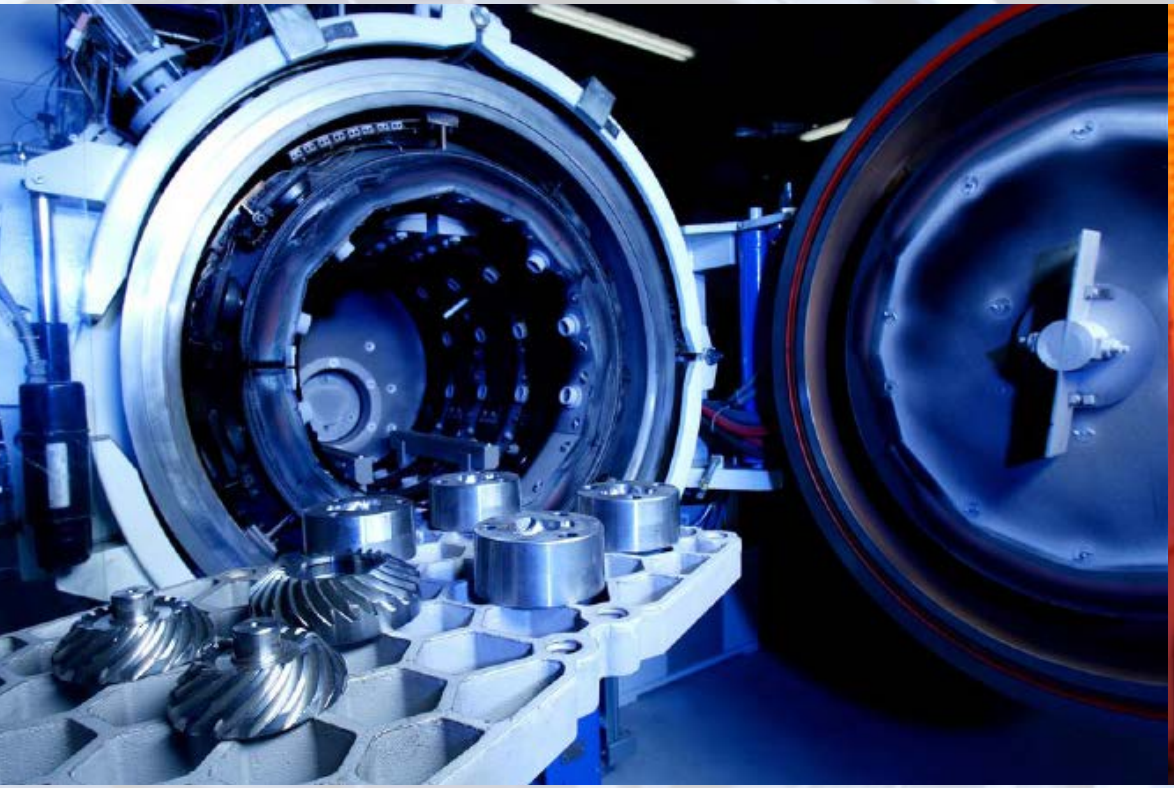
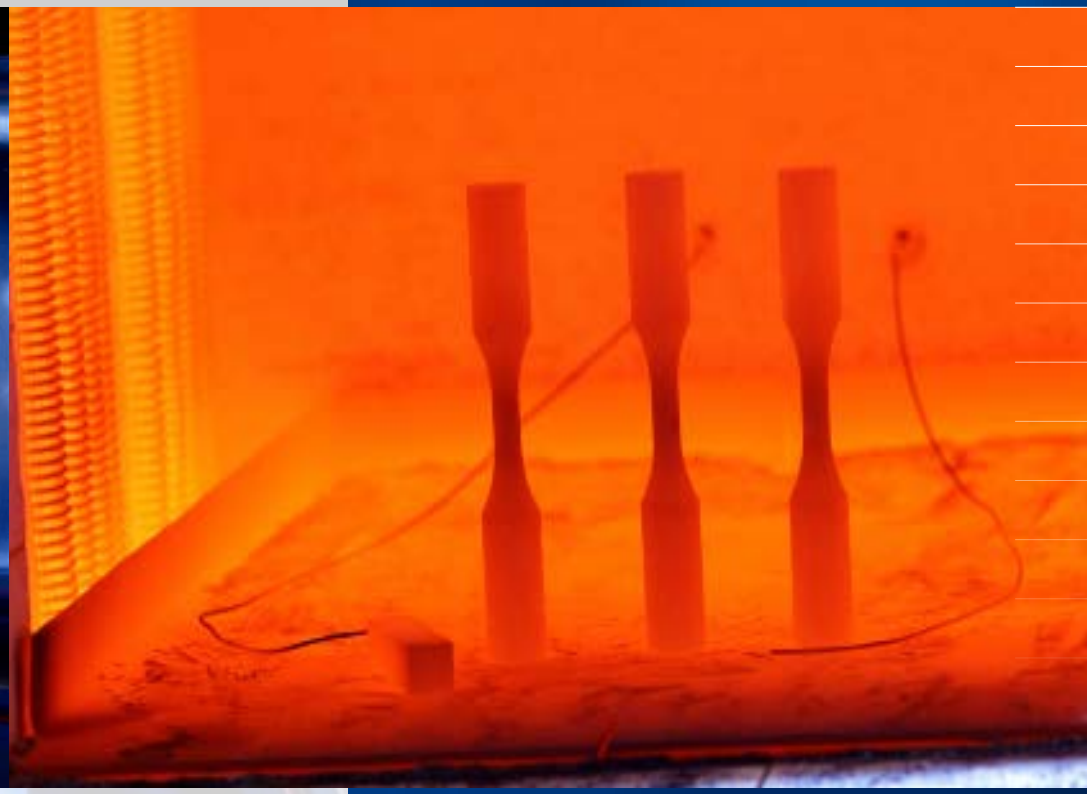
vacuum and inert gas heat treatment





standard and special vacuum heat treatments (hardening, annealing, tempering, ...) on specimens, components, small series or samples

our focus / competences

- individual, instrumented heat treatment processes under (convective) vacuum
- temperature-controlled heat treatment of samples and components incl. controlled quenching (lmin = 0.2)
- tempering or annealing under (convective) vacuum, inert gas (Ar, N_2) or atmospheric conditions

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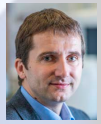

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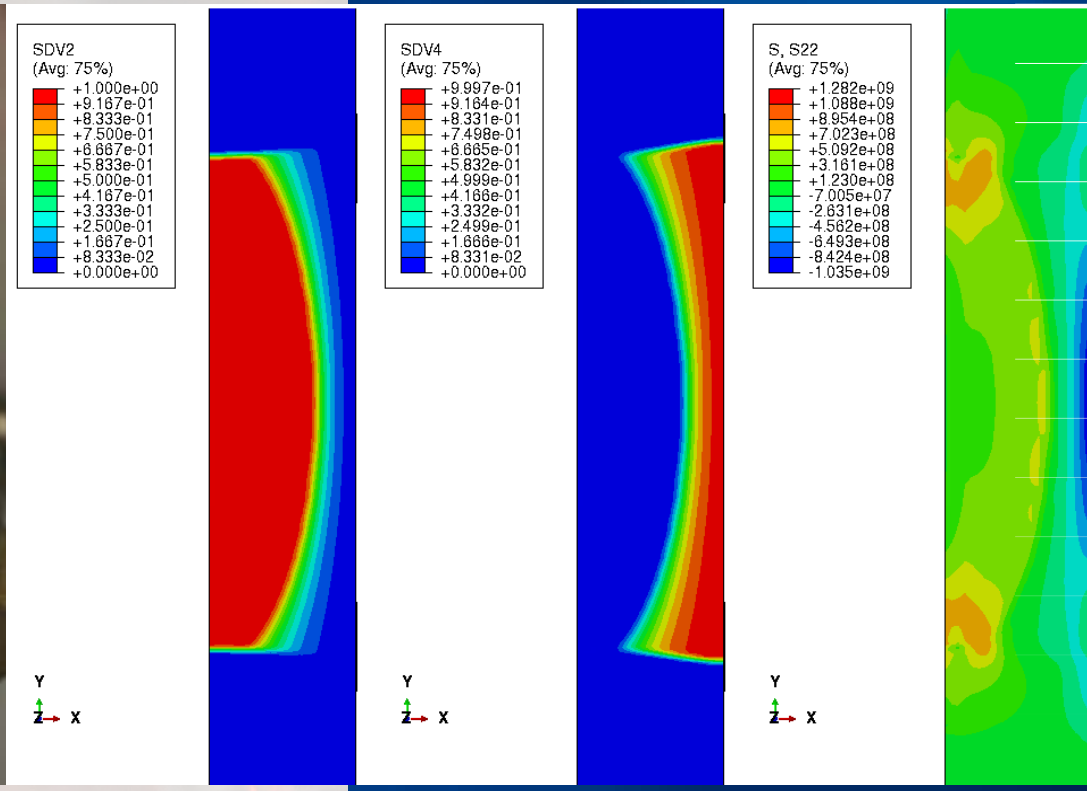
inductive heat treatment



development of inductive heat treatment processes on bar material

our focus / competences

- instrumented, inductive heat treatment with water or gas quenching for the development of heat treatment processes
- simulation of temperature, microstructure and residual stress distribution and development during inductive heat treatment
- recording of temperature-dependent B-H curves as input parameters for finite element simulation

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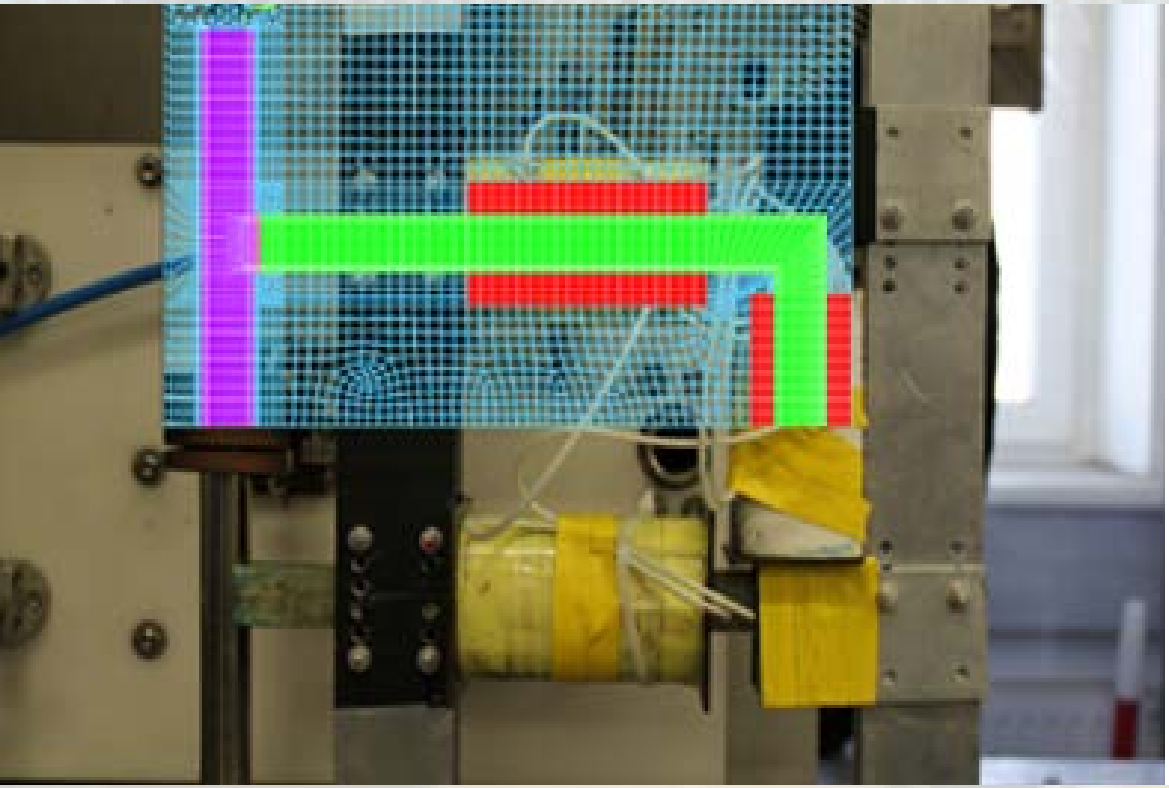
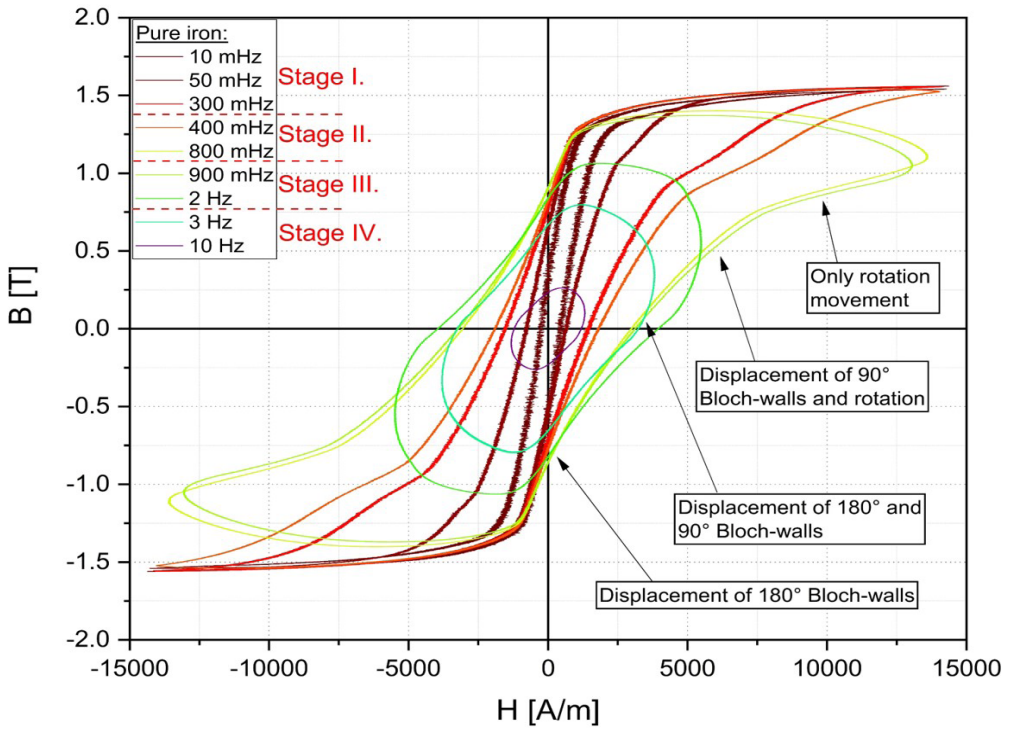
recording of BxH curves





recording of temperature-dependent B-H curves for the finite element simulation of inductive heat treatment processes

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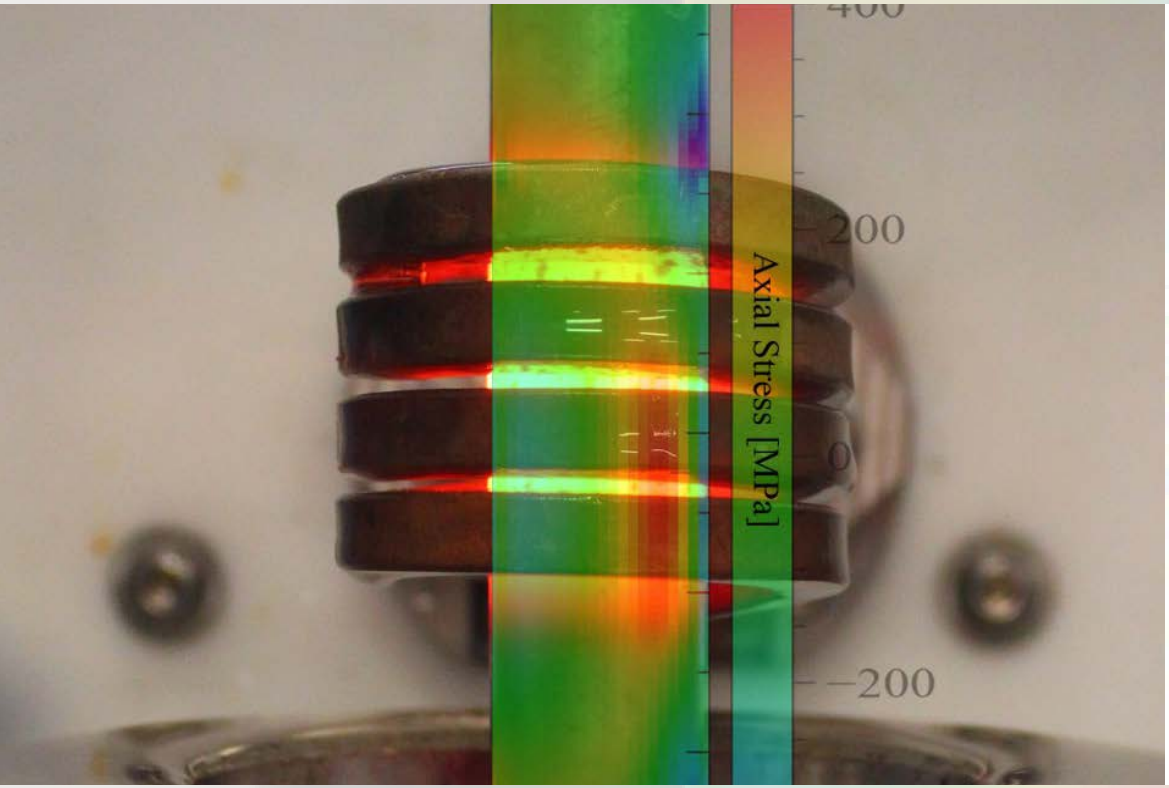
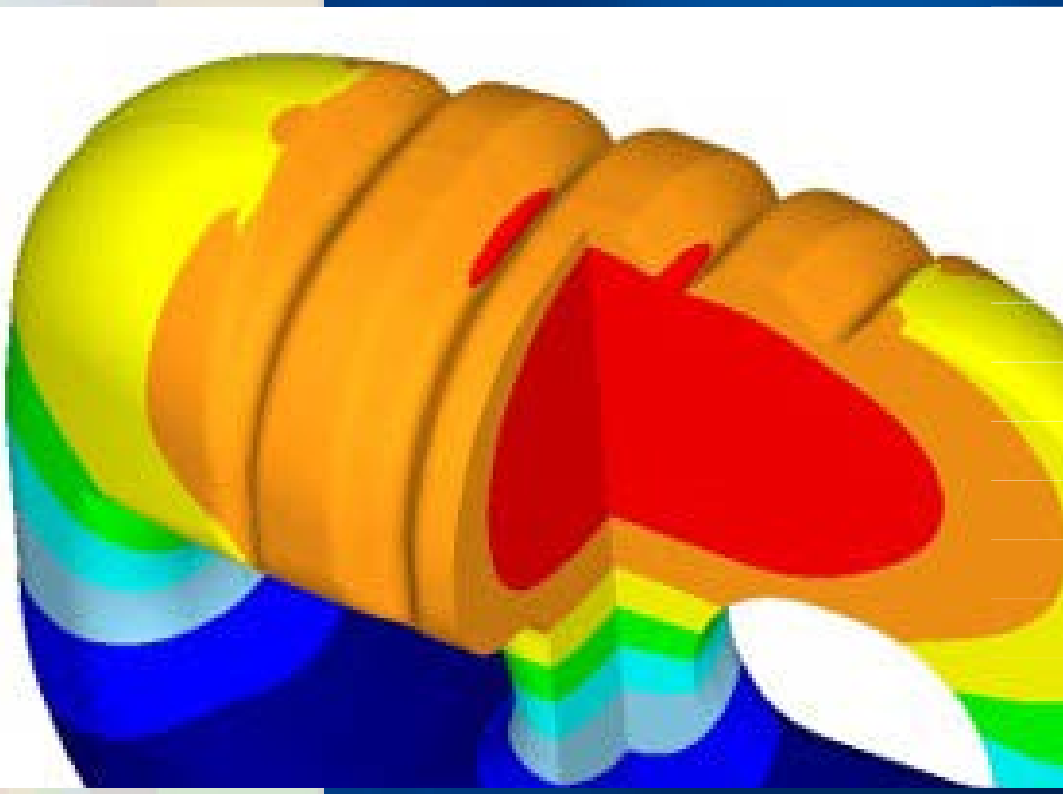
our focus / competences

- frequency- and amplitude-dependent recording of material-specific B-H curves (U-yoke).
- application to macroscopic, easy-to-produce industrially suitable specimens (rod DM 22 mm).
- recording of B-H curves at room temperature and elevated temperatures up to 1200°C.

FE simulation of heat treatment processes





customized heat treatment simulation considering the influence of shrinkage, creep effects, phase transformation and TRIP strain

our focus / competences

- Analysis of (industrial) heat treatment processes with finite element simulation (e.g. crack-prone component positions, critical quenching conditions)
- Simulation of the temporal development of stress distributions and stress peaks (e.g. due to shrinkage, phase transformation, TRIP effect)
- Determination of the thermophysical data of the materials concerned required for the FE simulation, including the B-H curves for inductive heat treatment

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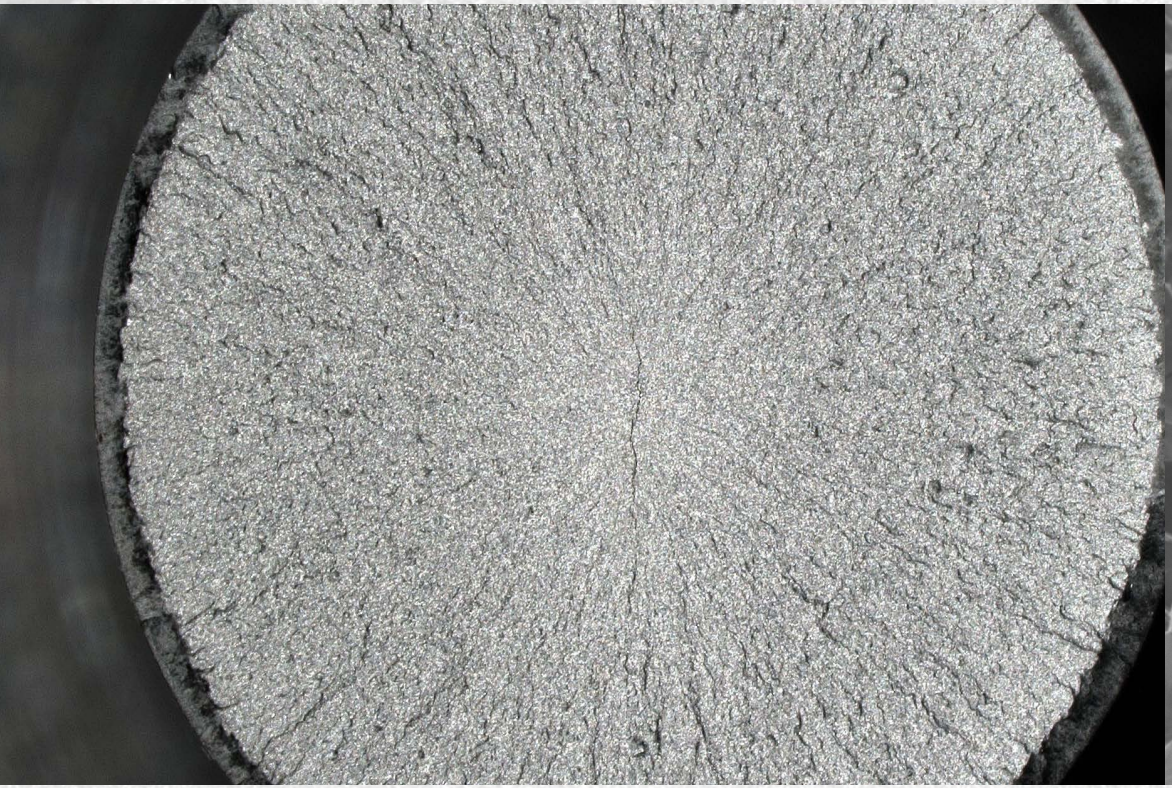
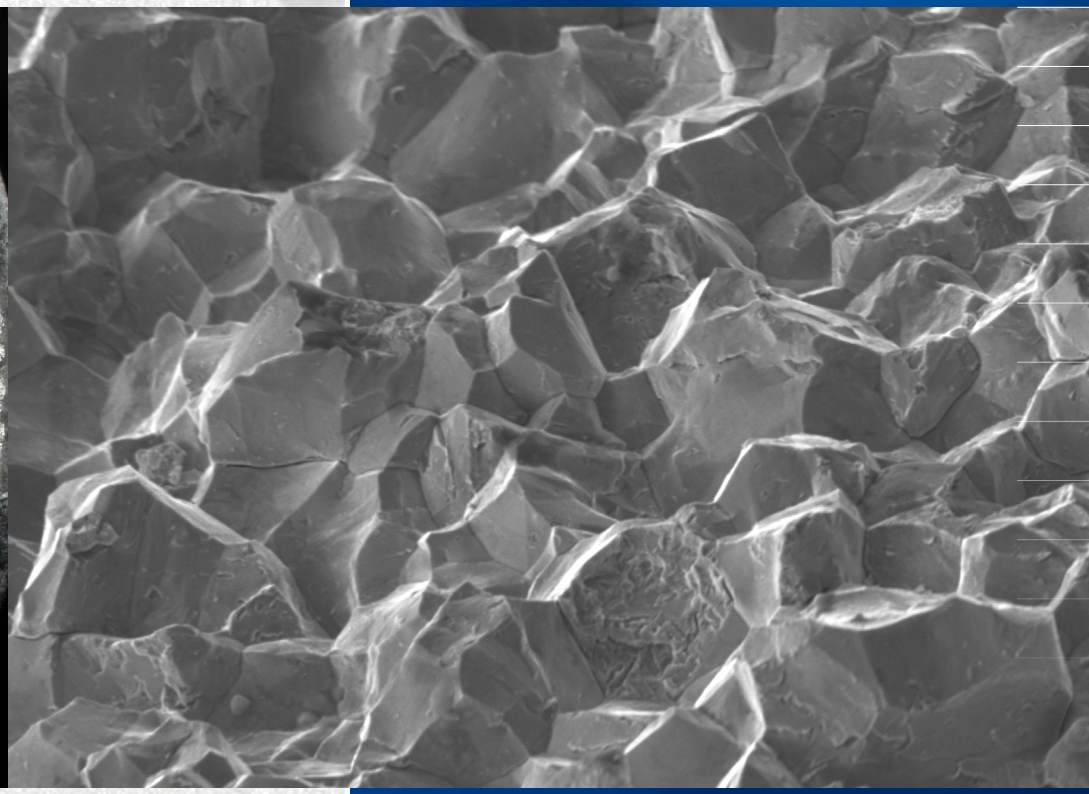
consulting and process development





consultation on the technical heat treatment of steels and performance of damage investigations on heat-treated components

our focus / competences

- damage investigations on improperly heat-treated components
- improvement and advice on the technical heat treatment of steels
- heat treatment of steels, tool steels (cold, hot and high-speed steels), aluminum, titanium and nickel-based alloys
- sample heat treatments incl. characterization

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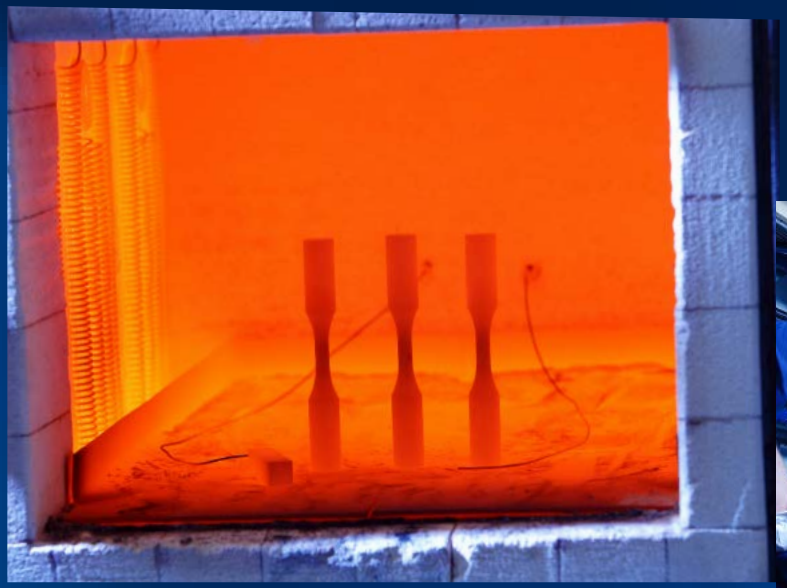

COMPETENCE & RELIABILITY

Service offer

- recording of continuous and isothermal transformation diagrams (ZTU / ZTA)
- experimental heat treatments (vacuum, inert gas, inductive) for sampling of components incl. metallographic microstructure analysis and verification of mechanical properties such as hardness, strength, impact energy or fracture toughness
- Finite Element (FE) simulation of heat treatment processes (temporal microstructure, hardness and residual stress development)
- consulting in the field of heat treatment
- damage analysis of improperly heat treated parts, tools and components and development of remedial measures

equipment

- quenching dilatometer DLI 805L from Bähr with inductive heating system (25-1300°C) and integrated gas cooling (N_2 or He)
- Systherms single-chamber vacuum furnace with integrated high-pressure gas quenching system (max. 14 bar), oven chamber: 400 x 400 x 600 mm (B x H x L)
- protective gas furnace (N_2 or Ar) up to 1200°C (oven chamber: 400 x 300 x 600 mm)
- Various air circulation chamber furnaces (tempering furnaces) up to 700°C (oven chamber: 220x200x495 mm) and up to 850°C (oven chamber: 350x400x500mm)
- Industrial induction hardness equipment ITP for inductive hardening/tempering of test specimens (l_{max} = 300 mm, $Ø_{max}$ = 30 mm) incl. water-, air- or inert gas quenching; vertical and horizontal operation; instrumentation by thermocouples
- Laserflash system LFA 427 from Netzsch (temperature range from -60°C to 1200°C)
- pushrod dilatometer from Netzsch DIL 402 CD (temperature range from -150°C to 1200°C)

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