

Mechanical Testing Laboratory

EXPERTISE & RELIABILITY



Mechanical Testing Laboratory

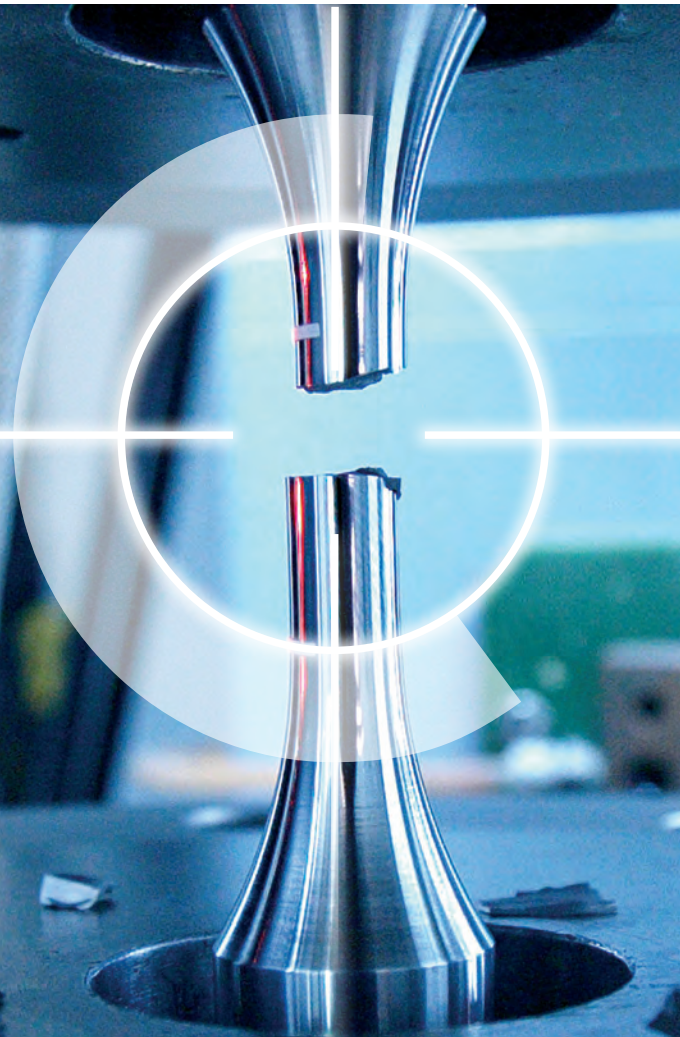
Our expertise is your benefit

The Materials Center Leoben offers a sound mix of theoretical and practical expertise and state-of-the-art facilities, making it a flexible and experienced partner for demanding research, development and application tasks in the areas of materials engineering, process engineering, quality assurance and component design.

The mechanical testing laboratory specialises in the static and cyclic testing of various metallic materials, metal / ceramic composites, cemented carbides etc. with special focus on:

- Determination of mechanical material parameters (hardness, yield stress, strength, ductility)
- Determination of cyclic material parameters (S-N curve, fatigue strength)
- Determination of material data for FE simulation (constitutive laws)

The range of services extends from tests in accordance with international standards to tests on high-strength brittle materials. If required, new testing methods are developed, which are offered as a service or within the framework of research projects.



EXPERTISE AND HIGH-TECH EQUIPMENT FOR YOUR SUCCESS

Mechanical testing of high-strength materials

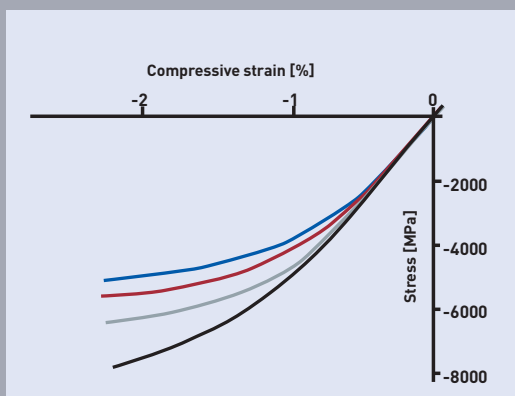
Tensile and compression testing (static and cyclic) of high-strength material including specimen preparation.



Our fields of expertise

MCL offers the following tests on high-strength steels and cemented carbides:

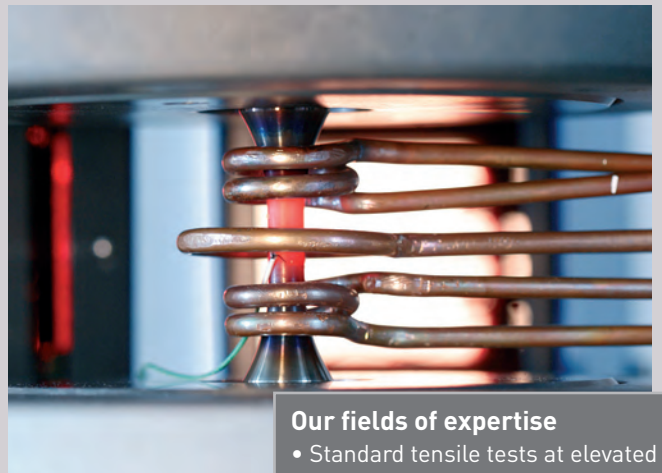
- Static tensile, compression and bending tests
- Characterisation of fatigue behaviour in the LCF and HCF range
- Characterisation of cyclic plastic material behaviour



Compressive flow curves
of different cemented
carbides

Mechanical testing at elevated temperatures

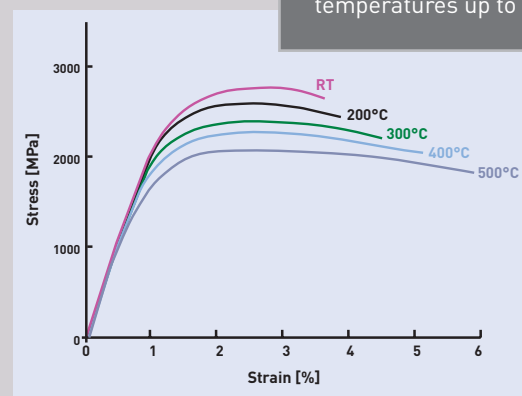
Measurement of mechanical parameters and flow curves at elevated temperatures using both furnace and inductive specimen heating (up to 900°C).



Our fields of expertise

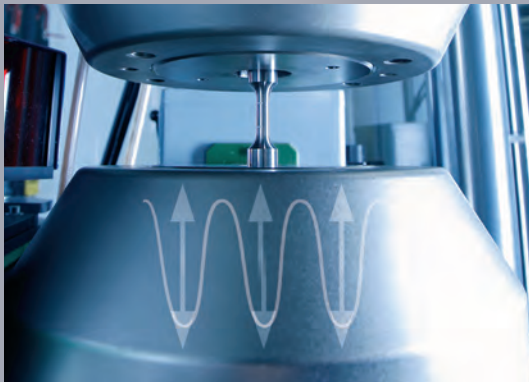
- Standard tensile tests at elevated temperatures in accordance with EN ISO 6892-2
- Uniaxial compression tests at elevated temperatures up to approx. 700°C (higher temperatures on request)
- Uniaxial tensile tests on flat and sheet specimens at elevated temperatures up to 900°C

Stress-strain curves of a PM
high-speed steel at different testing
temperatures



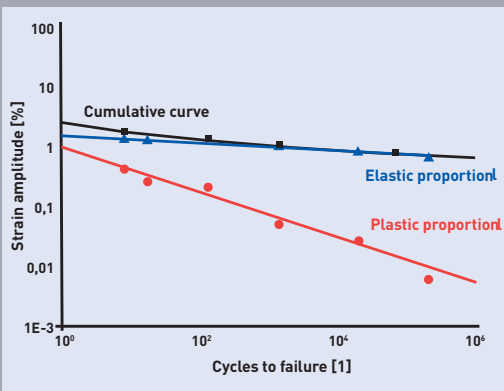
Fatigue testing

Measurement of “classical” S-N curves and strain S-N curves at room temperature and at elevated temperatures.



Our fields of expertise

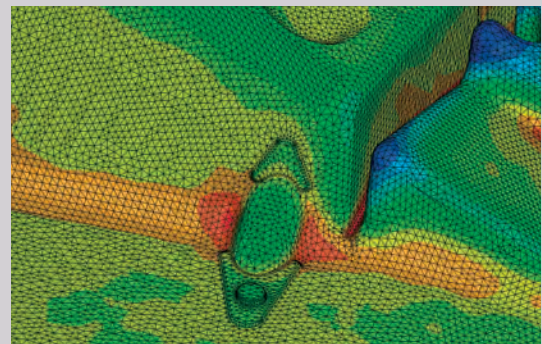
- Measurement of S-N curves of metallic materials
- Cyclic testing of small components (e.g. measurement of tooth root strength)



Strain S-N curve of a PM high-speed steel (hardness ~ 62 HRC)

Mechanical material data for FE simulation

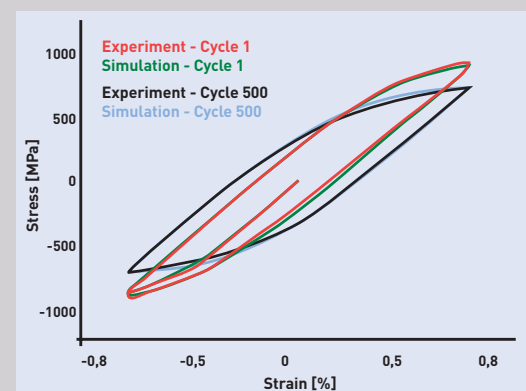
Testing of cyclic elasto-(visco-)plastic material behaviour up to approx. 700°C and determination of constitutive law parameters to be used in FE simulation.



Strain distribution in a die casting mold during operation

Our fields of expertise

- Development of experimental designs
- Performance of experiments
- Determination of material parameters for conventional constitutive laws



Comparison of experimental and simulated strain-stress curves after 1st and 500th cycle

RANGE OF SERVICES AND EQUIPMENT



Our range of services

Static materials testing

- **Uniaxial tensile test** [DIN EN ISO 6892-1](#)
- **Tensile test at elevated temperatures** [DIN EN ISO 6892-2](#)
Tensile test at low and high temperatures (-150°C to 900°C)
- **Three- and four-point bending test (incl. instrumented tests)**
- **Uniaxial compression test** or cylinder compression test
- **Compression and tension test at elevated temperatures** with inductive heating
- **Fracture toughness**
 K_{IC} [ISO 12135 / ASTM E 399](#)
 J_{IC} , $J_{0,2BL}$ and $J_{\Delta a}$ -curve [ISO 12135 / ASTM E 1820](#)
CTOD_{IC}, CTOD_{J0,2BL} and CTOD_{Δa}-curve [ISO 12135 / ASTM E 1820](#)
- **Notch bend impact test**
acc. to Charpy* [DIN EN ISO 148-1](#)
- **Hardness measurements**
Brinell [DIN EN ISO 6506-1](#)
Vickers [DIN EN ISO 6507-1](#)
Rockwell [DIN EN ISO 6508-1](#)
Vickers cemented carbides [DIN ISO 3878](#)
Instrumented hardness testing [DIN EN ISO 14577-1](#)

Cyclic materials testing

- **Low cycle fatigue tests on metallic materials up to 500°C**
(strain based approaches to total fatigue life, ratcheting, ...)
- **S-N curves** (tension / compression, cyclic bending)

* partly in cooperation with our scientific partners

Our equipment

- Zwick universal testing machine (250 kN) for tensile, flexure and compression tests with precision extensometers
- Zwick universal testing machine (150 kN) with high-temperature furnace up to 900°C and non-contact strain measurement
- Instron hydropulser (250 kN) for cyclic tests on high-strength materials with integrated inductive heating up to 700°C and high-resolution non-contact strain measurement
- Instron hydropulser (160 kN) with integrated temperature chamber (-150°C to 600°C) for dynamic and fracture mechanical testing
- Russenberger – resonant testing machine RUMUL, including high-temperature furnace (up to 900°C)
- Emcotest – universal hardness tester M4C750XY (49 to 7355 N) with automatic xy-table
- Instrumented pendulum impact tester from Zwick*
- Potential probes (DC and AC) from Matelect for crack length measurements in fracture mechanics experiments

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