

Why work with us?

Together we find a tailored solution for your current issues!

The Fraunhofer Institute for Mechanics of Materials is your partner for open questions related to the development and integrity of your components. At Fraunhofer IWM, experts assess, evaluate, and optimize the operational behavior of materials from a practical and customer-oriented point of view. We focus on the reliability, lifespan and functionality of your parts and systems.

At Fraunhofer IWM we combine the technical expertise as well as the scientific knowledge of the latest findings in the field of materials science. The determination of thermophysical measurements and thermomechanical testing follows the respective norms. In addition, we offer computational simulations based on the measurements that provide new insights and often lead to remarkable models describing the performance limits of components and systems. An in-house metallographic characterization can complete the investigation.

The established interaction between experiment and simulation at Fraunhofer IWM offers exceptional solutions in materials science and technology. Based on the broad expertise of our multidisciplinary research staff with 300 engaged employees we can build a tailored project team. Tell us about the ideas, goals and constraints that surround your efforts and together we develop an innovative project and find a customized solution!

More than 500 research and development projects per year and a certified quality management demonstrate our reliable project work adjusted to the framework of industry.

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Thermomechanics at Fraunhofer IWM

We offer thermomechanical testing and characterization of metals using the „Gleeble 3150“ thermomechanical simulator. Conductive materials can be heated up to their melting point, while simultaneously applying mechanical loads using force or deformation control.

Thus, we can reproduce nearly any heat treatment or welding process as well as temperature cycles with super-imposed tension-compression loads. Moreover, we conduct hot compression or tensile tests, determine time-temperature-transformation diagrams as well as strain rate and temperature dependent flow curves.

Thermomechanical testing

- Heating rate up to 8000 K/s, max. cooling rate 2500 K/s
- Tension/ compression up to +/- 44 kN
- Velocity up to 800 mm/s
- Measurements available under high vacuum and in gas atmosphere



Thermophysics at Fraunhofer IWM

In our thermophysical laboratory, we determine thermal expansion, specific heat capacity, density and thermal diffusivity. From these quantities we calculate the thermal conductivity of materials. A great variety of materials can be analysed, ranging from metals, plastics, ceramics and thermoelectric materials to reactive coatings.

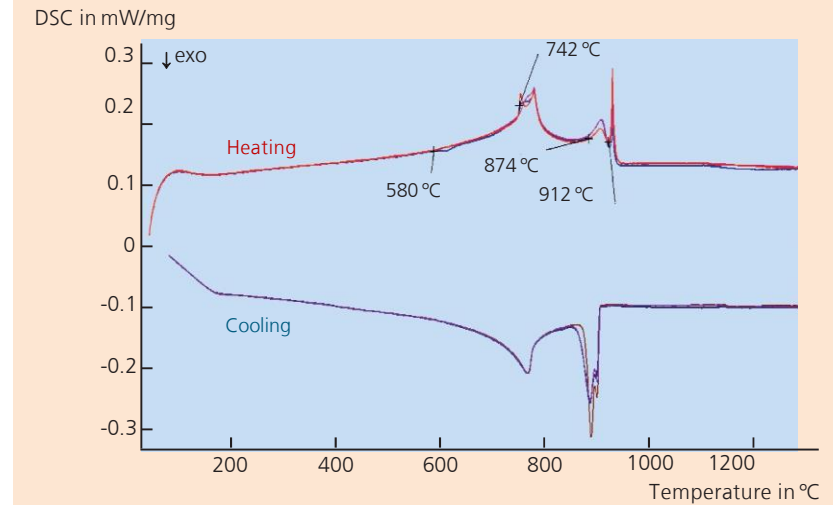
We analyse samples in the form of pastes, powders, liquids, and solids at temperatures from ambient up to 2000 °C.

Testing equipment

- NETZSCH TMA 402 F3 Hyperion®
- NETZSCH LFA 427 Laserflash
- NETZSCH DSC 404 C Pegasus®
- Gleeble® 3150 Thermomechanical Simulator

Dilatometric Measurement of Thermal Expansion (TMA)

- Measurements from room temperature up to 1600°C and heating rates from 0.1 to 20 K/min
- Determination of thermal expansion coefficient
- Analysis of volumetric phase changes, sinter processes or softening
- Measurements available under vacuum and in gas atmosphere
- Typical sample sizes: $\varnothing 3 - \varnothing 6$ mm, length: 5 – 25mm, similar sizes for sheet metal



Measurement of heat capacity using dynamic differential scanning calorimetry (DSC)

- Measurements from room temperature up to 1600°C and heating rates from 0.01 to 50 K/min
- Determination of transformation temperatures, melting and crystallisation points as well as other energetic processes
- Measurements available under vacuum and in gas atmosphere
- Typical sample size of solid materials: $\varnothing 5 \times 1.2$ mm

Measurement of thermal diffusivity and thermal conductivity using Laser Flash Analysis (LFA)

- Measurement of the thermal diffusivity in the range of 0.01 up to 1000 mm²/s
- Measurements from room temperature up to 2000°C at heating rates between 0.1 and 50 K/min
- Measurements available under vacuum and in gas atmosphere
- Sample sizes:
 - Diameter of round samples: 6, 10, 12.7 mm
 - Rectangular samples: max. 10 x 10 mm
 - Sample thickness depends on thermal diffusivity