3 Omega-method

The system is based on the 3Omega method to determine the thermal conductivity of bulk materials and thin films. A metal strip made of nickel or gold serves as the sensor in the 3-Omega method. An alternating current of a defined frequency omega is applied to the metal strip, heating the sample up. The by the way generated periodic temperature variations correspond to changes in resistance of the metal strip. This 3-Omega signal is subject to a phase shift comprising together with its amplitude the measurement signal.

The Fraunhofer setup for thermal conductivity

The 3-Omega system is suitable to measure the thermal conductivity of thin films down to a thickness less than 100 nm. The software extracting the thermal properties is based on analytical mathematics and the finite volume method. A standart system is equiped for room temperature measurements in vacuum. The range can be extended to 77K - 900K (see options).

By different shaping of the teststructures the thermal properties can be measured in-plane as well as cross-plane. The design of the necessary photolithography masks will be delivered as well as a reference sample (fused silica) with known thermal properties.

Specifications

- **Measurement range**
  - thermal conductivity: 0.2 - 20 W/mK

- **Measurement accuracy**
  - Thermal conductivity < ± 5 % (measured on fused silica)

Options

- sample holder integrated in:
  - cryostat for measurements between 80 and 600 K
  - vacuum chamber for measurements from room temperature up to 900 K.
- Special training for fabrication of test structures.
- measurement of the Seebeck coefficient with the so-called 2 Omega method.