

Hot-Disk for anisotropic materials

Graduate



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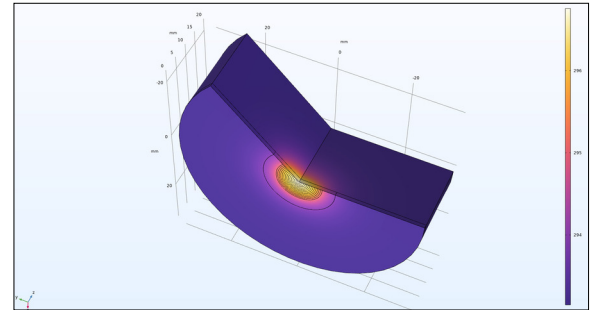
Initial Situation: There are a variety of measurement methods for determining the thermal properties of a material. One of these methods is the Transient Plane Source method (TPS). The company Hot Disk AB produces measuring instruments that use this method. The Institute of Microtechnology and Photonics (IMP) uses the TPS 500 measuring instrument to measure the thermal conductivity and the thermal diffusivity of materials. In its basic configuration, this measuring instrument is only capable of measuring the thermal properties of isotropic materials. The aim of this work is to develop a method to be able to measure also anisotropic materials (the thermal conduction is directional).

Approach: The finite element method (FEM) is used to realize the modeling. The simulation platform used is Comsol Multiphysics. The models were validated, and a large number of data sets were generated to investigate the thermal conductivity and thermal diffusivity of materials. The starting point for determining thermal conductivity and thermal diffusivity is the temperature rise of the sensor as the sample is heated. With this temperature rise, the evaluation algorithm for isotropic materials of the hot disk measuring instrument could be reproduced. The evaluation algorithm was extended so that anisotropic materials could also be measured.

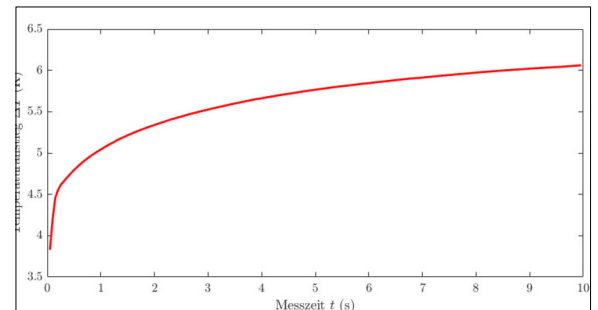
Result: To determine the thermal conductivity of an isotropic material, it is not necessary to know the density and specific heat capacity of the material. For anisotropic materials, these two material properties are an essential component to determine the radial and axial thermal conductivity. Through measurements with the TPS 500 measuring instrument of anisotropic materials, it was shown that the new evaluation algorithm is capable of

determining a direction-dependent thermal conductivity.

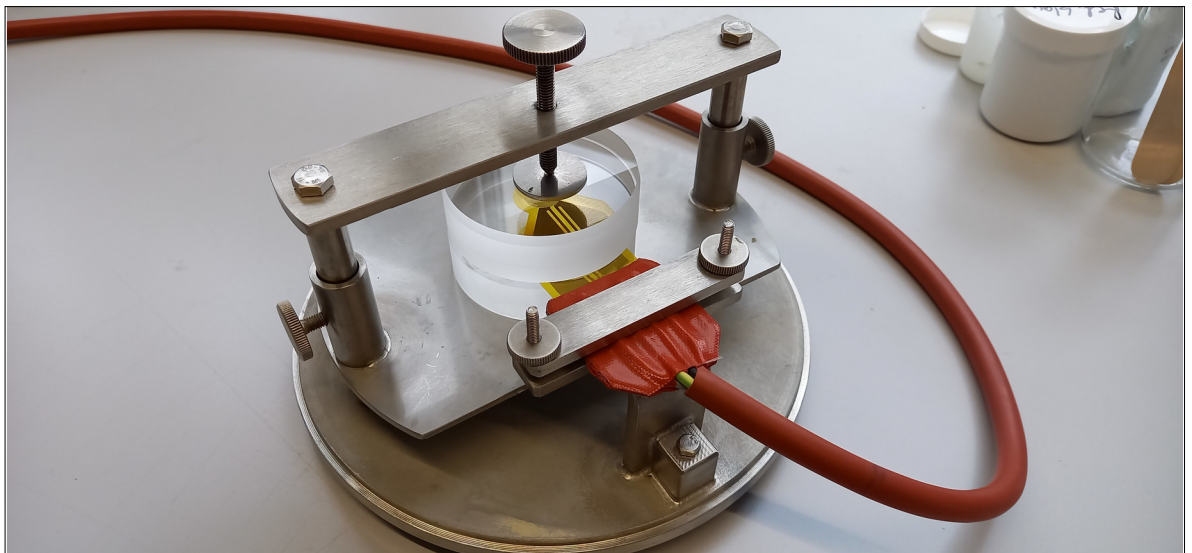
FEM simulation of TPS method
Own presentation



Temperature rise of the Hot Disk sensor during measurement
Own presentation



Measurement setup for a Hot Disk measurement
Own presentation



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Subject Area
Mechanical
Engineering