**Modeling and simulation of the guarded-hot-plate method for determination of thermal transmission properties**

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The ASTM Standard Test Method for steady-state heat flux measurements and thermal transmission properties by means of the guarded-hot-plate apparatus is a well-known, absolute measurement method. It is preferably used to determine the thermal conductivity of low thermally conducting, homogenous materials. For better understanding of test limitations and potential improvements of the measurement configuration towards smaller measurement errors, simulations with finite element method (FEM) were carried out. A test configuration was considered comprising an isothermal hot plate laterally surrounded by a distributed, guarded heating plate with a flat piece of sample material on both sides, all sandwiched between two heat sinks and an additional edge insulation around the stack. The influence of the temperature deviation of the metered area in the center of the sample stack from the primary guard surrounding it was investigated showing the importance of keeping these gradients as small as possible. Furthermore, the dimensional relation between the metered area and the primary guard as well as the necessity of a secondary guard to minimize edge heat losses of the assembly were explored. Based on the same measurement configuration a mathematical model was developed using the combination of eigenfunction expansions and finite-differences discretization. The difference equations were solved iteratively via a successive overrelaxation technique. This hybrid technique allowed the calculation of a three-dimensional temperature distribution within the sample material. Results of the simulation and modeling were compared and used to calculate the thermal conductivity for various model sample materials differing in geometry and thermal conductivity.