
Measurement of the thermophysical properties of an NPL thermal conductivity standard Inconel 600

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Abstract. Flash methods have become one of the most commonly used techniques for measuring the thermal diffusivity and thermal conductivity of various kinds of solids and liquids such as metals, carbon materials, ceramics, and polymers. Easy sample preparation, small sample dimensions, fast measurement times, and high accuracy are only some of the advantages of this nondestructive measurement technique. However, the accuracy of measurement and level of uncertainty of the resulting data are becoming increasingly important for countless industrial applications. Instruments must be analyzed to determine the uncertainty of the system at different temperatures and application ranges. One way of checking the accuracy of the results is to cross-check the unit with certified reference materials. However, there is a lack of standard materials for thermal diffusivity/thermal conductivity all over the world. Furthermore, for some available standards, the thermophysical properties are known only over a limited temperature range.

Here we report thermophysical property measurements on an NPL certified thermal conductivity standard, Inconel 600. Tests were carried out between -125 and 1000 °C. A DIL 402 C pushrod dilatometer was employed to determine the thermal expansion and density change of the material. The specific heat was measured by differential scanning calorimetry. The thermal diffusivity was measured with the laser flash technique. The measured data were used to determine the thermal conductivity of the material.