



The TCT 716 *Lambda* Guarded Heat Flow Meter for the Determination of the Thermal Conductivity of Metals

Validation with Inconel 600

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Introduction

Inconel 600 is a proven nickel-chromium-iron alloy that is often used as a reference material for determining thermal conductivity. Its thermal stability, oxidation resistance and mechanical strength make it ideal for use in calibration procedures. For this reason, it has been used as a standard material by research institutes for many years. Its ready availability and homogeneous composition also contribute to its suitability as a reference.

The Guarded Heat Flow Meter (GHFM) is best known for determining the thermal conductivity of polymers, but low-conducting metals can also be studied using this technique.

Measurement Conditions

The thermal conductivity was measured using the TCT 716 *Lambda* guarded heat flow meter (GHFM). In this

stationary method, a sample of defined thickness is placed between two plates that are heated to different temperatures. This creates a heat flow through the sample. The heat flow is detected and the thermal conductivity can be calculated.

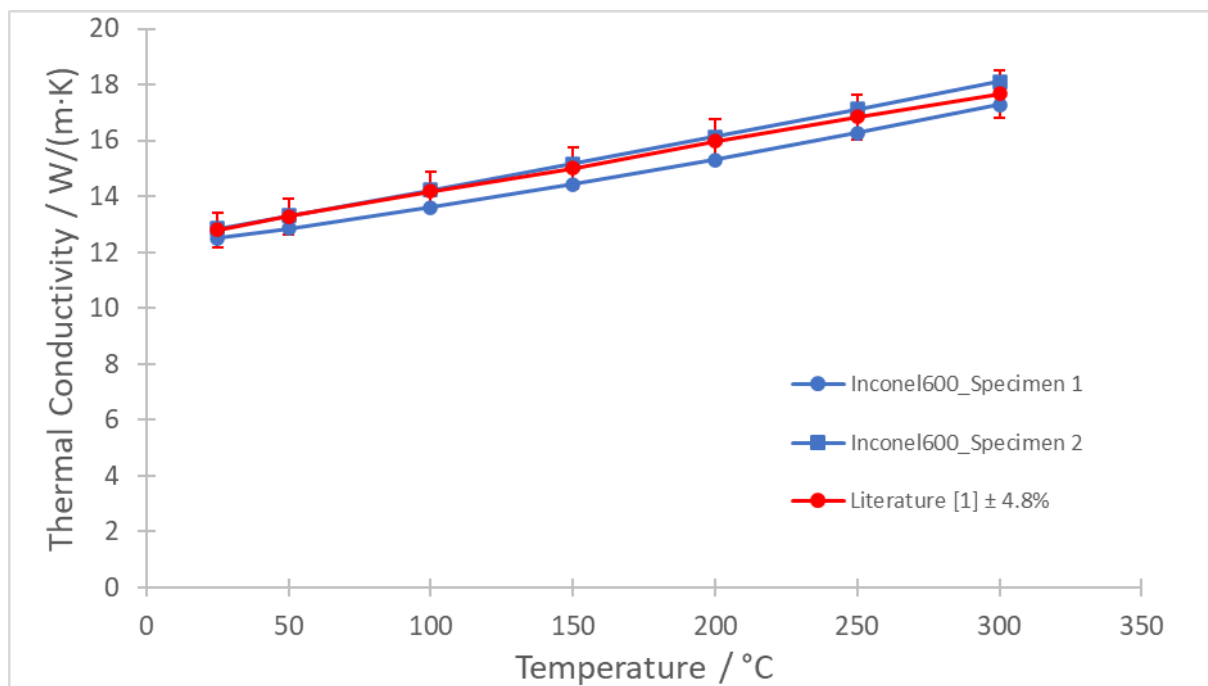
Using the TCT 716 *Lambda*, which allows for simultaneous measurement on two samples, two Inconel 600 samples with a diameter of 51 mm and a thickness of approximately 31.8 mm were analyzed. Prior to the measurement, the samples were coated with silicone grease to improve contact between the sample and the plates and to minimize interfacial resistance. The measurement was carried out simultaneously on both samples in a temperature range between room temperature and 300°C. A pressure of approximately 175 kPa was applied to the samples during the test.

For evaluation of the measurement results, the quartz glass calibration was used.

Table 1 Measurement parameters

Method	GHFM
Calibration material	Quartz glass
Samples	Inconel 600
Sample diameter	51 mm
Sample thickness	31.8 mm
Atmosphere	Air
Contact pressure	175 kPa
Temperature program	RT to 300°C in intervals of 50 K

APPLICATIONNOTE The TCT 716 *Lambda* Guarded Heat Flow Meter for the Determination of the Thermal Conductivity of Metals



1 Thermal conductivity of Inconel 600 – TCT 716 *Lambda* measurements compared to literature

Measurement Results

Figure 1 shows the thermal conductivity compared to literature data [1]. Both samples are within the expanded measurement uncertainty of approximately 4.8% expected for Inconel 600 [2].

Conclusion

The measurement results confirm that the TCT 716 *Lambda* Guarded Heat Flow Meter can be used to reliably determine the thermal conductivity, even on low-conducting metals. This underlines the precision and reproducibility of the measurement method, especially in the temperature range under consideration. The data obtained show good agreement with literature values, further confirming the suitability of this method for thermophysical analysis.

Literature

- [1] J. Blumm, A. Lindemann: Measurement of the thermophysical properties of an NPL thermal conductivity standard Inconel 600; High Temperatures-High Pressures 35/36(6):621-626; 2003
- [2] J. Wu, R. Morell, J. Clark, L. Chapman: Characterisation of the NPL Thermal Conductivity Reference Material Inconel 600; International Journal of Thermophysics 42/28; 2021