Experimental Investigation into Techniques for Reducing Thermal Contact Resistance in Steady-State Thermal Conductivity Measurements

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The National Physical Laboratory (NPL) has developed a new variation on the established guarded hot plate technique for steady-state measurements of thermal conductivity. This new guarded hot plate has been specifically designed for making measurements on specimens with a thickness that is practical for advanced industrial composite materials and applications. During the development of this new guarded hot plate, NPL has carried out an experimental investigation into methods for minimising the thermal contact resistance between the test specimen and the plates of the apparatus. This experimental investigation includes testing of a new approach to specimen surface temperature measurement in the guarded hot plate and also tests on different thermal interface materials for use in another NPL facility based on a commercial guarded heat flow meter apparatus conforming to standard ASTM E1530-11. The results of the investigation include initial validation of the surface temperature measurement in the guarded hot plate through agreement with the thermal conductivity values of NPL reference material. There are also results showing the effect on the measured thermal resistance of applying different quantities of the type of heat transfer paste suggested in ASTM E1530-11 (clause 10.7.3), and the effect on thermal resistance of two alternative types of thermal interface material. One of these alternatives shows improved thermal performance over the heat transfer paste and also has several practical advantages in terms of usability. Acknowledgements: This work was funded through the European Metrology Research Programme (EMRP) Project SIB 52 Thermo. The EMRP is jointly funded by the EMRP participating countries within EURAMET and the European Union.