

Reducing Lateral Heat Loss in High Temperature Guarded Hot Plate Apparatus

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We constructed a high temperature guarded hot plate (GHP) apparatus and tested it for thermal conductivity measurement up to 800 °C. In previous testing using thermal insulation materials, the lateral heat flow was as large as 7 % of heat flow across the sample specimen. When the guard temperature was controlled to slightly higher temperature than the hot plate temperature to compensate for the lateral heat loss, the GHP measurement showed extremely good linearity (better than 0.5 %) between the power dissipated from the hot plate and the temperature difference in the thermal insulator specimen. In attempt to reduce the apparent lateral heat loss, we made two amendments to the GHP apparatus. First, the temperature at the edge of the specimen was monitored by additional thermocouples. The power at the auxiliary heater was controlled such that the temperature at the edge of the specimen was the same as the average temperature of the specimen. Second, the thermocouples used to control the gap imbalance (to zero) and temperatures on heater plates were calibrated *in-situ*. For the *in-situ* calibration, two calibrated type R thermocouples were installed in the GHP while a thin copper sheet was loaded in place of the thermal insulation specimen. We describe the improvement of the performance, especially the reduction of lateral heat loss, after these amendments to the high temperature GHP.