

Estimation of Uncertainty of Thermal Conductivity Measurement with Single Laboratory Validation Approach

Authors : Saowaluck Ukrisdawithid

Abstract : The thermal conductivity of thermal insulation materials are measured by Heat Flow Meter (HFM) apparatus. The components of uncertainty are complex and difficult on routine measurement by modelling approach. In this study, uncertainty of thermal conductivity measurement was estimated by single laboratory validation approach. The within-laboratory reproducibility was 1.1%. The standard uncertainty of method and laboratory bias by using SRM1453 expanded polystyrene board was dominant at 1.4%. However, it was assessed that there was no significant bias. For sample measurement, the sources of uncertainty were repeatability, density of sample and thermal conductivity resolution of HFM. From this approach to sample measurements, the combined uncertainty was calculated. In summary, the thermal conductivity of sample, polystyrene foam, was reported as $0.03367 \text{ W/m}\cdot\text{K} \pm 3.5\%$ ($k = 2$) at mean temperature $23.5 \text{ }^\circ\text{C}$. The single laboratory validation approach is simple key of routine testing laboratory for estimation uncertainty of thermal conductivity measurement by using HFM, according to ISO/IEC 17025-2017 requirements. These are meaningful for laboratory competent improvement, quality control on products, and conformity assessment.

Keywords : single laboratory validation approach, within-laboratory reproducibility, method and laboratory bias, certified reference material

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