Determination of a Thermal Conductivity Curve Over a Large Range of Temperature

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New European product standards now include a mandatory requirement for manufacturers to declare the temperature-dependent thermal conductivity for each insulation product used in building equipment and industrial installations. A manufacturer can declare thermal conductivity values at defined temperatures or only a curve given by an equation. The declaration should be based on the guarded hot plate (GHP) method. LNE has made a lot of measurements on several thermal insulation materials. The paper will present a method of determining the thermal conductivity with a ΔT of 0 °C from data coming from the GHP with different ΔT. This method allows a better comparison between declarations of different insulation materials. The paper will also present a method to determine the interpolation curve with a defined uncertainty. The methodology is illustrated with a mineral wool over a large range of temperature. The guarded-hot-plate method, which has been standardized under the International Organization for Standardization (ISO 8302) and ASTM International (ASTM Test Method C 177) determines steady-state thermal transmission properties of flat slab specimens having a low thermal conductivity. The standard test methods for the guarded hot plate utilize the one-dimensional steady-state thermal conductivity equation for the determination of thermal conductivity (λ):

$$\lambda = \frac{Q\,L}{A\,\Delta T}$$

where Q is the time-rate of one-dimensional heat flow through the meter area of the guarded hot plate (W); A is the meter area of the apparatus normal to heat flow (m^2); ΔT is the temperature difference across the specimen (K); and L the specimen thickness (m).