Design of the Guarded Hot Plate Apparatus for the Measurement of High-Temperature Thermal Transmission Properties

Daeho Kim [S], Joohyun Lee, Sanghyun Lee and Inseok Yang [C]
Division of Physical Metrology, KRISS, Daejeon, Korea
iyang@kriss.re.kr

A high-temperature guarded hot plate apparatus is designed for the measurement of thermal transmission properties up to 1000 °C. The guidelines ASTM C177 and ISO 8302 are thoroughly analyzed and followed as design principles. The maximum transfer factor of the specimen that can be measured with the designed apparatus is 5 W/(m・K). To conduct the thermal transmission measurement in various non-oxidizing atmospheres the apparatus is designed to be inside a high temperature chamber. The heating part of the apparatus is surrounded by three radiation shields that protect the body of the chamber. The heating part is vertically divided into three layers; lower cold plate, hot plate, and upper cold plate layers. Because the apparatus should accommodate two specimens with the thickness up to 100 mm and the installation of the specimens should be easy, the hot plate and upper cold plate layers are designed to be movable independently. Since the parts in the heating area is exposed to high temperature up to 1000 °C, high temperature resilience of the moving parts inside the chamber is main concern. The moving parts are designed so that the thickness of the specimens is defined by the vertical distance between the plates with fixed maximum pressure to the plate. Therefore, both compressible and incompressible specimens can be measured with the apparatus. The vacuum system is also installed for the initial evacuation of the chamber to remove moisture contained in the parts and specimens inside the chamber.