

Design of a Sample Holder for Spectral- and Angle-Resolved Emissivity Measurements under Vacuum at Temperatures Up to 1000 °C

Max Reiniger^{C, S}, Albert Adibekyan, Christian Monte and Jörg Hollandt
Physikalisch-Technische Bundesanstalt (PTB), Berlin, Germany
max.reiniger@ptb.de

The Physikalisch-Technische Bundesanstalt (PTB) provides emissivity measurements over a wide range of temperature. Until recently the temperature ranges covered were by a setup under vacuum from -40 °C to 450 °C and by a dynamic emissivity measurement from 800 °C to 2000 °C. To bridge the gap we designed and optimized a sample holder operating between 50 °C and 1000 °C. A prerequisite for low uncertainties in emissivity measurements is a homogeneous temperature distribution on the sample surface. So, the main task of the development of the new high temperature sample holder was to find the optimum sample holder geometry and heating concept to reach the planned temperature up to 1000 °C with optimized temperature homogeneity. The sample itself and therefore its surface emissivity affect the temperature homogeneity. The challenge was to evolve a heating concept which is able to vary and optimize the surface temperature homogeneity for various surface emissivities. The thermal conductivity and emissivity of the sample holder, given by the material, its geometry and the heating concept were varied to find a solution. Simulations were done for three different materials: INCONEL[®] alloy 600, Nickel 200 and pure Molybdenum with different geometries and multiple heating zones. The identified concept features two heating zones: one at the back side and one at the curved shell of a cylindrical body. The sample holder is made from Molybdenum which allows reaching the desired temperature of 1000 °C at the sample surface due to its high thermal conductivity and its low emissivity compared to INCONEL[®] 600 and Nickel 200. Additionally we have designed an optimized two stage radiation shield to reduce radiation losses of the holder to lower the necessary heating power for reaching a maximum temperature of 1000 °C. First results of emissivity measurements will be shown at the conference.