

Tangential momentum accommodation coefficient measurements for various materials and gas species

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Abstract

The tangential momentum accommodation coefficient was measured from the gaseous flow through a single microtube. The mass flow rate was measured by the constant volume technique, where the rate is related to time rate of pressure variation in a fixed volume tank. The measured mass flow rate was fitted by the theoretical mass flow rate expressed by the slip velocity at the surface to deduce the slip coefficient, which can be related to the tangential accommodation coefficient. The mean Knudsen number, which is determined as the mean pressure of the inlet and the outlet, was set to be below 0.32, where the second-order slip boundary condition was suggested to be valid. The measurement system was designed to allow using a microtube with large diameter of several hundred micrometers. Since low pressure environment was essential for large Knudsen number condition for the flow through such large microtube, a low leakage measurement system realized by applying the UHV technology is needed. Applicability of sub millimeters size microtubes allowed us to measure the tangential momentum accommodation coefficients on various materials. In this study, we measured the tangential momentum accommodation coefficients on an engineering metal surface for various gas species.