

Experimental study of the gas flows through channels with circular cross sections

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Abstract

The experimental setup based on the constant volume technique is developed to measure the mass flow rate through the microtubes under the isothermal flow conditions. Four different gases: Helium, Nitrogen, Argon and Carbon dioxide, and two surface materials (Stainless steel and Sulfinert) are considered. In this study the Knudsen number varies from $\sim 10^{-4}$ to 0.3. In this range the approach based on the analytical solution of the Stokes equation subjected to the first and second order velocity slip boundary conditions is used. The tangential momentum accommodation coefficient (TMAC) is extracted from the experimental data on the mass flow rate using its analytical expression. The results are summarized in the tables representing the accommodation coefficients for the couples corresponding gas-surface material combinations. The influence of the molecular mass on the tangential momentum accommodation is discussed.