Abstract Submitted
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High Knudsen Number Fluid Flow at Near-Standard Temperature and Pressure Conditions using Precision Nanochannels[1] SUBHRA DATTA, A.T. CONLISK, The Ohio State University, WILLIAM H. FISSELL, Cleveland Clinic, SHUVO ROY, University of California, San Francisco, JEFF MAJESTRELLI, Cleveland Clinic — Gas flows over a wide range of Knudsen numbers ($\sim$0.5-10) are studied using silicon nanochannel arrays with slit-shaped pores that range from micrometer to sub-10nm scales. The flows are generated under conditions of room temperature and near-atmospheric pressure ($\sim$22°C and $\sim$101-115 kPa) and span the continuum flow, continuum-slip flow, transition flow and free-molecular flow regimes. The measured flow rates of helium, argon and carbon dioxide are in good agreement with the Unified Slip Model(USM) proposed by Beskok and Karniadakis (Beskok A., Karniadakis G.E., Nanoscale and Microscale Thermophysical Engineering 3 (1999), no. 1, 43-77). The measured volumetric gas flow rates agree well with calculations based on the USM up to a Knudsen number of about Kn $\sim$ 4, well into the transition regime; above this value the agreement for much of the data is qualitative and at very large Knudsen numbers the data is in the free molecular regime as expected.

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