Abstract Submitted
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Controlling Surface Roughness to Enhance Mass Flow Rates in Nanochannels[1] MALGORZATA ZIMON, University of Strathclyde and STFC Daresbury Laboratory, DAVID EMERSON, STFC Daresbury Laboratory, JASON REESE, University of Strathclyde — A very active field of research in fluid mechanics and material science is predicting the behavior of Newtonian fluids flowing over porous media with different wettabilities. Opposite effects have been observed: some state that wall roughness always suppresses fluid-slip, whereas others show that for some cases roughness may reduce the surface friction. In this work, MD simulations were carried out to further investigate physical mechanisms for liquid slip, and factors affecting it. A rough wall was formed by either periodically spaced rectangular protrusions or was represented by a cosine wave. The MD simulations were conducted to study Poiseuille and Couette flow of liquid argon in a nanochannel with hydrophilic kryptonian walls. The effect of wall roughness and interface wettability on the streaming velocity, and the slip-length at the walls, is observed to be significant. Our results show a dependency of mass flow rate on the type of flow and topography of the channel walls. For a fixed magnitude of the driving force, an increase in the mass flow rate, compared to the smooth surface, was observed for the wavy roughness, whereas the opposite effect was observed for Couette flow where a higher slip was obtained for rectangular gaps.

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