Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Physical mechanisms of flow resistance in textured microchannels SIMON GAME, DEMETRIOS PAPAGEORGIOU, ERIC KEAVENY, Imperial College London, MARC HODES, Tufts University — Transport in microchannels can be enhanced by replacing flat, no-slip boundaries with boundaries etched with longitudinal grooves containing an inert gas, resulting in an effective slip flow. Various physical considerations which are often omitted from mathematical models play a significant role in the behaviour of this flow. Such considerations include: gas viscosity, meniscus curvature, finite channel cross-sections, molecular slip on the gas/liquid or gas/solid interfaces. Using a computationally efficient, multi-element, Chebyshev collocation method, we are able to quantify and combine each of these physical effects. We have shown that for physically realistic parameter values, including each of these effects significantly alters the volumetric flow rate, and hence these effects should not be ignored. Using this framework, we hope to manipulate these effects in order to minimise the flow resistance of the channel.

Simon Game
Imperial College London

Date submitted: 31 Jul 2015 Electronic form version 1.4