Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Giant slip at liquid-liquid interfaces using a hydrophobic ball bearing LAURENT JOLY, QUENTIN EHLINGER, OLIVIER PIERRE-LOUIS, LPMCN - Université Lyon 1, France — We suggest to build an interface where hydrophobic beads maintain a gas layer between two liquids. We show that this interface behaves as a liquid-liquid ball bearing under shear and exhibits giant slip. Such a metastable configuration reminds of pillar-based superhydrophobic surfaces, used to amplify liquid-solid slip. To the advantage of hydrophobic ball bearings, beads are able to roll, thereby reducing friction at the liquid-bead interface. However beads will always penetrate inside the liquid, inducing viscous dissipation and consequently decreasing slippage. The penetration depth being directly controlled by the wetting angle of the liquid at the bead surface, the latter is expected to have a strong influence on the efficiency of the liquid/liquid bearing. We start by quantifying analytically the influence of the wetting angle on liquid/liquid slip in this system. We then confirm the obtained scaling law by means of Molecular Dynamics (MD) simulations. Liquid-liquid bearings open new pathways for micro and nanofluidics. One major direction could be to build fluidic channels without walls, where different liquids in contact could flow independently while maintaining an extremely low interfacial friction, and preventing mixing by diffusion between the different channels.

Laurent Joly
LPMCN - Université Lyon 1, France

Date submitted: 08 Nov 2012 Electronic form version 1.4