Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Momentum and mass transport over a superhydrophobic bubble mattress: the influence of interface geometry PEICHUN AMY TSAI, A. SANDER HAASE, ELIF KARATAY, ROB LAMMERTINK, University of Twente, SOFT MATTER, FLUIDICS AND INTERFACES GROUP TEAM — We numerically investigate the influence of interface geometry on momentum and mass transport on a partially slippery bubble mattress. The bubble mattress, forming a superhydrophobic substrate, consists of an array of slippery (shear-free) gas bubbles with (no-slip) solids walls in between. We consider steady pressure-driven laminar flow over the bubble mattress, with a solute being supplied from the gas bubbles. The results show that solute transport can be enhanced significantly due to effective slippage, compared to a fully saturated no-slip wall. The enhancement depends on the interface geometry of the bubble mattress, i.e. on the bubble size, protrusion angle, and surface porosity. In addition, we demonstrate that the mass transfer enhancement disappears below a critical bubble size. The effective slip vanishes for very small bubbles, whereby interfacial transport becomes diffusion dominated. For large bubbles, solute transport near the interface is greatly enhanced by convection. The results provide insight into the optimal design of ultra-hydrophobic bubble mattresses to enhance both momentum and mass transport.

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Date submitted: 02 Aug 2013 Electronic form version 1.4