Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Multilayer Liquid Spreading on Superhydrophilic Nanostructured Surfaces RONG XIAO, KUANG-HAN CHU, EVELYN WANG, Department of Mechanical Engineering, Massachusetts Institute of Technology — Superhydrophilic surfaces with nanoengineered structures have received recent interest due to the ability to manipulate fluids for applications in thermal management and microfluidics. However, the interactions of the liquid and nanostructures are complex, and unique wetting behavior on such surfaces exists. In this work, we investigated the spreading of water on silicon nanostructures with diameters ranging from 500 nm to 800 nm, separated by spacings of 500 nm. During the spreading process, the liquid was consistently separated into multiple layers of varying thicknesses. Experimental characterizations were performed to determine the thickness of the layers and a model based on surface energy minimization was developed to obtain increased understanding of the observed phenomenon. The model suggests that energy barriers from the scalloped side walls of the nanostructures, which were created by the deep reactive ion etching fabrication process, lead to disruptions in the spreading of the liquid film. A relationship between geometry and the energy barriers was obtained, which provides insight and opportunities to control the thickness of the liquid layers for a variety of microfluidic systems.

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Date submitted: 03 Aug 2008 Electronic form version 1.4