Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Solid or Liquid ? – Kinetically induced solidification in a simple nanoconfined liquid[1] PETER HOFFMANN, Wayne State University, GEORGE MATEI, Wayne State University, SHIVPRASAD PATIL, Wayne State University, AHMET ORAL, Bilkent University — For many years there has been a controversy regarding the supposed solidification of simple liquids when they are confined to a few nanometer film thickness. By using a novel, ultra-small amplitude Atomic Force Microscopy (AFM) technique, we have found that solidification in these systems seems to be due to a kinetic effect and does not occur in thermodynamic equilibrium. In particular, we studied OMCTS confined between a flat silicon surface and a silicon tip and found that at very low approach speeds (<= 0.3 Å/sec) the confined fluid remains liquid-like with no change in mechanical relaxation time from the bulk, although ordering is observed in the stiffness and damping of the film. However, when approaching the tip slightly faster at or above 6 Å/sec, the liquid suddenly changes properties dramatically. In the ordered regime, damping is greatly reduced and the mechanical relaxation times show large peaks, indicating an elastic, solid-like response. This result suggests that the observed solidification is a non-equilibrium effect induced at very long time scales.

[1]Funding is acknowledged from NSF-MRI and NSF-CAREER

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Date submitted: 01 Dec 2005 Electronic form version 1.4