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The riddle of nanoconfined liquids -solid or liquid?[1] PETER HOFFMANN, GEORGE MATEI, MIRCEA PANTEA, Wayne State University, SHIVA PATIL, University of Madrid, ASHIS MUKHOPADHYAY, Wayne State University — Using a specially designed Atomic Force Microscope (AFM), we recently found that the mechanical behavior of simple liquids can be surprisingly rich when liquids are confined to only a few molecular layers. Under nanoscale confinement, OMCTS, a model silicone oil, remains liquid at thermal equilibrium while exhibiting molecular layering. However, at the application of a very small squeeze rate of the order of 1 molecular layer/second, elastic ('solidlike') behavior can be induced. On the other hand a different silicone oil, TEHOS, which has a more open molecular structure, behaves 'solidlike' even at very slow squeeze rate and there is an indication, using fluorescence correlation spectroscopy, that it may spontaneously 'solidify' close to a flat solid surface. Shear measurements show that when the liquid is allowed to order between the AFM tip and the substrate, the shear stiffness is enhanced, supporting the notion that these liquids can indeed 'solidify' under certain circumstances.

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