Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Mechanical properties determination of PDMS films on hard substrate using atomic force microscopy WENWEI XU, TODD SULCHEK, The George W. Woodruff School of Mechanical Engineering, Georgia Institute of Technology — Mechanical properties of PDMS thin films adhering on hard substrate were investigated using Atomic Force Microscope (AFM) with a spherical tip. Simulation was implemented using finite element method and was compared to the experiments. The effect of the hard substrate on the mechanical response of the PDMS film becomes significant when the indentation depth exceeds 45% of the sample thickness. This relationship was also verified by comparing Hertz model to the experiments in the whole indentation range. Hertz model is not applicable in the large deformation region because the large deformation violates the assumption on which the Hertz model is based. The point wise Young's modulus as a function of indentation was obtained using Hertz model and also identified the effect of the hard substrate on mechanical responses. Furthermore, the point wise Young's modulus in the linear elasticity region decreases with increasing film thickness, until the sample is thick enough and its modulus reaches that for bulk PDMS. In the point wise Young's modulus plot, the Young's moduli at small indentations were several orders of magnitude higher than those in the linear elasticity region; this phenomenon has been observed in previous research and was also studied in our experiments.

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Date submitted: 23 Nov 2010 Electronic form version 1.4