Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Mechanical Properties of Thin Polymer Films Studied by Atomic Force Microscopy BLANDINE JEROME, LPMCN Lyon (F) & LBNL Berkeley, CHRISTIAN VIALLETON, LPMCN & MATEIS-INSA Lyon (F), LAURENT CHAZEAU, MATEIS-INSA Lyon (F), ELISABETH CHARLAIX, LPMCN Lyon (F) — Introducing inorganic nanoparticles into a polymer is known to modify the macroscopic mechanical properties of the material. This is often interpreted by assuming the presence of a polymer layer with different properties at the interface with the particles. There is however little direct information available on the mechanical properties of such an interfacial layer. We have used an Atomic Force Microscope (AFM) as a nano-indenter to probe the mechanical response of thin poly(styrene butadiene) random copolymers deposited on oxidized silicon wafers (model silica surface). Indentations were performed at different approach and retraction speeds at room temperature (polymer in the rubbery state) on films with thicknesses ranging from 40nm to 500nm. Approach and retraction curves obtained at high speeds are characteristic of the indentation of an elastic material with an adhesive tip/polymer contact. At low speeds, the adhesion forces dominate for low applied forces, while the elasticity of the polymer dominates the behaviour at high applied load. This allows us to separate the mechanical response of the polymer film from the tip-polymer adhesion that involves some dissipation taking place close to the contact line between the polymer free surface and the tip.

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Date submitted: 27 Nov 2007 Electronic form version 1.4