Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Measuring local viscoelastic properties of complex materials with atomic force microscopy PAULA WOOD-ADAMS, WENSHENG XU, Concordia University — Tapping mode atomic force microscopy is a technique to measure the topography and properties of surfaces involving a micro-cantilever with a tip at one end that is excited into an oscillation near its resonance frequency. The cantilever-tip assembly is positioned vertically such that the tip touches the surface at the bottom of its down-stroke and then scanned over the surface. The oscillation of the cantilever is affected by the topography of the surface, the local surface properties and the feed back controller which maintains the amplitude of the oscillation at a fixed set point value. The vertical movements needed to maintain constant oscillation amplitude are used to draw the topography image and the phase lag of the oscillation relative to the excitation force is used to draw the phase image. The phase lag is sensitive to local mechanical properties under certain experimental conditions and we have found that by using silicon as an internal standard reference surface we can unambiguously relate the phase lag to local viscolastic properties of a polymeric material. We have built a model describing this relation, validated the model with experimental data and finally inverted it such that it can be used to determine local properties. This allows us to measure high frequency local viscoelastic properties on length scales as small as several nanometers. This technique works well for relatively compliant polymer surfaces with a shear modulus less than about 1 GPa. Funding Provided by the Taiho Kogyo Tribology Research Foundation.

Paula Wood-Adams
Concordia University

Date submitted: 04 Dec 2005 Electronic form version 1.4