The mechanical properties of supported thin polystyrene films
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Ann Arbor — The mechanical properties of supported thin polystyrene films with
thicknesses in the range of 100 nm to 1 micron were studied by atomic force mi-
croscopy (AFM) nanoindentation measurements. The effective modulus of the 1
micron thick PS film at small indentation depths, in the range of few nanometers
(~3 nm), was independent of frequency (indentation rate) in the range we stud-
ied. On the other hand, the effective modulus of thinner PS films showed an in-
crease in the modulus with decreasing film thicknesses and this enhancement was
frequency-dependent. Finite element analysis revealed that the stress field induced
by nanoindentation propagates a few hundred nanometers into the film even with
only a few nanometers of indentation, and the enhancement in the effective modulus
stems from the underlying hard substrate.