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Membrane-Enhanced Surface Acoustic Wave Analysis of Polymer Brushes DAVID A. BRASS, KENNETH R. SHULL, Northwestern University — We show that detailed structural information about polymer brushes can be obtained from a simple membrane inflation technique in conjunction with a quartz crystal resonator. The sensitivity of these quartz crystal resonators is determined by the propagation of acoustic shear waves through the materials that are placed in contact with the oscillating crystal. Coupling of the these 'surface acoustic waves' into the membrane is strongly affected by the thickness of the brush layer, which is in turn affected by specific interactions between the polymer brush and the surface with which it is brought into contact. The mechanical resonance of the quartz crystal is affected by these brush parameters, and we refer to the accompanying analysis of this resonance as 'membrane-enhanced surface acoustic wave analysis'. The analysis combines self consistent mean field theory of the polymer brush with the relevant theories of acoustic wave propagation. The model has been tested experimentally with grafted poly(ethylene glycol) brushes in contact with thermoplastic elastomer membranes. We also show how the technique can be used to quantify the strength of specific interactions between the electrode surface of the quartz resonator and functional groups placed at the ends of the PEG brushes.

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