

Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Polyelectrolyte Interfacial Swelling and Film Stability VIVEK PRABHU, ASHWIN RAO, SHUHUI KANG, ERIC LIN, NIST, Gaithersburg, Maryland, SUSHIL SATIJA, NIST Center for Neutron Research — The phase stability of polyelectrolytes at interfaces and in thin films are of fundamental interest for the fabrication of high resolution features by photolithography. In this process, a latent chemical image is formed within a thin polymer film by exposure to light and subsequently resolved by selective dissolution. The selective dissolution occurs at a polyelectrolyte copolymer gradient comprised of hydrophilic (weakly acidic) and hydrophobic groups. The balance between the hydrophobicity and hydrophilicity (degree of ionization) controls the film stability when exposed to an aqueous hydroxide solution. The average copolymer content that dissolves away can be understood by phase diagrams, but a residual material that swells, but does not dissolve, occurs within the gradient interface. Controlling this swelling amplitude and depth is of technological interest to prepare high fidelity features of ever smaller dimensions. Contrast variant neutron reflectivity and quartz crystal microbalance quantify this nanometer-scale spatial distribution of polyelectrolyte and aqueous base. The swelling spatial extent measured during in situ dissolution, water rinse, and drying implies the polymer profile is dynamic on the nanometer scale. The profile control by ionic strength and charge valence will also be discussed.

Vivek Prabhu
NIST, Gaithersburg, Maryland

Date submitted: 20 Nov 2006

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