Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Intricacies of Polymer Dewetting: Nanoscaled Architectures for the Tailored Control of Polystyrene Thin Film Stability[1] JUSTIN CHEUNG, MANI SEN, ZHIZHAO CHEN, NAISHENG JIANG, MAYA ENDOH, TADANORI KOGA, Stony Brook University, SUSHIL SATIJA, National Institute of Standards and Technology — Recently, structural properties of polymer thin films have garnered attention for their relevance in the fields of organic photovoltaics and biosensors. The dewetting of polymer films poses an obstacle in the face of widespread implementation. For this study, we show that adsorbed polymer chains on a substrate surface play crucial roles in film stability. Polystyrene (PS) thin films (20 nm in thickness) with different molecular weights (Mw) on silicon (Si) substrates were used as a model. The PS films were annealed at high temperatures for several days, and Mw dependence on film stability was evidenced. At the same time, the annealed PS films were leached with a good solvent and the residue films (i.e., irreversibly adsorbed layers) were characterized by x-ray reflectivity (XR). We reveal strong correlation between film stability and two different interfacial structures of the adsorbed polymer chains: their opposing wettability against chemically identical free polymer chains results in a wetting-dewetting transition at the adsorbed polymer-free polymer interface. This is a unique aspect of polymer thin film stability and may be generalizable to other polymer systems regardless of the magnitude of solid-polymer attractive interactions.

[1]We acknowledge the financial support of NSF Grant (CMMI-1332499)

Justin Cheung
Stony Brook University

Date submitted: 02 Nov 2015 Electronic form version 1.4