Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Relaxation Kinetics of Nanostructures on Polymer Surface: Effect of Orientation, Spatial Confinement, and Chain Mobility[1] H.G. PENG, Y.P. KONG, A.F. YEE, Depart. of Chemical Engineering and Materials Science, Univ. of California, Irvine — Nanostructures provide an opportunity for studying relaxation and chain dynamics of polymers when the radius of gyration is not small compared with the dimension of the structure. PS (PDI=1.03-1.05, Mw=6.4 to 1571 kg/mol) gratings of varying line-widths (600 nm, 270 nm, and 30 nm) were fabricated by nanoimprint lithography. When annealed at T $\sim$ bulk Tg, the grating height monitored with an AFM relaxes as surface tension and other driving forces overcome the polymer viscosity. The temperature for rapid relaxation decreases as the feature size diminishes for all molecular weights (MWs), but a simple explanation based on surface enhanced mobility fails to explain the results. The residual molecular orientation effect is identified as the main relaxation driving force for gratings of MWs much larger than the entanglement MW. Comparison between the various nanostructure sizes allows to observe the spatial confinement effect and to determine whether a thin mobile surface layer exists.

[1]This work is supported by National Science Foundation (CMMI-0728352).

Huagen Peng

Date submitted: 03 Dec 2007 Electronic form version 1.4