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**Nanoscale Confinement Induced Control of Polymer Thin Film Instabilities** DIYA BANDYOPADHYAY, ARVIND MODI, ALAMGIR KARIM, Department of Polymer Engineering, The University of Akron, Akron, OH 44325 — Control of stability and wettability of polymer thin films is invaluable to a range of functional coatings with applications from electronics to biomedical coatings, yet simple non-chemical modification strategies to accomplish this are generally lacking. We demonstrate a novel route to effectively control instabilities in model polystyrene films on partially wetting and non-wetting solid substrates that would otherwise lead to film dewetting. The method involves top down confining capillary force lithography at various length scales. Systematic experimental studies on silicon and silicon oxide substrates supported by analytical theory shows that for confining pattern wavelengths less than $\sim$ 10 times film thickness, stabilizing surface tension forces dominate the overall energy balance of the system giving rise to stable films under confinement. Interestingly, thermal annealing at elevated temperatures after removal of confinement does not revert to growth of longer instability modes and stability of PS films is retained. These results pave the way for important new technological applications of otherwise unstable polymer films.

Diya Bandyopadhyay
Department of Polymer Engineering,
The University of Akron, Akron, OH 44325

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