Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Roll-to-Roll Nanoimprint Lithography Simulations for Flexible Substrates[1] ANDREW SPANN, AKHILESH JAIN, ROGER BONNECAZE, University of Texas at Austin — UV roll-to-roll nanoimprint lithography enables the patterning of features onto a flexible substrate for bendable electronics in a continuous process. One of the most important design goals in this process is to make the residual layer thickness of the photoresist in unpatterned regions as thin and uniform as possible. Another important goal is to minimize the imprint time to maximize throughput. We develop a multi-scale model to simulate the spreading of photoresist drops as the template is pressed against the substrate. We include the effect of capillary pressure on the bending of the substrate and show how this distorts uniformity in the residual thickness layer. Our simulation code is parallelized and can simulate the flow and merging of thousands of drops. We investigate the effect of substrate tension and the initial arrangement of drops on the residual layer thickness and imprint time. We find that for a given volume of photoresist, distributing that volume to more drops initially decreases the imprint time. We conclude with recommendations for scale-up and optimal operations of roll-to-roll nanoimprint lithography systems.

[1]The authors acknowledge the Texas Advanced Computing Center at The University of Texas at Austin for providing high performance computing resources.

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Date submitted: 23 Jul 2015 Electronic form version 1.4