Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Direct Write Thermocapillary Dewetting of Polymer Thin Films by a Laser-Induced Thermal Gradient JONATHAN SINGER[1], PAO-TAI LIN, STEVEN KOOI, JURGEN MICHEL, LIONEL KIMERLING, Massachusetts Institute of Technology, EDWIN THOMAS, Rice University — Laser direct write (DW) is an attractive alternative to the slower vacuum chamber particle beam techniques as it can achieve up to cm/s patterning rates. The materials employed for both laser and charged particle DW, however, are often expensive, designer materials. By taking advantage of the interaction between optical and thermal effects, we have developed a positive-tone laser DW technique that can induce controlled dewetting conventional polymer systems (here polyvinylacetate, polystyrene, and polyvinylpyrrilidone). Via this combination of antireflection, dewetting, and thermal absorption, features ¡100 nm can be achieved through exploiting overlap-based pattern formation, but with a much greater degree of deliberate control than is usually achieved by bottom-up dewetting. This is accomplished with a continuous wave, 532 nm source and free space optics that have a relatively low numerical aperture (NA=0.4), thus representing a sub-diffraction limit patterning technique. Using experiments and simulations, we demonstrate the mechanism and efficacy of this technique and investigate the effects of material parameters such as molecular weight and glass transition temperature.

[1](Currently at Yale University)

Jonathan Singer
Yale University

Date submitted: 14 Nov 2013 Electronic form version 1.4