Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Massively Multiplexed Cantilever-free Scanning Probe Lithography KEITH A. BROWN, DANIEL J. EICHELSDOERFER, Northwestern University Department of Chemistry and International Institute for Nanotechnology, WOOYOUNG SHIM, Northwestern University Department of Materials Science and Engineering, RADHA BOYA, ABRIN L. SCHMUCKER, GUOLIANG LIU, Northwestern University Department of Chemistry and International Institute for Nanotechnology, CHAD A. MIRKIN, Northwestern University Department of Chemistry, Department of Materials Science and Engineering, and International Institute for Nanotechnology — Cantilever-free scanning probe lithography has emerged as a low-cost technique for rapidly patterning nanoscale materials. In this architecture, an array of probes is fabricated on a soft backing layer that provides mechanical compliance to each probe while an underlying hard surface maintains the structural integrity of the array. One drawback of this technique is that each probe in the array acts simultaneously and thus generates a copy of the same pattern. Here, we discuss recent efforts to incorporate heaters into these probe arrays so that when a given heater is activated, the thermal expansion of the elastomer actuates a single tip. We find thermal actuation to be powerful enough to actuate individual tips over 4 μm with minimal crosstalk, fast enough to actuate on relevant time scales (20 ms), and scalable by virtue of being electrically addressable. Furthermore, tuning the individual heaters allows for variability in the arrays to be compensated for precisely, resulting in high quality nanopatterning. The addition of tunable actuators transforms cantilever-free scanning probe lithography into a technique capable of true desktop nanofabrication.

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Date submitted: 09 Nov 2012 Electronic form version 1.4