Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Controlled Chemical Patterns with ThermoChemical Nano-Lithography (TCNL) KEITH CARROLL, School of Physics, Georgia Institute of Technology, ANTHONY GIORDANO, School of Chemistry and Biochemistry, Georgia Institute of Technology, DEBIN WANG, Lawrence Berkeley National Laboratory, VAMSI KODALI, School of Physics, Georgia Institute of Technology, W.P. KING, Department of Mechanical Science and Engineering, University of Illinois Urbana-Champaign, S.R. MARDER, School of Chemistry and Biochemistry, Georgia Institute of Technology, E. RIEDO, J.E. CURTIS, School of Physics, Georgia Institute of Technology — Many research areas, both fundamental and applied, rely upon the ability to organize non-trivial assemblies of molecules on surfaces. In this work, we introduce a significant extension of ThermoChemical NanoLithography (TCNL), a high throughput chemical patterning technique that uses temperature-driven chemical reactions localized near the tip of a thermal cantilever. By combining a chemical kinetics based model with experiments, we have developed a protocol for varying the concentration of surface bound molecules. The result is an unprecedented ability to fabricate extremely complex patterns comprised of varying chemical concentrations, as demonstrated by sinusoidal patterns of amine groups with varying pitches (∼5-15 μm) and the replication of Leonardo da Vinci's *Mona Lisa* with dimensions of ∼30 x 40 μm^2. Programmed control of the chemical reaction rate should have widespread applications for a technique which has already been shown to nanopattern various substrates including graphene nanowires, piezoelectric crystals, and optoelectronic materials.

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Date submitted: 23 Jan 2012 Electronic form version 1.4