Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Floating Tip Nanolithography YEHIAM PRIOR, KAIYIN ZHANG, ALEXANDER MILNER, Department of Chemical Physics, Weizmann Institute of Science, Rehovot, Israel 76100, MICHAEL KARPOVSKI, Department of Physics, Tel Aviv University, Tel Aviv, Israel — We introduce a new mode of operation to standard atomic force microscopes, working under ambient conditions, for truly noncontact nanolithography. A phase-locked loop, based on tiny oscillations (<1 nm) of the cantilever at a frequency far from its mechanical resonance, is used to maintain the gap between the tip and the sample at a predetermined value of 1 - 4 nanometers continuously for long times without the tip ever touching the surface. In a geometry characteristic for Apertureless Scanning Near Field Optical Microscope, the tip is illuminated by a focused beam of a femtosecond laser (800 nm, 20 fsec, 100 mw) for nano-patterning of the area under the tip. Under the laser irradiation the tip apex heats to a few hunderd degrees as verified by a direct measurement of Raman line shifts, and the elecrtomagnetic enhancement under the tip is used when the laser irradiates the actual tip apex. We demonstrate Floating Tip Nanolithography of two different types, both with lateral resolution of 10-20 nm. With a hot tip (the laser is not in contact with the surface) we thermally pattern the surface of a polymer film, and based on the electromagnetic field enhancement under the sharp tip we ablate narrow lines on a gold film. Future applications will be discussed.

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Date submitted: 29 Jan 2008 Electronic form version 1.4