Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Nanoscopic oxidation of p-type and un-doped Si (100) surfaces using un-externally biased atomic force microscope tips (AFM) in the presence of selected organic solvents JEFFREY MCCAUSLAND, SAJEEVI WITHANAGE, ROBERT MALLIK, SERGEI LYUKSYUTOV, University of Akron — A conductive un-biased AFM tip oscillating above p-type or un-doped Si (100) treated with toluene, butan-2-ol, and propan-2-ol creates nanostructures ranging in height from 1-100 nm. The tip was oscillated in ambient conditions (30-70% Rel. Humidity) at frequencies in the 10^2 kHz range. It was repeatable with various concentrations of solvent in aqueous solution. It is suggested that mechanical oscillations of the AFM tip polarizes the solvent molecules deposited on the surface resulting in electron transfer from the tip to the surface followed by feature formation. This process effectively creates an electrochemical cell at the microscopic level and the miscibility of the solvents is the key to enabling the process. Species which ionize during the process may be consumed in irreversible reactions whereas the alcohols act as catalysts and are not consumed. The influence of boron defects in the Si substrates is also discussed. It appears that the observed oxidation is different from all other similar reported phenomena including local anodic oxidation, and chemo-mechanical lithographic techniques utilizing AFM.

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Date submitted: 31 Oct 2015 Electronic form version 1.4