

Abstract Submitted  
for the GEC12 Meeting of  
The American Physical Society

**Role of Photons, Ion Implantation and Mixing in Sub-threshold Selective Etching of Si** JULINE SHOEB, SARAVANAPRIYAN SRIRAMAN, TOM KAMP, ALEX PATERSON, Lam Research Corporation, Fremont, CA, ETCH PRODUCT DEVELOPMENT, LAM RESEARCH CORPORATION, FREMONT, CA TEAM — As device sizes shrink, control of selectivity and damage during plasma etching becomes important. Recent literature reports the role of photons in the cleaving of surface and sub-surface Si-Si bonds which may initiate Si etching by radicals, even below the threshold energies needed for ion-assisted etch.<sup>1</sup> Simultaneous effects of photons and ion penetration can degrade the selectivity. Photon assisted Si etching in below-threshold ion energies in Cl<sub>2</sub> plasmas reported 4-10 nm/Min. etch rate.<sup>2</sup> We investigated the effects of photons in sub-threshold etching of Si in HBr/He/O<sub>2</sub> plasmas. As photons with wavelengths <170 nm have enough energy to cleave Si-Si bonds, we concentrated on 58.4 nm photons emitting from He(2 <sup>1</sup>p) and 130nm photons emitted by O(3s) which can penetrate ~10nm into Si.<sup>3</sup> This paper will discuss the role of photons and mixing in silicon-dioxide/silicon etching using modeling & simulation, experiments and diagnostics.

<sup>1</sup>H. Shin, W. Zhu, V. M. Donnelly, and D. J. Economou, J. Vac. Sci. Technol. A **30(2)**, 021306 (2012).

<sup>2</sup>Ibid.

<sup>3</sup>J. R. Woodworth, M. E. Riley, V. A. Amatucci, T. W. Hamilton, and B. P. Aragon, J. Vac. Sci. Technol. A **19**, 45 (2001).

Juline Shoeb  
Lam Research Corporation, Fremont, CA

Date submitted: 15 Jun 2012

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