Abstract Submitted
for the GEC15 Meeting of
The American Physical Society

Low Damage Etching with Atomic Layer Precision L. DORF, S. RAUF, G. MONROY, K. RAMASWAMY, K. COLLINS, Y. ZHANG, Applied Materials — In this presentation, we describe a Low Damage Etch Chamber (LoDEC) for atomic layer etching (ALE) comprising: (1) an electron beam source (1–2 keV) for generating radical-poor, low electron temperature ($T_e \sim 0.3$ eV) plasma, (2) a remote plasma source (RPS) for supplying radicals to the substrate, and (3) a bias generator for creating the voltage drop (0–50 V) between the substrate and the plasma to accelerate ions over etch-threshold energies. In LoDEC, we reproduced the conventional *Si*-etch ALE cycling scheme: in 1$^{\text{st}}$ part of the cycle, *Cl* atoms are injected by RPS to passivate the surface for $\Delta t = \tau_p$, and in 2$^{\text{nd}}$ part, RPS is turned off and etching is done in e-beam Ar/N_2 plasma at low bias power for $\Delta t = \tau_b$. As τ_b is increased, we observe saturation in the etch depth per cycle, Δ_c, signifying that the entire passivation layer is being removed each cycle, resulting in layer-by-layer etching. In LoDEC, this scheme can be implemented at much lower ion energies, E_i, than in conventional tools, potentially resulting in lower damage to advanced materials. We also obtained the dependence of Δ_c on ion energy and τ_p for a given τ_b. Finally, using LoDEC we developed a novel technique for etching *a-Si* in *Cl* below known threshold energy, at $E_i \sim 5 - 7$ eV (TEM shows etch rates of $\sim$ 3–4 nm/min).

L. Dorf
Applied Materials

Date submitted: 20 Jun 2015 Electronic form version 1.4