Abstract Submitted
for the GEC17 Meeting of
The American Physical Society

Numerical study of atomic layer precision control for SiO2 etching ZHANG SAIQIAN, DAI ZHONGLING, WANG YOUNIAN, School of Physics and Optoelectronic Engineering, Dalian University of Technology — In semiconductor fabrication industry, the application of 3D structures makes profile, damage and selectivity control more difficult. Atomic layer etching (ALE) becomes a potential way to achieve high precision control of etching. In ALE, cyclic passivation and removal of the passivated layer are performed and the self-limiting nature guarantees the 1ML/cycle in ideal case. But throughput issue arises from purge step limits the application, many study try to achieve the ALE or ALE-like precision control with less time or equipment costs by compromising the precision. In this study, a multi-dimensional model is built to simulate the SiO2 etching in fluorocarbon plasmas. First, global and sheath model are used to get energetic particle fluxes. Then particles are traced in the trench model and finally a surface Monte Carlo method is used to consider surface reactions. Results show that by cyclic control of high and low ion energies, better precision control is achieved compared to conventional etching, even without alternating the feed gas. But non-ideal etching like micro-trenching, sidewall slope exists. Control of ion energy distribution and duty ratio of energy modulation can be used to optimize the profile and selectivity control.

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Date submitted: 08 Jun 2017 Electronic form version 1.4