Abstract Submitted
for the GEC13 Meeting of
The American Physical Society

Development and characterization of a neutral beam source for sub-10 nm etching[1] DANIIL MARINOV, ZIAD EL OTELL, NICHOLAS ST. BRAITHWAITE, MARK BOWDEN, Department of Physical Sciences, The Open University, Walton Hall, Milton Keynes, MK7 6AA, UK — Neutral beam etching is a promising technology for damage-free sub-10 nm device fabrication. In this work a neutral beam is generated by surface neutralization of ions extracted from a pulsed ICP discharge in Ar/SF_6. Negative ions are extracted during the afterglow phase when an ion-ion plasma is formed. The evolution of the density of various charged species is measured with different techniques (Langmuir, hairpin and ion flux probes). High density plasma, with electron number density in the range 10^{17} - 10^{18} m^{-3}, is typically produced in the pulsed ICP. The electron heating in the active-glow phase is characterized using trace rare gas optical emission spectroscopy with Ar, Kr and Xe admixtures. The energy spectra and fluxes of the extracted ions are measured using a retarding field analyzer. The potential of pulse tailoring of the discharge for optimization of negative ion formation is investigated, while varying the extraction pulse waveform provides another degree of freedom to obtain desirable neutral beam characteristics. Finally, the etching performance of the neutral beam source is demonstrated on patterned and non-patterned silicon wafers.

[1]This work is part of the EU-FP7 project Single Nanometer Manufacturing

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Date submitted: 02 Jul 2013 Electronic form version 1.4