Abstract Submitted
for the GEC10 Meeting of
The American Physical Society

Synchronous Plasma Pulsing for Etch Applications M. HAASS, M. DARNON, E. PARGON, CNRS-LTM, S. BANNA, Applied Materials, O. JOUBERT, CNRS-LTM — The use of plasma processes is the most viable technological solution to address the critical dimension control at the nanometer range required in microelectronics. However, conventional plasma etch processes are reaching their limits in terms of etch selectivity and profile control at the atomic scale. In this study, we investigate the potential of pulsed plasmas to further improve etching processes. The experiments are performed in a 300mm AdvantEdge tool from Applied Materials. The inductively coupled plasma is sustained by two RF generator (13.56 MHz) to create the plasma and to polarize the wafer, modified using Pulsync to allow synchronous pulsing at different frequencies and duty cycles. We demonstrate the interest of synchronously pulsed HBr/O2 plasmas to etch silicon trenches. In particular, experiments carried out at a frequency of 1 kHz and a duty cycle of 20% show an enhanced quality of the patterned profiles, compared to continuous wave processes. A high selectivity, uniformity and a minimization of aspect ratio dependent phenomena are observed while the etch rate relative to the plasma ON time increases. These improvements are linked to the balance between plasma dissociation and recombination during the ON and OFF time of the pulsed plasma, influencing the composition of neutral and ion flux. Preliminary results show that this balance is controlled by the duty cycle rather than the pulsing frequency.

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Date submitted: 27 May 2010 Electronic form version 1.4