Abstract Submitted
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Plasma-surface interactions during Si etching in Cl- and Br-based plasmas: An empirical and atomistic study HIROTAKA TSUDA, TATSUYA NAGAOKA, HIROKI MIYATA, YOSHINORI TAKAO, KOJI ERIGUCHI, KOUICHI ONO, Kyoto University — Nanometer-scale control of Si etching in Cl_2- and HBr-containing plasmas is indispensable in the fabrication of gate electrodes and shallow trench isolation. There are profile anomalies of sidewalls such as tapering, bowing, footing (or corner rounding), and notching, which largely affect the critical dimension. There are also anomalies of bottom surfaces such as microtrenching and roughness (or residues), which affect the bottom uniformity, and lead to recess and damage in gate fabrication. Atomic-scale cellular model (ASCeM) based on the Monte Carlo method has been developed to simulate plasma-surface interactions and the profile evolution during etching, including passivation layer formation, and also ion reflection and penetration on feature surfaces. We have also studied atomistic plasma-surface interactions by classical molecular dynamics (MD) simulation, where an improved Stillinger-Weber interatomic potential was newly developed. The numerical results were compared with etching experiments and also with surface diagnostics including *in-situ* Fourier-transform-infrared reflection absorption spectroscopy (FTIR-RAS), to reveal the origin of profile anomalies on feature surfaces during etching, and then to achieve the precise control of etched profiles.

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