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Damage-free Neutral Beam Etching, Deposition and Surface Modification Processes for Novel Nano-scale Devices
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For the past 30 years, plasma process technology has led in the efforts to shrink the pattern size of ultralarge-scale integrated (ULSI) devices. However, inherent problems in the plasma processes, such as charge build-up and UV photon radiation, limit the process performance for nanoscale devices. To overcome these problems and fabricate nanoscale devices in practice, we have proposed damage-free neutral-beam process. In this presentation, I describe the issues of plasma processes and the demanded atomic layer process for future nanoscale devices. I also introduce our developed damage-free etching, structure-designable deposition of super low- k SiOC film and low-temperature oxidation (thin SiO_2 , GeO_2) processes using neutral beams and discuss the actual applications of neutral beam processing for future nanoscale devices (such as, Fin-MOSFET, and Quantum Dot Solar Cell). Neutral beams can perform atomically damage-free etching, deposition and surface modification. Then, the neutral beam process can precisely control the atomic layer chemical reaction and defect generation. This technique is a promising candidate for the nano-fabrication technology in future nanoscale devices.