Plasma surface kinetic studies of silicon dioxide etch process in inductively coupled fluorocarbon plasmas

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Recently, one of key issues in advanced dielectric etching processes toward the nanoscale devices is to achieve ultra-high deep contact hole. For this purpose, various fluorocarbon gases have been used with numerous additives (e.g., O_2, CO and Ar) to optimize the reactant fluxes and obtain the ideal etch profiles. As an effort to address this issue, we present a fluorocarbon plasma-surface kinetic modeling based on the experimental plasma diagnostic data for silicon dioxide etching process under inductively coupled fluorocarbon plasmas. To capture the realistic surface reaction behavior, a polymer layer based surface kinetic studies are proposed as considering material balance of deposition and etching by using surface reaction researching tools, CANTERA. The surface kinetic studies of the fluorocarbon film region is based on a complex fluorocarbon balance for plasma etching conditions considering deposition, etching and polymer consumption. Finally, the surface kinetic studies results showed good agreements with experimental etch rates as functions of ion energy.