Polymer Layer based Surface Kinetic Model on Silicon Dioxide Etch Process in Inductively Coupled Fluorocarbon Plasmas

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To achieve ultra-highdeep contact hole, the fluorocarbon gases have been used with numerous additives 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 modelingbased on the experimental plasma diagnostic datafor silicondioxide etching process underinductively coupled C4F6 plasmas.For this work, the cut-off probe and QMS were used for measuring the electron densities and the ion and neutral radical species.Furthermore, the surface analysis using XPS was performed to investigate the thickness and the chemical bonding of the formed polymer passivation layer during the etch process.Based on these experimental data, we proposed a realistic etching model using the “well-mixed” assumption to the ion mixing zone.The surface model of the fluorocarbon film region is based on a complex fluorocarbon balance for steady-state substrate etching conditions considering deposition, etching and consumption.Finally, the surface kinetic modeling results showed good agreements with experimental etch rates as functions of ion energy.