Diffusion effects of surface reaction model under the fluorocarbon plasma

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Recently, plasma etching technology of high aspect-ratio contact hole etching(HARC) is confronted by the greatest difficulty because it has depended on empirical knowledge of process engineers due to its inherent complexities. As the feature size of HARC decreases up to nanoscale, various plasma chemistries based on fluorocarbon mixture have been investigated to meet the tight process margin. However, there still exist big gaps between engineering and academic fields, leading to the absence of surface kinetic models for predicting the plasma process. To address these issues in this work, we developed a realistic surface reaction model of plasma etching process for various target materials. This model was considered with both a self-consistent model of passivation layer and detailed kinetic models of plasma deposition and etching. The plasma etching process using the fluorocarbon gas was simulated about the ration of neutral flux to ion flux, the ion energy. Through verification of this model via comparisons with experimental data, we demonstrate that our surface reaction model can be useful to industrial applications toward 3D HARC technology.