

3D feature profile simulation of mask effects in high aspect contact hole etch process

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Recently, one of the critical issues in the etching processes of the nano-scale devices is to achieve ultra-high deep contact hole without anomalous behaviors such as sidewall bowing, and twisting profile. As an effort to address this issue, we have developed a 3D feature profile simulator coupled with well-defined plasma-surface kinetic model for silicon dioxide etching process under fluorocarbon plasmas. The 3D feature profile simulator developed in our group consists of multiple level set based moving algorithm, and ballistic transport module. In this work, effects of mask etching are mainly investigated for high aspect ratio contact hole etch process. For realistic mask etch simulation, we developed typical surface reaction model including mask sputtering and polymer passivation and incorporated it into multiple level set algorithm. Finally, it is demonstrated that high aspect contact hole etch profile can be strongly affected by mask etching shapes such as necking and bowing.