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Prediction of SiO₂ etching profile under the presence of RIE-lag effect TAKASHI YAGISAWA, TOSHIAKI MAKABE, Keio University — As the size of ULSI elements shrinks further, functional design for a top-down plasma processing will be strongly required in order to predict and overcome many types of damages induced by plasma etching. The reactive ion etching (RIE) of high-aspect contact hole (HARC) or inter-layer dielectric (ILD) has been traditionally performed by fluorocarbon chemistry under the presence of high-energy ion bombardment in a two-frequency capacitively coupled plasma (2f-CCP) reactor. It is experimentally known as RIE-lag effect that the etching rate at the bottom decreases with increasing the aspect ratio of the pattern. The dependence of etch rate on the aspect ratio will be a crucial issue to be addressed in a top-down plasma nano-processing. In the present study, a feature profile evolution of SiO₂ trench pattern is predicted under competition among etching and polymer deposition by the level-set method. When the etch depth is small, the incident ions are reflected at the sidewall and focused in the center of the trench, resulting in a slight enhancement of the etch rate at the bottom. On the other hand, the geometrical shadowing effect which reduces both ions and radicals striking the bottom surface will be dominant at high aspect ratio. Dependence of RIE-lag on a biasing voltage will also be discussed.

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