3D Feature profile simulation of oxygen effects in plasma oxide etching process

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The high-aspect-ratio (HAR) oxide etching process is one of the challenging processes in the semiconductor industry till date. Due to the inherent complexities of this process, there is no robust simulation tools which has been developed yet for the advancement of the next-generation process and the process engineers rely on their experience-based knowledge. To address this issue, we have developed a 3D feature profile simulator for the HAR etching process under fluorocarbon plasmas. In this study, we proposed a realistic surface reaction model considering the oxygen effect and integrated it with 3D feature profile simulation. The contribution of oxygen radicals in this model is incorporated effectively into the oxide etch reaction for the mixed layer beneath the steady-state passivation layer. Furthermore, the 3D feature profile simulation was verified with the experimental data. Finally, this work will discuss how the realistic simulation tool of the HAR etching process can be applied to the semiconductor industry.