GPU based 3D feature profile simulation for ultra-high deep etch process in inductively coupled fluorocarbon plasmas

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Recently, one of the critical issues in the etching processes of the nanoscale devices is to achieve ultra-high deep contact hole without anomalous behaviors such as sidewall bowing, and twisting profile. However, most of the process development still depends on the empirical routs due to the inherent complexities of plasma processes. As a part of an effort to address this issue, we have developed 3D topology simulator using the multiple level set based moving algorithm, ballistic transport module and surface reaction module. Especially, we demonstrate that the ballistic transport calculation requiring the time consumable computations are improved drastically by GPU based numerical computation, leading to the real time computation. Furthermore, a fluorocarbon plasma-surface kinetic modeling was performed using robust surface reaction researching tools, CANTERA, for plasma etching process under inductively coupled fluorocarbon plasmas. Finally, we illuminate critical aspects of ultra-high aspect contact etching through real-time and realistic 3D feature profile simulation for ultra-high aspect contact hole etching under fluorocarbon plasma.