Large scale feature profile simulation for plasma etch process of high aspect ratio contact hole

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Plasma etching processes of the nanoscale devices still remain great challenge for predictable modeling and simulation to understand anomalous behaviors such as sidewall bowing, and twisting profile. As an effort to address this issue, we have developed a 3D feature profile simulator using level set algorithm with new memory saving technique, which is suitable in the single contact hole etching. However, large scale feature profile simulations are required to predict effects of various mask patterns, and surface charging, leading to huge computational memory and time. In this work, we developed several computational strategies including a compressed algorithm of huge memory and fast searching algorithm by applying run−length encoding algorithm. Furthermore, a parallelized algorithm using GPU will be discussed for large scale computation. Finally, 3D etch profile simulation for 30 contact holes with ultra−high aspect ratios is demonstrated with consideration of realistic plasma surface chemistry.