Feature Scale Simulations of Deposition Processes PAUL MOROZ,
Tokyo Electron U.S. Holdings, Inc., DANIEL J. MOROZ, University of Pennsylvania — Deposition processes, together with etching, planarization, and implantation, represent the basis of materials processing. Requirements for the accuracy of processing are becoming ever more stringent and thus the role of numerical simulations grows. The feature scale simulator FPS3D [1,2] allows detailed simulation of simultaneous deposition, etching, and implantation processes. In this report, we emphasize FPD3D's capability to simulate deposition. We simulate and analyze the deposition of copper seed layer films into high-aspect-ratio features, examining the profile conformity and feature-filling quality of the deposited copper layers and their dependence on the energy and angular distributions of incoming fluxes of species. A number of cases were analyzed, including the following: isotropic flow of Cu, directional flow of Cu, isotropic flow of Cu together with ions, and directional flow of Cu together with ions. It was found that directional flow of Cu together with ions has significant advantages over other options, allowing efficient Cu seed layer deposition even for small high-aspect-ratio features. We also discuss detailed structure of deposited layers such as agglomeration into islands with specific orientation and film roughness.

[1] P. Moroz, IEEE Trans. on Plasma Science, 39 (11) 2804 (2011)
[2] P. Moroz, D. J. Moroz, ECS Transactions, 50 (46) 61 (2013).

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