GEC12-2012-000081

Abstract for an Invited Paper
for the GEC12 Meeting of
the American Physical Society

Physics and chemistry of complex oxide etching and redeposition control

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Since its introduction in the 1970s, plasma etching has become the universal method for fine-line pattern transfer onto thin films and is anticipated to remain so in foreseeable future. Despite many success stories, plasma etching processes fail to meet the needs for several of the newest materials involved in advanced devices for photonic, electronic and RF applications like ferroelectrics, electro-optic materials, high-k dielectrics, giant magnetoresistance materials and unconventional conductors. In this context, the work achieved over the last decade on the etching of multicomponent oxides thin films such as barium strontium titanate (BST), strontium titanate (STO) and niobate of calcium and barium (CBN) will be reviewed. These materials present a low reactivity with usual etching gases such as fluorinated and chlorinated gases, their etching is mainly governed by ion sputtering and reactive gases sometimes interact with surface materials to form compounds that inhibit etching. The etching of platinum will also be presented as an example of unconventional conductor materials for which severe redeposition limits the achievable etching quality. Finally, it will be shown how simulation can help to understand the etching mechanisms and to define avenues for higher quality patterning.

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