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Ion-beam-assisted nano-texturing of halite-structure thin films
VLADIMIR MATIAS, Los Alamos National Laboratory — We study biaxial crystalline texturing at early film growth in a variety of compounds during ion-beam-assisted deposition (IBAD). We have found that many different halite-structure compounds share the ion-beam texturing ability at nucleation and early film growth. This includes numerous oxides and nitrides. Fluorite-structure compounds also exhibit the possibility of fast IBAD texturing. For these materials IBAD texturing can be achieved within the first few nanometers of deposited material. We examine the detailed texture evolution for MgO. To perform these experiments we developed a unique experimental methodology based on linear combinatorial research. Three different texture development regions can be identified in MgO texture evolution. The first stage where biaxial texture first appears is during grain nucleation. There is evidence of a phase transition in this region. With additional IBAD texture continues to improve by grain alignment up to a certain point. Further improvement in crystalline alignment can be achieved by a third stage of epitaxial overgrowth. We find that the IBAD texture development is very sensitive to the nucleation surface conditions, both chemical species and surface morphology. An in-plane texture of less than 2° and an out-of-plane texture of less than 1° are attainable in an artificially textured MgO layer on an amorphous substrate This work is supported by the DOE Office of Electricity Delivery & Energy Reliability.

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