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Nucleation of MB_2 thin films on Si by low temperature CVD: island statistics and growth kinetics A. YANGUAS-GIL, N. KUMAR, J.R. ABELSON, Materials Science and Engineering Dep., U. of Illinois at Urbana-Champaign — HfB_2 thin films are deposited onto H-terminated Si by CVD using the single source precursor $Hf(BH_4)_4$, which affords extremely conformal and smooth film growth. HfB_2 films are technologically interesting as hard coatings and as impurity diffusion barriers. We analyze the nucleation process by in-situ spectroscopic ellipsometry (SE) and ex-situ AFM. The objective is to derive mechanistic information on the growth kinetics from a statistical analysis of the early stages of growth. The experimental results reveal that HfB_2 nucleates on Si(001) forming 3D islands and that there is an agreement between the SE data and the AFM measurements. Quantitative information on island statistics is extracted from AFM data taken after various growth times. The island height distribution functions are consistent with the presence of a physisorbed state of the precursor molecule. This situation is similar to that of the capture zone 2D island growth models in the literature and is in agreement with previous results on the steady state growth of HfB_2. The island spatial distribution and the correlation between island height and capture zone area indicate that nucleation is random and keeps on taking place until coalescence is reached. We show that the nucleation rate can be enhanced by surface activation, leading to a reduction in the grain size and lateral correlation length of the films.

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