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Flux threshold of He-ion-beam induced nano-fuzz growth on hot tungsten below and above the displacement damage threshold energy[1]
HUSSEIN HIJAZI, MARK E. BANNISTER, CHAD M. PARISH, HARRY M. MEYER III, FRED W. MEYER, Oak Ridge National Laboratory — Measurements of nano-fuzz growth on linear plasma devices have shown that below the displacement damage energy threshold, a minimum He-ion flux is required for nano-fuzz formation. We report comparative measurements of nano-fuzz flux thresholds below and above the displacement damage energy threshold using well characterized He ion beams at the ORNL MIRF. He-ion-beam flux distributions were optimized and measured at 218 and 2000 eV prior to ion beam impact on W coupons heated to about 1000 deg. C. After exposure times ranging from 4200 to 7200 seconds, the beam spots were examined by SEM over a 0.5 mm x 0.5 mm grid, which was spatially correlated to the measured flux distributions. In this manner, we were able to obtain, in a single ion beam exposure, the flux dependence of the observed surface morphology changes at each of the two energies. At 218 eV, for fluxes below $1.5 \times 10^{16}/cm^2s$, ordered surface structures are observed, with great grain-to-grain variability, together with blisters and pinholes, while above this flux value, individual grain characteristics disappear, and nano-fuzz growth is observed. At 2 keV, very similar surface morphologies are observed, but the flux threshold for nano-fuzz formation has almost doubled, to $2.5 - 3 \times 10^{16}/cm^2s$. Possible reasons for this increase will be discussed.

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