

Structural changes in thin films of yttria-stabilized zirconia irradiated with uranium ions in the electronic stopping regime

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Poly-crystalline, partially monoclinic, yttria partially stabilized zirconia (Y-PSZ) was deposited on a 25 nm thick Au-covered (1 0 0) Si substrate by means of UV pulsed laser ablation. The 400 nm thick films were irradiated with single ionized swift heavy uranium (^{238}U) ions of about 1300 MeV, applying ion fluences from 5 to 20 x 10¹¹ cm⁻². The samples were characterized before and after irradiation using X-ray diffraction (XRD), micro-Raman spectroscopy, and transmission electron microscopy (TEM). With increasing ion fluence there is a progressive change from monoclinic to tetragonal/cubic polymorphs. TEM of selected samples indicates formation of Au islands on the Si substrate and the development of a defective microstructure under irradiation. The nature, distribution and aggregation of ion-beam induced defects are mainly associated with oxygen migration to the film surface and are probably responsible for the structure changes under irradiation.