

Structural modifications induced by swift heavy ions in thin films of yttria fully stabilized zirconia

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Among ceramic materials for nuclear waste containment, single crystal yttria fully stabilized zirconia (FSZ) gained particular consideration because of its excellent radiation resistance both in the elastic and inelastic collision regime. We deposited amorphous and polycrystalline, cubic FSZ thin films on (1 0 0) Si by ultraviolet pulsed laser ablation and irradiated them with swift heavy uranium ions of 2.6-GeV energy at fluences between 2 and 12×10^{11} ions cm^{-2} . The films were characterized before and after irradiation using X-ray reflectivity, grazing incidence X-ray diffraction, micro-Raman spectroscopy and transmission electron microscopy. Under ion irradiation, as-deposited crystalline films undergo amorphisation, followed by partial recrystallisation, whereas as-deposited amorphous films retain their disordered character. The dominant defects produced in the films are oxygen vacancies which may explain the amorphisation to recrystallisation path of our crystalline films.