Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Irradiation Response of Nanocrystalline Cubic Zirconia WILLIAM WEBER, YANWEN ZHANG, WEILIN JIANG, PHILIP EDMONDSON, Pacific Northwest National Laboratory, FEREYDOON NAMAVAR, University of Nebraska Medical Center — Cubic zirconia is a potential inert matrix phase for burning actinides in some advanced fuel cycles. We have investigated the irradiation response of nanocrystalline cubic zirconia. The nanocrystalline zirconia films were prepared by ion-beam-assisted deposition that produced nanostructurally-stabilized pure cubic zirconia with an average grain size of 7.7 nm. The films were irradiated with 2 MeV Auions at 160 K and 400 K to doses up to 35 displacements per atom. The average grain size determined by grazing incident X-ray diffraction increases with dose and saturates at high doses. Under irradiation at 160 K, the increase in grain size saturates at about 30 nm; while under irradiation at 400 K, slower grain growth is observed. The decrease in saturation value with increasing temperature indicates thermal grain growth does not contribute to the observed grain growth. While the cubic phase is retained, some reduction of O in the irradiated films is indicated from the Rutherford backscattering spectroscopy measurements. The ratio of O to Zr decreases from close to 2.0 for the as-deposited films to about 1.65 at the highest doses. Transmission electron microscopy observations and selected area electron diffraction have also confirmed the grain growth and phase stability.

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Date submitted: 20 Nov 2009 Electronic form version 1.4