

## Effects of irradiation-induced structural disordering in zirconate pyrochlores at high pressures

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**Abstract:** The effects of swift heavy ion irradiation-induced disordering on zirconate compounds ( $A_2Zr_2O_7$  where A = Sm, Er, and Nd) at high pressures are investigated using synchrotron X-ray diffraction (XRD). Irradiation experiments were performed at the GSI Helmholtz Center with  $^{197}\text{Au}$  ions accelerated to energy of 2.2 GeV. Angle dispersive synchrotron powder X-ray diffraction measurements were completed at the Advanced Photon Source at Argonne National Laboratory, where samples were pressurized up to  $\sim 60$  GPa using-diamond anvil cells. Analysis of the XRD data demonstrate that: (1)  $\text{Sm}_2\text{Zr}_2\text{O}_7$  and  $\text{Nd}_2\text{Zr}_2\text{O}_7$  undergo a phase transformation from ordered pyrochlore to a disordered defect-fluorite with swift heavy ion irradiation; 2) energetics of disordering lower the pressure transition point in pyrochlores  $\text{Sm}_2\text{Zr}_2\text{O}_7$  and  $\text{Nd}_2\text{Zr}_2\text{O}_7$  and; 3) swift heavy ion irradiation increases the pressure transition point in a defect-fluorite  $\text{Er}_2\text{Zr}_2\text{O}_7$  by introducing more interstitials. The effects of disordering in different zirconate compositions under high pressure are explained in terms of the variation in phase space with A-site cation substitution.