

## **Structural modifications of $Gd_2Zr_{2-x}Ti_xO_7$ pyrochlore induced by swift heavy ions: Disordering and amorphization**

Lang M, Zhang, FX, Ewing RC, Lian J, Trautmann C, Wang ZW  
*Journal of Materials Research Vol. 24 No. 4 (2009) 1322-1334*

The isometric, pyrochlore structure type,  $A_2B_2O_7$ , exhibits a wide variety of properties that find application in a large number of different technologies, from electrolytes in solid oxide fuel cells to actinide-bearing compositions that can be used as nuclear waste forms or inert matrix nuclear fuels. Swift xenon ions (1.43 GeV) have been used to systematically modify different compositions in the  $Gd_2Zr_{2-x}Ti_xO_7$  binary at the nanoscale by radiation-induced phase transitions that include the crystalline-to-amorphous and order-disorder structural transformations. Synchrotron x-ray diffraction, Raman spectroscopy, and transmission electron microscopy provide a complete and consistent description of structural changes induced by the swift heavy ions and demonstrate that the response of pyrochlore depends strongly on chemical composition. The high and dense electronic energy deposition primarily results in amorphization of Ti-rich pyrochlore; whereas the formation of the fully disordered, defect-fluorite structure is the dominant process for Zr-rich pyrochlore.