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Zirconia-Based Materials for Transmutation of Americium and Curium: Cubic Stabilized Zirconia and Pyrochlores. *

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Abstract

Fundamental aspects of several different zirconia-based systems were explored with the perspective of employing these matrices for the transmutation of americium and/or curium in reactors or advanced neutron sources. We have incorporated and studied americium and curium in face centered cubic, zirconia-based materials, with and without yttria stabilization, as well as in zirconia-based pyrochlores. From this work, it appears that yttria cubic-stabilized zirconia (Y-CSZ) materials, which are well known refractory ceramics, would be suitable either as diluents or inert matrices for transmutation schemes involving americium and/or curium. Several experiments have demonstrated that cubic-stabilized zirconia materials are very resistant to neutron irradiation and to damages related with fission processes. One particularly attractive material is a 25 mol % yttria stabilized matrix, which exhibits a stable, single phase (fluorite-type), which can incorporate significant amounts of americium or/and curium oxides. In a study with americium, it was determined that the cubic lattice parameters of such products were linear with the americium composition. Zirconia-based pyrochlores, which are also refractory ceramic materials, offer another potential matrix for the transmutation of americium and curium. The presentation will compared structural properties of these fluorite-type and pyrochlore-type zirconia systems, and also discuss the fundamental physicochemical aspects of these materials with regard to their application in transmutation schemes.

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