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Radiation stability study of melt processed and hot isostatically pressed multi-phase ceramic waste forms

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Multi-phase ceramic waste forms were fabricated by melt-processing and hot isostatic pressing (HIP) to immobilize alkaline/alkaline earth (Cs/Sr-CS) + lanthanide (LN) + transition metal (TM) fission product waste streams from nuclear fuel reprocessing. Al2O3 and TiO2 were combined with these waste components to produce multi-phase crystalline ceramics containing hollandite-type phases, perovskites, zirconolite/pyrochlores and other minor phases. In this study, ion irradiations are performed to test and compare radiation tolerance of multi-phase ceramics produced via melting processing and HIP techniques.
For the radiation stability test, selected crystalline ceramic samples are exposed to charge particles generated by an ion accelerator, which is used to simulate self-radiation in a waste form. Ion irradiation-induced microstructural modifications, volume swelling and microcracking are examined using X-ray diffraction, transmission electron microscopy, scanning electron microscopy and other characterization methods. Our preliminary results reveal similar radiation tolerance in these multi-phase ceramics with different fabrication techniques.

Summary

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