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Synthesis and microstructural characteristics of simulated iodine-bearing waste formed by HIP sintering of the silver impregnated alumina sorbent

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Silver impregnated materials are widely used as an absorbent of radioactive iodine in the nuclear industry. A commercial fuel reprocessing facility of Japan will be working in shortly. The waste management for the spent alumina sorbent (AgA) to be disposed in deep underground is a challenge because iodine-129 has the extreme long-life and a mobile nature in aquifer systems. For the safety disposal, a candidate immobilization technique has been proposed, the first advantage of which is the simple hot isostatic press (HIP) process confining silver iodide (AgI) into the corundum matrix without the separation of iodine from the spent AgA to alleviate the process complications. The previous research has suggested that the densification of the waste form matrix is valid to improve the waste form performance under a repository. Here, we have examined the HIP sintering behavior of alumina matrix by adding several commercially available alumina reagents and virgin AgA in order to optimize the waste composition. After consolidation by HIPing at 175 MPa up to 1325℃ the 3-dimensional microstructure of the simulant waste form has been analyzed using the images processing technique from the data pile of scanning electron microscopy (SEM). The fine particles of AgI are confirmed to be distributed homogeneously and are separated independently by the alumina (corundum) matrix. The matrix porosity and the connected pores are negligible. The tolerance will be assessed using the standard static leaching test under an expected repository condition.

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