



Contribution ID : 43

Type : **Oral Presentation**

Sodalite waste forms for iodine

Wednesday, 1 November 2017 15:45 (15)

Iodine-129, released in the off-gas stream during nuclear fuel reprocessing, is problematic due to its long half-life, high mobility in the earth's environment, incorporation into the human thyroid, and difficulty in immobilizing it using traditional vitrification methods. Iodosodalite ($\text{Na}_8\text{Al}_6\text{Si}_6\text{O}_{24}\text{I}_2$) has been considered as to immobilize iodine-129 due to feasibility of synthesis at low temperature ($<200^\circ\text{C}$) and compatibility with glass matrices for encapsulation of sodalite crystallites. Our study focused on synthesis and characterization of glass-bonded sodalite waste forms, in which we sought to study the effects of process variables on the resulting crystallization and iodine retained. X-ray diffraction, X-ray photoelectron spectroscopy, Fourier transform infrared spectroscopy, electron microscopy, neutron activation analysis, and thermal analysis were performed to characterize the physical and chemical properties of the specimens. Chemical durability tests were also performed on synthesized pellets.

Summary

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Session Classification : Ceramic and Glass-Ceramic Wasteforms

Track Classification : National and international collaborative waste management programs