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Chemical Durability of Borosilicate Glass-Ceramic High-Level Waste Form in Dilute and Static Conditions

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A borosilicate glass-ceramic waste form is being developed to significantly increase waste loading of high-level waste relative to single phase glass. The glass-ceramic waste form is comprised of approximately 70% borosilicate glass, 20% oxyapatite ($X_2\text{Ln}_8\text{Si}_6\text{O}_{26}$), and 10% powellite (XMoO_4), by mass, where X = alkaline earth and Ln = lanthanides. Understanding the overall corrosion behavior of the glass-ceramic is complicated because each phase corrodes at a different rate and there are matrix effects. Durability of the multiphase waste form was investigated with single-pass flow-through and static leach testing, but the results were convoluted because elements were present in multiple phases. In an effort to deconvolute the corrosion process of the full waste form, additional corrosion testing was performed on the full waste form and individually-synthesized phases (remainder glass, oxyapatite, and powellite). Results of these tests are presented and comparisons between the glass-ceramic waste form and individual phases are discussed.

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