Vitrification of Waste Containing High Content of Molybdenum and Sodium

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Abstract

Sodium carbonate is currently being considered as a wash-out reagent for the removal of the settled solids in the unagitated Highly Active Liquor (HAL) storage tanks at Sellafield. As the settled solids are expected to comprise mainly zirconium molybdate (ZM), this will result in a feed to the Waste Vitrification Plant (WVP) containing high concentrations of both molybdenum and sodium. This feed is expected to be challenging for WVP due to solubility limitations in existing base glass compositions and the operating temperature.
In particular, depending on the wash-out strategy employed, there is the potential to produce high volumes of sodium-containing waste, which will result in large quantities of vitrified HLW containers. Hence, new glass compositions are being investigated as part of a 3-year Innovate UK-funded collaborative project in order to maximise the sodium content of the vitrified product and minimise the number of containers produced. This paper describes the fabrication and characterisation of a number of sodium titanosilicate (NTS) compositions that can potentially contain up to _˜15 wt% waste Na2O, more than double what is possible using the current UK HLW glass borosilicate composition.
Early results indicated that aluminium-containing NTS compositions met all the product quality requirements, including durability, but were prone to phase separation. Conversely, boron-containing NTS compositions were significantly more stable but generally had very poor durability. Thus, hybrid compositions were investigated in an attempt to optimise the boron and aluminium contents in order to meet both the waste loading and product quality requirements of the final waste form.

Keywords: nuclear, waste, vitrification, sodium, molybdenum

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