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A study to develop a new glass formulation for the immobilisation of HLW containing molybdenum and large amounts of sodium.

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A study to develop a new high level waste (HLW) glass formulation for waste from the highly active liquor storage (HAL) tanks at Sellafield is described. A likely washout scenario for the tanks at the end of operations involves the use of sodium carbonate as a tank washout reagent [1] leading to a high soda wastestream. Titanium is not currently used in existing HLW formulations in European nuclear waste glasses, however, literature suggests that titanosilicate glasses can accommodate large amounts of sodium [2-4], even up to 50 mol% [5]. Following a combinatorial type approach exploring the effects of variation of alumina (Al_2O_3), boron oxide (B_2O_3), calcium and mixed alkali content in sodium titanosilicate formulations with and without waste simulant (including molybdenum and zirconium oxides) and durability assessment, two promising formulations are currently being trialled and full product waste simulant containing glass being prepared via base glass frit plus waste simulant combination. Further durability trials and structural characterisation are also being investigated and results will be reported.

1 M. J. Edmondson et al., "A Methodology for Post Operational Clean Out of a Highly Active Facility Including Solids Behaviour", 12386, 2012 (Submitted for the WM2012 Conference, Phoenix, Arizona, USA).

2 Hamilton, E. H. and G. W. Cleek (1958). "Properties of sodium titanium silicate glasses" J. Res. Nat. Bur. Standards. 61 (2) 89-94.

3 Turnbull, R. C. and W. G. Lawrence (1952). "The role of titania in silica glasses" J. Amer. Ceram. Soc. 35 (2) 48-53.

4 Strimple, J. H. and E. A. Giess (1958). "Glass formation and properties of glasses in the system $\text{Na}_2\text{O}-\text{B}_2\text{O}_3-\text{SiO}_2-\text{TiO}_2$ " J. Amer. Ceram. Soc. 41 (7) 231-237.

5 Washburn, E. W. and E. N. Bunting (1934). "Note on phase equilibria in the system $\text{Na}_2\text{O}-\text{TiO}_2$." J. Res. Nat. Bur. Standards 12 (2) 239-239.

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Summary

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