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Alkali tin silicate glass as a wasteform for the immobilisation of plutonium

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UK stocks of separated civil plutonium are projected to exceed 140 tons at the end of reprocessing. This material may require immobilisation in a proliferation resistant wasteform, should it prove uneconomic to recycle in MOX fuel. We have investigated and optimised alkali tin silicate glass compositions for the immobilisation of this stockpile using CeO_2 as a PuO_2 surrogate. A remarkable two-fold increase in Ce solubility was achieved by in-situ reduction of CeO_2 to Ce_2O_3 , as demonstrated by Ce L3 XANES, through addition of zero valent iron, which also assisted in reducing the processing temperature. Preliminary investigation showed this approach to be compatible with Hot Isostatic Pressing, enabling batchwise processing of alkali tin silicate glasses, which is advantageous from fissile material accountancy and criticality considerations. This work demonstrates the feasibility of an alternative and simple approach to conditioning the plutonium stockpile, through hot isostatic pressing of a full glass wasteform, potentially compatible with the full envelope of plutonium feedstock.

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