Impact of gamma radiation on CeO_2 doped cementitious grouts used for nuclear waste disposal in the UK

S. A KEARNEY[1], C.L. CORKHILL[1], J.L. PROVIS[1]*

[1]NucleUS Immobilisation Science Laboratory, Department of Materials Science and Engineering, University of Sheffield, Sir Robert Hadfield Building, Sheffield, S1 3JD, UK (*correspondance: j.provis@sheffield.ac.uk)

UK policy for the management of hazardous intermediate level waste (ILW) involves encapsulation in cementitious grouts prior to interim storage and final disposal in a geological disposal facility. The grouts are typically blends of Portland cement (PC) with high volumes of blast furnace slag (BFS), which are subjected to high levels of ionising radiation exposure throughout service, but the effects of this on the grouts are not well understood. Experimental investigation of gamma and alpha exposure has been undertaken in order to assess the extent of damage through atomic displacement, and/or radiolysis of water within the system. These processes may induce alterations in physical properties via chemical and microstructural variations. Samples of BFS:PC have been subjected to bulk gamma irradiation up to 20 MGy and then characterised to determine changes in the phase assemblage and microstructure. CeO_2 was incorporated into BFS:PC samples of similar composition as a simulant for PuO_2, and the response of the microstructure and phase assemblage to gamma irradiation was investigated. As the grouts provide both physical and chemical barriers to radionuclide migration, leachate testing was completed to provide information on how gamma exposure impacts immobilisation capacity of the doped systems. This paper outlines the main findings from this experimental programme, and assesses the impact of radiation damage on the prediction of cementitious wasteform performance.