

## **ASSESSING THE LONG-TERM STRUCTURAL CHANGES OF METAKAOLIN GEOPOLYMERS ENCAPSULATING STRONTIUM LOADED ION-EXCHANGER**

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Zeolite-type inorganic ion-exchangers are extensively used in the nuclear industry to remove fission product radionuclides from contaminated process water and in groundwater cleanup. A significant amount of ion-exchangers loaded with concentrated radioactive isotopes of Sr are generated every year, and this is a particularly pressing issue in the Fukushima Daiichi site, where minimising the environmental release of these radioisotopes is currently the focus of much work. Encapsulation of these granular radionuclide-loaded ion-exchangers, which are often stored as slurries, into a stable solid waste form (as required for disposal) with a low leaching rate of toxic ions is challenging but critical for the safety of long-term geological disposal. Metakaolin geopolymers are attracting interest in the immobilisation of nuclear wastes. However, only limited information is available from the literature regarding the stability of key ion-exchangers in geopolymer binders, and the potential modifications occurring in the binder materials as a function of interactions with the ion exchangers. In this study, an ion exchanger representing those used in the Fukushima Daiichi wastewater treatment process, loaded with inactive isotopes of Sr, was encapsulated using metakaolin-based geopolymers. Different alkali cations were used as activators and the effects of different reaction temperatures were also assessed. The phase evolution, dimensional stability, and changes in microstructure of the geopolymer binders containing Sr-loaded ion-exchanger were characterised up to 1 year, to provide important information for evaluating the partitioning of Sr between the pore solution, ion-exchangers, and the binder.