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## **Geopolymers for Radioactive Waste Immobilisation made from New Zealand Fly Ash**

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**SUMMARY.** Geopolymers are made by adding aluminosilicates to concentrated alkali solutions for dissolution and subsequent polymerisation to form a solid to take place. They are amorphous to semi-crystalline three dimensional aluminosilicate networks. Their physical handling is similar to that of Portland cement, hence they have been considered for low and intermediate level (ILW) immobilisation (among other applications) by various workers.

For ILW immobilisation, we investigated a geopolymer made from fly ash dissolved in sodium hydroxide and sodium silicate solutions. We added Cs and Sr to simulate the corresponding radionuclides that are amongst the worst difficult to immobilise. The effects of modest heating ( approx. 500°C) on the incorporation of the Cs and Sr were also examined. X-ray diffraction (XRD) showed the geopolymers to be mainly amorphous but with a small amount of crystalline phases such as calcite and quartz. The mullite which was in the original fly ash was also present but to a smaller extent. The crystalline phases were confirmed by transmission electron microscopy. Energy dispersive x-ray spectroscopic analysis of selected regions of the amorphous and crystalline phases is discussed with reference to the fly ash and the distribution of Cs and Sr in the microstructure. The leaching behaviour was considerably superior to that of Portland cement.