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ANSTO's Plutonium Wasteform Research

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Actinide-bearing waste streams which typically include fissile material, for example Pu-239, offer unique immobilization challenges. Key aspects to waste form design include maximizing the waste loading, producing a chemically durable product, maintaining flexibility to accommodate waste variations, a proliferation resistance to prevent theft and diversion, and appropriate process technology to produce waste forms that meet requirements for actinide waste streams.
Synroc waste forms incorporate the actinides within mineral phases, producing products which are much more durable in water than baseline borosilicate glasses. Other advantages are that the mineral phases can incorporate neutron absorbers allowing criticality control both during processing and whilst within the repository as well as high waste loadings and increased proliferation resistance. With a waste loading of 40-50 wt.%, Synroc would also be considered a strong candidate as an engineered waste form for used nuclear fuel and highly enriched uranium-rich wastes. The HIP technology offers several advantages such as increased density, minimum grain size and removes the need for costly and bulky off-gas systems. This paper will highlight the latest developments of Synroc as an advanced waste form and technology platform for actinide bearing wastes including recent radiation damage results of high zirconolite glass-ceramic wasteforms for plutonium immobilization.

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