

## Low-Risk Nuclear Waste Forms for Plutonium & Actinides

### Executive Summary

**CLASS:** Nuclear waste immobilization technologies.

**STATUS:** Demonstrated; mature technology.

**MARKETS:** Actinide-bearing waste streams, plutonium legacy wastes, partitioned actinide streams with and without impurities.

**INTELLECTUAL PROPERTY:** Know-how, R&D, patents, process technology.

**COMMERCIALIZATION:** Strategic alliances with end users and engineering contractors.

### Technology Background

ANSTO, has over 25 years experience in designing low-risk, reduced-cost, tailored ceramic and glass-ceramic waste forms for the immobilization of radioactive waste.

The US DOE in 1997 competitively selected a titanate ceramic waste form, developed by ANSTO, Lawrence Livermore National Laboratory and Savannah River Site, as the means of immobilizing excess weapons plutonium - the Plutonium Immobilization Project (PIP). This waste form and its processing were subsequently developed at full scale and qualified for disposal by ANSTO, LLNL, PNNL, ANL and SRS.

synrocANSTO has developed a range of tailored waste forms directed towards actinide wastes difficult to incorporate in glass.



### synrocANSTO Advantages

synrocANSTO's broad and internationally recognised technical team can develop a solution for actinide-waste problems. The advantages of tailored waste forms for actinide wastes are:

- High actinide waste loadings - resulting in a reduced number of disposal canisters, substantial repository disposal cost savings and decreased processing time;
- Easy to process using mature technology proven in the nuclear industry, including sintering or hot-isostatic pressing;
- Criticality safe – titanate ceramic readily incorporates neutron absorbers such as Hf, Gd and Sm for criticality control;
- The ceramic and glass-ceramic waste forms are flexible, can be tailored to suit the requirements of the waste and will readily accommodate process impurities;
- The titanate phases that incorporate the plutonium are extremely chemically durable, much more so than borosilicate glass;
- Proliferation resistant;
- Significant reduction in neutron dose rate to workers compared to borosilicate glass.

### Market Applications

**DEMONSTRATED:** Ceramic waste forms - DOE competitively selected titanate ceramic for the disposition of excess weapons plutonium;

**DEMONSTRATED:** Glass-ceramic waste forms - developed for legacy wastes containing actinides;

**DEMONSTRATED:** Waste form processing from laboratory to large-scale;

**DEVELOPING:** directly disposable matrices for use as targets for burning Pu in nuclear reactors;

**DEVELOPING:** "disposable spent fuel" concept.

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Contact: [bruce.begg@synrocانsto.com](mailto:bruce.begg@synrocانsto.com)

ANSTO, Inc. • 1220 L Street N.W. Suite 100-170 • Washington, DC 20005

Tel: +1 (202) 390 2044 • Web: [www.synrocانsto.com](http://www.synrocانsto.com)