Synroc tailored Wasteforms for accident tolerant nuclear fuels

PhD scholarship

Since the Fukushima Daiichi accident in 2011, there has been much research on the development of accident tolerant fuels (ATF), capable of withstand severe accident conditions without melting. Uranium nitride (UN), uranium silicide (U_3Si_2) and uranium diboride (UB_2) are promising candidate ATF materials, which combined good corrosion resistance in high temperature steam and air with high uranium density.

Most research on ATF have focused on the front-end of the nuclear fuel cycle, i.e. the synthesis, fabrication and in-reactor performance of the fuel, with relatively little effort on the back-end of the fuel cycle; that is the processing, management and disposal of the fuel after it has been used in the reactor. While there are established and well-proven solutions for disposing conventional (uranium oxide) used nuclear fuels, these may not be suitable for the non-oxide ATF. One of the most promising wasteform solutions for ATF is the Australian-invented Synroc. Synroc leverages the inherent stability of certain minerals (which have survived millions of years of radiation and corrosion below the earth's surface) to immobilize nuclear waste in a durable, compact and highly-tailorable form.

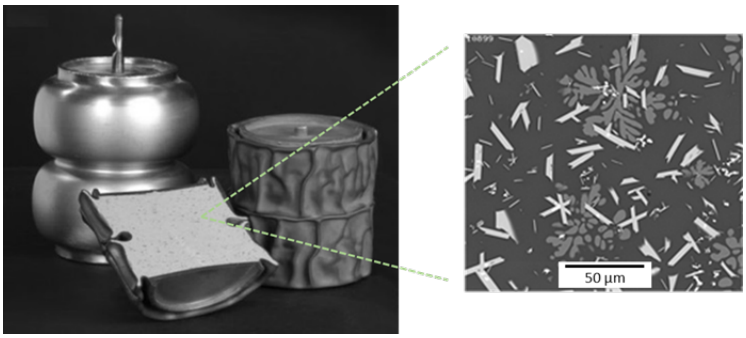

Figure 1 – Example of Synroc before and after sintering (left) and resulting microstructure (right)

The aim of this project is to develop a series of bespoke Synroc nuclear wasteforms, tailored specifically for the chemistry of selected ATF materials, including (doped and undoped) UN, U_3Si_2 and UB_2. The project will be carried out in collaboration between the University of New South Wales (UNSW Sydney), and the Australian Nuclear Science and Technology Organisation (ANSTO).

The candidate will be supervised by Dr. Patrick Burr and Dr. Edward Obbard at USNW and Dr. Dan Gregg at ANSTO. The student will be part of the wider nuclear research group (AtomCraft) at UNSW Sydney, which is a tight-knit, inclusive, and enthusiastic group of diverse background. We value diversity and encourage applications from all backgrounds to apply. A background in materials science or solid state chemistry is beneficial, as is experience in the synthesis, characterisation and testing of samples.

The project is supported by a generous scholarship of $38,600/year stipend plus $10,000 of travel support, provided by a philanthropic donor. Candidates with an exceptional track record may be eligible for additional scholarship top-ups. Send email applications and queries to p.burr@unsw.edu.au. When applying, please include your CV and transcript of most recent or current degree.