

## Dr Thomas Bell

### Overview

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### Research

The current commercial procedure (PUREX process) for recovering uranium (U) and plutonium (Pu), from spent nuclear fuel consists of dissolving the fuel rods in nitric acid and extraction of U(VI) and Pu(IV) using a solution of tri-*n*-butyl phosphate (TBP) in an organic solvent, kerosene. A special class of alternative solvents called hydrophobic ammonium based ionic liquids (HAILS) have the potential to act as much better solvents than kerosene as they show high stability in a radioactive environment, can help reduce the risk of a chain reaction occurring, and are non-volatile and non-flammable. The aim of my research was to investigate the key factors of importance in optimising the separation of U and other relevant metals (such as rhodium (Rh)) using HAILS.

Several novel HAILS were prepared, and their use in the extraction of U(VI) from nitric acid studied with the result that very high levels of extractability were obtained in a number of cases. The mechanism for this extraction was extensively studied in order to fully understand the underlying chemistry. Following on from the recovery of U(VI), Rh (III) was also successfully extracted from nitric acid using HAILS. This result was the first known successful extraction of Rh(III) from nitric acid and has great potential in increasing the worldwide supply of this rare metal.

Publications: (i) K. Takao, T. J. Bell, Y. Ikeda, *Inorg. Chem. Forum.*, paper accepted, 2012. (ii) T. J. Bell, Y. Ikeda, *Dalton Trans.*, 2012, 41, 4303. (iii) T. J. Bell, Y. Ikeda, *Dalton Trans.*, 2011, 40, 10125. Presentations: (i) GLOBAL 2011, Makuhari, Japan, 2011. (ii) COIL-4, Washington D.C., U.S.A., 2011. (iii) JSPS Science Dialogue Programme, Yamanashi, Japan, 2011.

### Life in Japan and recommendations for future fellows

I was very fortunate in that I had a very good research environment with excellent and very helpful work colleagues. Outside of research, I was able to have many unforgettable experiences, such as climbing Mount Fuji, watching Sumo wrestling and baseball and visiting cities as diverse as Kyoto, Hiroshima, Hida-Takayama, and Matsumoto amongst others. On a more sombre note, I was also present in Tokyo, when the Great Eastern Japan Earthquake struck but thanks to the JSPS earthquake training I had received a few months previously, I was not as unprepared as I might have been. I stayed in Japan throughout the period following this and the togetherness of the Japanese people really impressed me. The Fukushima nuclear power plant incident was very close to my line of research and hence, did not worry me unduly at the time. I wish all my colleagues who are still working on resolving this incident, all the best.

I would definitely recommend that all new fellows have some Japanese language lessons before they start their fellowship and once in Japan, continue with these as I did. It really helped me to immerse myself in the culture and gain a better understanding of the Japanese people. I would also recommend that fellows experience as much of Japan as possible and above all, have fun!



**My Laboratory**



**View from Mount Fuji**