

## A comparative study of the sorption of U(VI) on SiO<sub>2</sub> and TiO<sub>2</sub> in the presence of phosphate

M. J. COMARMOND<sup>1\*</sup>, H. FOERSTENDORF<sup>2</sup>, K. HEIM<sup>2</sup>,  
K. MÜLLER<sup>2</sup>, J. J. HARRISON<sup>1</sup> AND T. E. PAYNE<sup>1</sup>

<sup>1</sup>Australian Nuclear Science and Technology Organisation, Locked Bag 2001, Kirrawee DC, NSW 2232, Australia  
(\*correspondence: mjc@ansto.gov.au)

<sup>2</sup>Helmholtz-Zentrum Dresden-Rossendorf e.V., Institute of Resource Ecology, P.O. Box 510119, 01314 Dresden, Germany

The ternary systems containing aqueous U(VI), aqueous phosphate and the model minerals SiO<sub>2</sub> and TiO<sub>2</sub>, respectively, were investigated using a batch sorption technique and *in situ* attenuated total reflection Fourier-transform infrared (ATR FT-IR) spectroscopy. Batch sorption studies indicate an increase in U(VI) uptake in the presence of phosphate, consistent with previously reported studies. In-situ IR spectroscopic sorption experiments conducted at pH 5.5 for equimolar concentrations of uranyl and phosphate of 20 µM in 0.1 M NaCl provide a detailed insight into the surface speciation for these ternary systems, with differences observed in the sorption characteristics at the two model oxide surfaces.

The spectroscopic results for SiO<sub>2</sub> strongly suggest the formation of a solid U(VI) phosphate phase as a surface precipitate on the silica phase, evidenced by characteristic bands observed in spectra of prolonged sorption and of subsequent sorption of U(VI) and phosphate. In the case of TiO<sub>2</sub>, both the sequential sorption of U(VI) and phosphate, and vice versa, were examined to ascertain the formation of a ternary surface complex. The sorption of phosphate on the TiO<sub>2</sub> surface is presumably dominated by the formation of inner sphere complexes [1] [2] as was found earlier for the sorption of U(VI) represented by a band at around 910 cm<sup>-1</sup> [3]. After subsequent sorption of U(VI) or phosphate, similar IR spectra were obtained to those following sorption onto pristine TiO<sub>2</sub>. This finding indicates the absence of significant interactions between U and P at the surface, i.e. no formation of a surface precipitate. It can be concluded that TiO<sub>2</sub> provides different binding sites for these ions under these experimental conditions.

[1] Connor & McQuillan (1999) *Langmuir* **15**, 2916-2921.

[2] Kang *et al.* (2011) *J. Colloid Interface Sci.* **364**, 455-461. [3] Müller *et al.* (2012) *Geochim. Cosmochim. Acta*, **76**, 191-205.