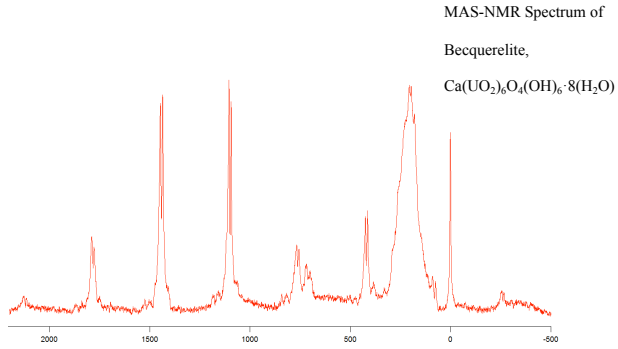
Development of Solid State MAS-NMR techniques for the characterization of uranium minerals produced during dissolution of spent nuclear fuel.

BENG THYE TAN[1], SAPTARSHI BISWAS[2], ROBERT J. BAKER[2] AND IAN FARNAN[1]

[1]Department of Earth Sciences, University of Cambridge, Downing Street Cambridge CB2 3EQ United Kingdom
[2]School of Chemistry, University of Dublin, Trinity College, College Green, Dublin 2, Ireland

The migration of radionuclides from underground nuclear waste repositories will involve formation of uranium secondary minerals when groundwater reacts with the spent nuclear fuel. Potential secondary phases of uranium minerals have been fabricated to develop an understanding of the local structural controls on ^{17}O NMR parameters. These can be used to identify such environments in amorphous phases, which can precede the development of well-defined crystalline mineral phases during spent fuel dissolution.



Solid state ^{17}O MAS- NMR spectra of uranium minerals obtained in a 9.39T magnetic field spinning at 18 kHz have been analyzed to determine primary and secondary neighbors to the oxygen atoms present in the mineral. Very detailed differences in the uranyl bonding can be determined. Mineral compositions of interest are those containing calcium (Ca^{2+}), carbonate (CO_3^{2-}), and silicate (SiO_4^{4-}) which are often present in ground water.

[1] R. J. Baker, *Coord. Chem. Rev.*, 2014, 123-136.
[2] Amme, M., Wiss et al, 2005. *J. Nuc. Mat.* **341** 209-233.