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

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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 17O 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 17O 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 (Ca²⁺), carbonate (CO₃²⁻), and silicate (SiO₄⁴⁻) which are often present in ground water.