

## **Alteration of dehydrated schoepite and soddyite to studtite, $[(\text{UO}_2)(\text{O}_2)(\text{H}_2\text{O})_2](\text{H}_2\text{O})_2$**

**TORI Z. FORBES, PATRICK HORAN, TARA DEVINE, DANIEL MCINNIS, AND PETER C. BURNS\***

Department of Civil Engineering and Geological Sciences, University of Notre Dame, 156 Fitzpatrick Hall, Notre Dame, Indiana 46556, U.S.A.

### **ABSTRACT**

The oxidation of used nuclear fuel in a geologic repository has important implications for the mobility of radionuclides and fission products in the environment. Hexavalent uranium (uranyl) minerals, including oxyhydroxides and silicates, form as alteration phases on the surface of fuel pellets in laboratory simulations. However, alpha-radiolysis of water forms hydrogen peroxide in solution, which may favor the alteration of these secondary phases to the uranyl peroxide mineral studtite. This study investigates the alteration of dehydrated schoepite,  $\text{UO}_3(\text{H}_2\text{O})$ , and soddyite,  $[(\text{UO}_2)_2(\text{SiO}_4)](\text{H}_2\text{O})_2$ , in the presence of aqueous solutions containing hydrogen peroxide. Crystalline samples were reacted with various concentrations of hydrogen peroxide and the resulting material was analyzed by powder X-ray diffraction. Both dehydrated schoepite and soddyite readily convert to studtite in the presence of hydrogen peroxide following the reaction stoichiometry. These results indicate that the possible impact of peroxide buildup on the stability of alteration phases in a repository setting should not be overlooked.

**Keywords:** Soddyite, studtite, schoepite, nuclear waste, geologic repository