

## **Speciation of uranium and thorium in surface-modified, hydrothermally treated, (UO<sub>2</sub>)<sup>2+</sup>-exchanged smectite clays**

Daniel M. Giaquinta, Lynda C. Soderholm, Steven E. Yuchs, and Stephen R. Wasserman

*Chemistry Division, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, IL 60439, U.S.A.*

X-ray absorption spectroscopy (XAS) is used to determine the uranium and thorium speciation in exchanged and surface-modified clays. The XAS data from uranyl- and thorium-loaded bentonite clay are compared with those obtained after the particle surfaces have been coated with alkylsilanes. These silane films, which render the surface of the clay hydrophobic, are added in order to minimize the ability of external water to exchange with the water in the clay interlayer, thereby decreasing the release rate of the exchanged-uranium species. Mild hydrothermal conditions are used in an effort to mimic potential geologic conditions that may occur during long-term radioactive waste storage. The XAS spectra indicate that the uranyl monomer species remain unchanged in most samples, except in those samples that were both coated with an alkylsilane and hydrothermally treated. When the clay was coated with an organic film of octadecyltrimethoxysilane, hydrothermal treatment results in the formation of aggregated uranium species in which the uranium is reduced from UVI to UIV. XAS spectra of thorium-loaded clays indicate the formation of the ThO<sub>2</sub>-like hydrous polymer that has been reported previously.

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