

Spectroscopic identification of Np(V) sorption complexes at the mineral oxide-water interface

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Neptunium (Np) is one of the most important components of nuclear waste to consider for the long-term safety assessment of nuclear waste repositories, due to the increasing enrichment through decay of Am-241, the long half-life and the high toxicity of Np-237. Hence, great attention is attracted to its geochemistry [1]. The molecular processes occurring at the solid-water interfaces present in the biogeosphere, strongly affect its migration [2]. Components of geological materials, such as metal oxides and hydroxides with a widespread environmental presence, high sorption capacity and tendency to form coatings on mineral surfaces, play an important role in regulating the Np mobility [3].

For a better understanding of the molecular events occurring at the mineral surfaces, x-ray absorption and vibrational spectroscopies are useful tools for the in-situ identification of actinyl surface species. In addition, time-resolved measurements provide kinetic information on the surface reactions [4].

In this work, Np(V) sorption on the oxyhydroxides of Fe, Mn, and Al is investigated by a combination of in-situ ATR FT-IR and EXAFS spectroscopies under a variety of environmentally relevant sorption conditions. By comparing Np(V) surface complexation reactions on hematite, magnetite, birnessite, and corundum a very similar sorption behavior, namely the formation of one single inner-sphere complex can be elucidated. The spectroscopic results improve the geochemical transport modeling of Np(V) macroscopic data [4].

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