Glenn T. Seaborg Center Special Seminar

Characterization of actinide reactivity and speciation at solid: mineral interfaces

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Bldg. 70A, Room 3377

Understanding the subsurface migration of actinides is vital for the development of robust and reliable performance assessment models of actinide bearing waste disposal facilities. Interactions between actinides and soil/rock surfaces is a primary mechanism controlling the mobility of actinides in the subsurface environment. In this work, fundamental studies of actinide interactions with pure minerals and natural soils are presented in terms of the primary interfacial reactions including: sorption, redox reactions, and surface mediated precipitation. The primary focus of this review is the characterization of surface mediated redox reactions between the mineral and actinides and development of quantitative thermochemically based models describing the speciation of the actinides in aqueous and solid phases. The models are used to determine the enthalpy and entropy contributions to the overall free energy of actinide sorption to minerals. General comparisons of these studies indicate that the strength of actinide sorption are proportional to hydration energy and effective charge of the given actinide ion. Observed reactions include formation of monomeric surface complexes, surface mediated redox reactions, aging or hysteretic sorption, and surface induced precipitation. The variability in these observed surface reactions of actinides requires a more detailed level of characterization of the surface speciation in order to accurately quantify actinide mobility in the environment. Examples of each type of reaction will be presented and discussed.

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