American Mineralogist, Volume 99, pages 696–703, 2014

Effect of clays and metal containers in retaining Sm^{3+} and ZrO^{2+} and the process of reversibility

Said El Mrabet[1], Miguel A. Castro[1], Santiago Hurtado[2], M. Mar Orta[1], M. Carolina Pazos[3], María Villa-Alfageme[4] and María D. Alba[1,*]

[1]Instituto Ciencia de Materiales de Sevilla, CSIC-Universidad de Sevilla, Avda. Américo Vespucio, 49. 41092 Sevilla, Spain
[2]Servicio de Radioisótopo del CITIUS, Universidad de Sevilla, Avda. Reina Mercedes, 4. 41012 Sevilla, Spain
[3]Escuela de Ciencias Químicas, Universidad Pedagógica y, Tecnológica de Colombia UPTC, Avda. Central del Norte, Vía Paipa, Tunja, Boyacá, Colombia
[4]Department Física Aplicada II, Universidad de Sevilla, Avda. Reina Mercedes, s/n. 41012 Sevilla, Spain

Abstract

Knowledge and understanding about radionuclides retention processes on the materials composing the engineered barrier (clay mineral and metallic container waste) are required to ensure the safety and the long-term performance of radioactive waste disposal. Therefore, the present study focuses on the competitiveness of clay and the metallic container in the process of adsorption/desorption of the radionuclides simulators of Am^{3+} and UO_2^{2+}. For this purpose, a comparative study of the interaction of samarium (chosen as chemical analog for trivalent americium) and zirconyl (as simulator of uranyl and tetravalent actinides) with both FEBEX bentonite and metallic container, under subcritical conditions, was carried out. The results revealed that the AISI-316L steel container, chemical composition detailed in Table 1, immobilized the high-radioactive waste (HRW), even during the corrosion process. The ZrO^{2+} was irreversibly adsorbed on the minireactor surface. In the case of samarium SEM/EDX analysis revealed the formation of an insoluble phase of samarium silicate on the container surface. There was no evidence of samarium diffusion through the metallic container. Samarium remained adsorbed by the container also after desorption experiment with water. Therefore, steel canister is actively involved in the HRW immobilization.

Keyword: Geological disposal, metallic canister, clay minerals, radionuclide waste, actinide, sorption/desorption