Sorption properties of ^{60}Co, ^{152}Eu, ^{160}Tb and ^{241}Am in geological materials

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Introduction

Lee et al. [1] reported that the sorption trend of ^{152}Eu and ^{241}Am in geological materials was very simliar. In this paper, we performed a batch experiment in order to 1) confirm the usefulness of rare earth element as analogue of actinde and 2) compare the sorption property among REE, actinide and low to medium radioactive nuclide such as ^{60}Co.

Samples and Experimental Method

We performed the batch experiment using ^{60}Co, ^{152}Eu, ^{160}Tb and ^{241}Am as radiotracers in granitoids, meta-basalt, and tuff. All the radiotracers in the works were gamma emitted radionuclides, and their half lives were more than 2 months for the long term experiment. The sorptin ratio (A/A_0) of radionuclides on rock powders in neutral groundwater solution for contact period are presented in Figure 1.

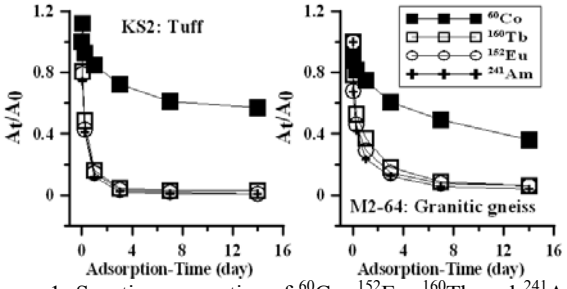

Figure 1. Sorption properties of ^{60}Co, ^{152}Eu, ^{160}Tb and ^{241}Am in geological rocks.

Results and Discussions

In Figure 1, we can observe that the sorption trend of ^{152}Eu, ^{160}Tb and ^{241}Am with time is very simliar whereas that of ^{60}Co is different from those of ^{152}Eu, ^{160}Tb and ^{241}Am. This confirms that rare earth element is a good analogue of actinides in geological envrionments. Particularly, we could confirm that the sorption behavior of actinide is different from that of low to medium radioactive nuclide in geological materials.

Reference

[1] Lee, S.G., Lee, K.Y., Cho, S.Y., Kim Y. & Woo, N.C. (2004) Geochim.Cosmochim.Acta. 68, A510.

Synthesis and thermochemistry of nitrate cancrinite and nitrate sodalite

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Nitrate cancrinite and nitrate sodalite are important constituents of high-level nuclear wastes at several US Department of Energy (DOE) storage sites. The precipitation and phase transition behaviors of tank waste simulants were closely followed by oven synthesis and in situ solution calorimetry. It was shown that precipitation followed a pathway of amorphous - zeolite A - sodalite - cancinite in certain concentration range. A simple method for the synthesis of high purity nitrate cancrinite was developed. The thermochemical properties of nitrate cancrinite were investigated using a combination of TG, FTIR and high temperature oxide solution calorimetry. The enthalpies of formation of nitrate cancrinite from oxides and elements were determined as -903.27 ± 15.72 kJ/mol and -14258.31 ± 17.34 kJ/mol, respectively.