

The degree and kinetics of chlorite dissolution at various conditions

EUNGYEONG KIM^{1*}, HO YOUNG JO¹ AND JI-HOON RYU²

¹Korea University, Earth and Environmental Sciences, Seoul, Republic of Korea, * egkim113@korea.ac.kr

²Korea Atomic Energy Research Institute, Daejeon, Republic of Korea

High-level radioactive wastes should be isolated permanently in the deep geological repository. Shallow groundwater can flow along fractures into the deep geological repository, causing oxic conditions. In the oxic conditions, uranium can be oxidized from U(IV) to U(VI) ions. The U(VI) ions can easily migrate in groundwater because of their high mobility. Chlorite, which is a phyllosilicate mineral, generally occurs in fractures of crystalline rocks. Chlorite may affect redox conditions of deep geological conditions by its oxidation. Before chlorite is oxidized, dissolution of chlorite can occur.

This study investigated the degree and kinetics of chlorite dissolution at various conditions. Batch dissolution tests with CCa-2 samples were conducted for 60 days at various conditions (e.g., pH and oxidizing agent and NaCl concentrations). The leachate and reacted solid samples were collected from the batch tests every 10 days. The ion concentrations of the leachate samples were analyzed using ICP-AES. The mineralogical and morphological characteristics of the reacted solid samples were analyzed using SEM and XRD analyses.

The degree of chlorite dissolution was relatively higher at low pH (pH = 3). Almost no effect of the concentration of oxidizing agent on the chlorite dissolution was observed. The chlorite dissolution occurred within 10 days for all test conditions used in this study. Mg and Si ions were predominantly dissolved from the chlorite samples. Almost no Al ions were observed probably due to precipitation of Al ions. Results of SEM analysis showed that surface and edge of the chlorite samples tended to be crispy and smooth with the reaction time. The XRD results showed that the unreacted chlorite sample consisted of mainly clinoclone, whereas the reacted chlorite samples for 60 days consisted of mainly leuchtenbergite.