Contribution ID: **174** Type: **Verbal**

Study on sorption and diffusion of Sr in crushed and intact basalt and granite investigated in column method

Monday, 12 May 2014 14:45 (15 minutes)

This study investigates sorption and diffusion of Strontium (Sr) in two potential host rocks (granite from Kinmen Island and basalt from Penghu Island) by using batch and through-diffusion methods in order to establish a reliable safety assessment methodology. These methods were applied to crushed and intact rock samples to investigate the actual geological environment. According to solid-phase analysis, including X-ray diffraction, elemental analysis, auto radiography, and polar microscopy, the sorption component primarily contained iron–magnesium (Fe–Mg) minerals in basalt and granite. Moreover, the distribution coefficient (Kd) of Sr in various concentrations (~10−2–10−7 M) obtained from batch tests indicated a higher sorption capacity in basalt than that in granite because of the 10% Fe–Mg mineral content. The diffusion of Sr both in granite and basalt reach steady state after 100 days and apparent diffusion coefficient (Da) were 3.29×10-11 m2/s (for Sr in crushed granite), 4.17×10-12 m2/s (for Sr in crushed basalt), respectively. However, diffusive result (Da) of Sr in intact rocks was estimated a lower value than those obtained using crushed rocks. According to the diffusive results in crushed and intact rocks, it showed that major retardation of Sr depended on the microporous structure of tested media, such as decreases of constrictivity (δ) and increases of tortuosity(τ). In fact, the solid/liquid (S/L) ratio decreased as is the case when switching from batch to column experiments and the sorption effect on minerals became even more negligible in retardation of radionuclide migration.

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Session Classification: Chemistry of Nuclear Fuel Cycle 1

Track Classification: Chemistry of Nuclear Fuel Cycle / 1st ASGARD International Workshop