

Iron corrosion related bentonite alteration

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According to the current state of knowledge, the only reliable option to safely dispose highly radioactive waste over extended periods of time (up to 1 Ma) is in deep geological repositories. Multibarrier disposal systems, consisting of a technical barrier, a geotechnical barrier and the host rock, are constantly being revised and improved to optimize safety. In repositories in clay rock bentonite is usually suggested as a geotechnical barrier material. After closure of the repository, the bentonite will be saturated by groundwater coming in from the host rock, and in presence of water, the corrosion of the steel containers will start. During corrosion, canister and bentonite will experience elevated temperatures due to radioactive decay in the waste. Aerobic conditions will turn rapidly into anaerobic conditions, initiating the release of dissolved mobile Fe(II) species. This may lead to iron induced alteration processes, accompanied by the formation of secondary mineral phases. Especially the alteration of 2:1 phyllosilicates into 1:1 iron-bearing phyllosilicates might have an impact on the bentonite properties and affect the migration behavior of radionuclides. Numerous studies investigated this clay mineral alteration due to selected single mineral syntheses.^[1-3] This paper highlights bentonite (GMZ and MX-80) alteration using Fe(II)Cl₂ and Fe-powder as iron sources at 90°C under anaerobic conditions. Infrared Spectroscopy (IR), X-ray Diffraction (XRD) are shown in Figure 1. They will be discussed in conjunction with Electron Microscopy data (FIB-SEM). Both Bentonites showed a loss of crystallinity, partial dissolution and structural decomposition of the octahedral sheets (Fig.1). In general, the MX-80 Bentonite is more affected by alteration.

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References

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