Geophysical Research Abstracts
Vol. 21, EGU2019-19175, 2019
EGU General Assembly 2019

Comparative erosion of raw and purified smectites in artificial fractures: accessory minerals vs equilibrium chemistry

Ursula Alonso (1), Tiziana Missana (1), Miguel García-Gutiérrez (1), Ana M. Fernández (1), Jesús Morejón (1), Manuel Mingarro (1), Magnus Kronberg (2), and Patrik Sellin (2)

(1) CIEMAT, Madrid, Spain, (2) Swedish Nuclear Fuel and Waste Management Company (SKB), Stockolm (Sweden)

Erosion and colloid formation are amongst the processes that may compromise the safety of a bentonite barrier in a high-level radioactive waste repository: mass depleting will weaken the barrier confining properties and colloids will enhance radionuclide transport.
Different experimental and theoretical studies were conducted to assess the main physico-chemical characteristics that favor or inhibit erosion. Amongst many other aspects, it has been brought up whether the presence of accessory minerals in bentonites may play a role in the overall erosion.
Previous studies showed that the presence of certain minerals restricted the dispersability and stability of bentonite particles. Other studies hypothesized that accessory minerals may form an external ring in the expanded clay, hindering further smectite expansion in fractures.
In this study, the erosion/radial expansion behavior of a raw bentonite with high smectite content (Wyoming MX-80) was compared to that of purified smectite samples to which the accessory minerals and / or the soluble salts were removed.
An experimental set-up consisting on a compacted clay pellet placed in an artificial smooth fracture, filled with low ionic strength water, was selected. The expansion of the clay in the fracture was monitored. At the end of the experiment, the equilibrium water and the expanded clay ring in the fracture were sampled, as a function of the radial distance from the pellet surface, for geochemical and mineralogical analyses.
The expansion of raw MX-80 in the fracture was shorter than that of the purified clay fractions, but salt-free clay experienced similar expansion as that of the clay in which both the accessory minerals and the soluble salts were removed. This indicated that accessory minerals are not primarily responsible for slowing down clay expansion in the fracture. Moreover, post-mortem analyses discarded the presence of an outer ring enriched with accessory minerals. The similar mineralogical composition measured on the expanded clay from raw and purified materials suggested that the smectite particles themselves form a coherent filter in the border of the expanded ring, which is able to stop further particle diffusion in the fracture. The water chemistry established at the equilibrium plays a major role restricting clay expansion.
The research leading to these results was funded by the Swedish Nuclear Fuel and Waste Management Company (SKB) under POSKBAR Project.