

BENTONITE COLLOID STABILITY UNDER GEOCHEMICAL CONDITIONS RELEVANT FOR A DEEP GEOLOGICAL REPOSITORY IN FRACTURED ROCKS

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The erosion of the bentonite backfill material in a repository for high level nuclear waste placed in a fractured rock will be strongly depended on the ground water/pore water geochemical conditions. If the ionic strength of the ground water decreases under the critical coagulation concentration (CCC), colloids can be detached from the bentonite backfill material and transported in a fracture. Therefore, in this study colloid stability measurements are conducted for Febex bentonite and the Clay Mineral Society source clay SWy-2 bentonite by varying ionic strength, pH and type of electrolyte (Na, Ca, Mg) to determine colloid stability fields. The dynamic light scattering technique is used to investigate the time-dependent colloid aggregation behavior.

The Febex bentonite colloid stability increases with increasing pH as expected due to the deprotonation of the montmorillonite edge silanol/aluminol groups. Edge-face interactions delimit the colloid stability at low pH. For comparison, the colloid stability of the reference clay SWy-2 was measured for divalent cations (Ca, Mg). The Febex bentonite being of hydrothermal origin having impurities of amorphous silica shows a considerable higher stability in the pH range 7-9 compared to SWy-2. This colloid stability increase in the pH range 8-10 could be simulated for Swy-2 by addition of amorphous SiO₂ possibly explaining the observed discrepancies between Febex and SWy-2 bentonite.

The influence of low concentrations of dissolved organic carbon (DOC), usually present in fractured rock systems in the range of 1-10 mg/L, is simulated by adding fulvic acid (Gorleben aquifer derived GoHy-573 FA). It could be shown that this low concentration of DOC significantly increases the colloid stability especially in the low pH range.

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