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To cite this version:
Nicolas Marty, Sylvain Grangeon. Dissolution kinetics of AFm-Cl as a function of pH at room temperature.. 14ème Collogue du Groupe Français des Argiles, May 2016, Poitier, France. 2016. <hal-01293219>

HAL Id: hal-01293219
https://hal-brgm.archives-ouvertes.fr/hal-01293219
Submitted on 24 Mar 2016

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Dissolution kinetics of AFm-Cl as a function of pH at room temperature.

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Estimation of reliable weathering/dissolution rates of cement phases is of fundamental importance for modelling the temporal evolution of radioactive waste repositories and well for CO₂ geological storage. In this context dissolution kinetics of AFm (hydrated calcium aluminates) have been studied with flow-through experiments at pH ranging from 9.2 to 13. Dissolution kinetics of a pure AFm-Cl, i.e. a mix between the Friedel's salt and its naturally-occurring form, hydrocalumite, have been investigated. Mineralogical (XRD) and chemical (EPMA, TEM/EDX) analyses have been performed to characterize the reacting minerals prior and after dissolution experiments.

For pH values ranging from 10 to 13, flow-through experiments indicate congruent dissolutions of AFm-Cl (i.e. Ca/Al ratios close to 2 both for solids and outlet concentrations). In contrast a precipitation of Al-phases and mixed Al/Ca phases are expected at pH 9.2 leading to high Ca/Al ratios of outlet solutions. However, estimated rate in such condition appears to be weakly affected by these secondary-phase formations. Accordingly, far-from-equilibrium dissolution rates were normalized to the final specific surface areas (ranging from 6.1 to 35.4 m² g⁻¹). None significant effect of pH on dissolution kinetics can be draw and therefore the far-from-equilibrium dissolution kinetics at pH ranging from 9.2 to 13 and room temperature is expressed as:

\[
\log R (mol m^{-2} s^{-1}) = -9.23 \pm 0.18
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