

Modeling the chemistry/transfer coupling of radionuclides in cement-based materials in presence of high nitrate concentrations.

Highly concentrated nitrate solutions can affect the behavior of radionuclides in terms of speciation/sorption/transfer and the physico-chemical behavior of the cementitious materials. The cement-based materials have low permeability and they can fix the radionuclides limiting their migration through the clayrock environment. The objectives of this Ph.D thesis is the assessment of the impact of the high concentrations of nitrate on the properties of the radionuclide transfer.

This project proposes to provide a relevant response to this issue by developing a multi-physics model regarding the chemistry/transfer coupling affected by saline solutions. The effects of highly concentrated saline solutions needs to be characterized regarding (1) the microstructural properties of the cementitious materials (solid phase distribution, transfer properties) and (2) the diffusive behavior of radionuclides (diffusion, sorption, double layer, speciation/solubility, chemical activity...). The project is then composed by two steps: **experimental investigation** and **multi-scale modeling** dedicated to the reactive transfer in cement-based materials.

Supervisors: The Ph.D project will be supervised by Karim Aït-Mokhtar (Professor) and Olivier Millet (Professor) at the Laboratory of Environmental Engineering Sciences (LaSIE) located at La Rochelle (south-west coast of France), and by Pierre Henocq (Research engineer at Andra).

Collaboration: This work will be carried out in the framework of the Research Group (GDR CNRS MeGe) in geo-environmental mechanics, including multiphysics coupling, discrete and micromechanical modeling, multiscale approaches: <http://gdr-mege.univ-lr.fr/>

Qualifications: Master degree (or equivalent qualification) in mechanics, computational mechanics, applied mathematics. physics, chemistry.

Start date of the position: September/October 2014.

Financial support: ANDRA allocation – 2000€ per month.

Application procedure: suitable, highly-motivated candidates should send electronic applications to olivier.millet@univ-lr.fr Applications should include a cover letter describing interests and qualifications for the position and a complete curriculum vitae.

Application deadline: 15 April 2014.