Coupled Chemo-Hydro-Mechanical analysis of Bituminized Waste swelling due to water up-taking

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Abstract

This paper presents results and discussions about mechanisms and their couplings during bituminized waste water up-taking. Bituminized Waste Products(BWP) are produced by an industrial reprocessing of radioactive waste (low or medium activity and long life). Geological storage is the reference solution for this kind of wastes. Under geological disposal conditions, and after a period of hundred thousand years, BWP will undergo water re-saturation from the host rock. A one dimensional chemo-hydro-mechanical numerical model has been implemented with a finite volume scheme. Using this model, the role of each mechanism and coupling has been evaluated by simulating water up-taking tests under constant volume. Indeed, the impact of dissolution permeation, diffusion and osmosis has been investigated. Moreover, the dependency of material parameters with porosity variations has been studied. This numerical simulation has shown that osmosis is the principal mechanism of water up-taking. Nevertheless, other mechanisms might not be negligible.

Key words: Bituminized waste Products (BWP) / Chemo-Hydro-Mechanical analysis / Swelling / Diffusion / Osmosis