

XAFS studies for Evaluation for engineered barrier system for radioactive wastes

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Radioactive wastes from nuclear fuel reprocessing should be isolated from the biosphere for an extremely long time because they contain long-lived nuclides. These wastes are supposed to be disposed of in rock 500 to 1000m below ground. Cementitious materials and bentonite are used as engineered barriers in such repositories. After they are closed, groundwater may come in contact with the cementitious materials and become hyper alkaline. This groundwater is likely to affect the properties of the bentonite and surrounding rock, and also change their barrier characteristics such as permeability and adsorption of nuclides.

In order to construct a safe engineered barrier system, basic studies have been progressed in the material scientific field also. In mineralogical and geochemical analyses of cement-bentonite interaction, identification of Ca speciation and its quantification in both parts are very important because Ca has possibility to exist as CSH, interlayer cation of smectite, CaCO₃, Ca(OH)₂ and so on. If the identified phase is CSH, its Ca/Si ratio is also very important information. The speciation and quantification are definitely necessary for the geochemical modeling of cement-bentonite interaction.

Because of low crystallinity of those Ca-compounds in Cementitious materials and bentonite, XAFS technique were used for the speciation and quantification of them. Calcium K-edge XAFS spectra of standard Ca-materials such CSH, some Ca chemical compounds, and the test blocks for investigation the alteration of bentonite and rock from Bure site in France were measured at BL12C, Photon Factory, KEK, Japan, with a fluorescence XAFS measurement system where sets ionization chamber for I₀ and Lytle type fluorescence detector for I_f.