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μ-XRF and μ-XANES study of Np sorption on Opalinus Clay

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Until now the problem of high-level nuclear waste storage has not been solved. Argillaceous rocks such as Opalinus Clay (OPA) are considered by several European countries as a potential host rock formation for nuclear waste repositories. With respect to the long term storage of spent nuclear fuel, 237Np will be one of the main contributors to the radiotoxicity of this waste material. To predict the migration behaviour of neptunium in the case of a release from the storage place, the interactions with the surrounding clay formation have to be investigated in detail. The radionuclide retardation will be defined by different mechanisms such as sorption and diffusion. Natural heterogeneous OPA from Mont Terri, Switzerland, was used in our study at the SLS MicroXAS beamline to investigate the speciation of Np(V) on OPA thin sections as well as in an intact OPA bore core from a diffusion experiment. Spatial distributions of Np, Fe and Ca were determined by μ XRF mapping. The examination of intensive Np spots by Np LIII-edge XANES spectroscopy showed that Np(V) is partly reduced to Np(IV), probably by Fe(II) minerals. This reduction process significantly reduces the mobility of Np in OPA.

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