

Atomic scale in situ observation of cation exchange on montmorillonite surface

ARAKI, Yuki^{1*} ; SATOH, Hisao² ; ONISHI, Hiroshi¹

¹Graduate School of Science, Kobe Univ., ²Mitsubishi Materials Corporation

The clay minerals are expected to apply for the assessment of radioactive waste due to their ion exchange property. While the stoichiometry of the ion exchange has been understood well, the dynamics of the ions at the clay-solution interface, such as the effect of topography of the clay surface on selectivity of the ion exchange and the surface diffusion of the ions, has not been clarified.

We performed in situ observation of the ion exchange on the montmorillonite with atomic resolution in the 0.1 ~ 1 M cesium chloride solutions by the frequency modulation atomic force microscopy (FM-AFM). The montmorillonite is 100 nm plate-like crystal whose interlayer cations are sodium and calcium ions. The replacement of the ions on the montmorillonite surface was identified by the change of the configuration of the lattice of the montmorillonite surface in the cesium chloride solutions. We introduce the result of the FM-AFM observations of the atomic-scale change of the montmorillonite surface depending on the concentration of the cesium ions.

Keywords: clay, montmorillonite, ion exchange, frequency modulation AFM