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Cs sorption-desorption mechanisms on clay minerals by XAFS, STXM, DFT calculation methods

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Three years have passed since Fukushima Dai-ichi Nuclear Power Plant (FDNP) Accident; a serious contamination problem still remains. Therefore, Japanese and local governments promotes the decontamination projects in which contaminated surface soil is removed and then, is moved it to interim storage area. Since soil waste is extremely large and space of an interim storage is limited, a suitable waste reduction method would be required, also in anticipation of final disposal of the waste after about 30 years. On these backgrounds, we have performed elucidation of the sorption-desorption behaviors of Cs on clay minerals by XAFS: EXAFS/XANES, DXAFS, STXM, TEM/SEM-EDS, and theoretical calculation methods, aiming at soil waste volume reduction in Fukushima. In this presentation, we plan to touch uranium behaviors in this area.

In this area, species of clay minerals on which Cs adsorbed were unexpectedly few according to the radio autography and SEM and TEM-EDS analyses; mainly were a several micaceous minerals and its weathered minerals. Therefore, illite and vermiculite were used to elucidate sorption behavior on clay minerals in Fukushima. The Fourier-transformed EXAFS oscillation for the clay mineral samples prepared under laboratory scales concentration indicated that cesium existed in the interlayer for vermiculite and mainly on the surface for illite. The DXAFS experiment supported this result of the Cs sorption behavior in vermiculite in addition to detection of the detailed sorption dynamics. Furthermore, the chemical bond of Cs with the clay minerals revealed two types of futures by EXAFS, i.e., Cs showed heavy elements feature like actinides in chemical bond. It might be related with selectivity on sorption on clay minerals in environment and it's stability in clay minerals.

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