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ORAL PRESENTATION - Development of Decontamination Method Using Ionic Liquid as a Medium for Treating Waste Contaminated with Uranium

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Most of the metal or bed material wastes generated from uranium enrichment facilities or uranium refining and conversion plants are contaminated by uranium fluoride compounds. It is desirable to recover as much uranium as possible from these wastes. Additionally, if these wastes are decontaminated up to a level regarded as nonradioactive waste, the decontaminated materials should be reused.

In this study, we have evaluated the feasibility of application of 1-butyl-3-methyl-imidazolium chloride (BMICl) and cholin chloride-urea (CCU) ionic liquids to the treatments of metal waste contaminated with uranium. Dissolution experiments were carried out by adding UF4 powder samples into BMICl and CCU under atmospheric conditions. UF4 samples were completely dissolved in BMICl after around 6h at 100 °C, and 38% of samples were also dissolved in CCU after 5 h at 100 °C. Steel waste contaminated with UF4 was also decontaminated using BMICl at 100 °C under atmospheric conditions. The uranium concentrations of metal waste were found to decrease below the clearance level (1Bq/g) within 3h.

Cyclic voltammograms of the sample solutions prepared by dissolving steel waste into BMICl were measured. The reversible and irreversible peaks were observed around 0 and -1.2 V, respectively. These peaks were assigned as one electron reduction process of Fe3 + and one electron reduction process of UO22+, respectively. These results suggest that electrolytic deposition of uranium should be performed without mixing of iron deposit. Bulk electrolysis of sample solutions prepared by dissolving steel waste into BMICl was also carried out at -1.5V at 80 °C. The deposits were formed on a carbon electrode as cathode. In analyses of deposits using XPS, only uranium component was detected.

Consequently, we confirmed that BMICl and CCU are effective media for the decontamination of uranium waste and that uranium can be recovered selectively from BMICl solution containing iron by the electrolytic method.

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