

Effect of Cl₂ on Electrodeposition Behavior in Electrowinning Process

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Abstract

Pyroprocessing at KAERI (Korea Atomic Energy Research Institute) consists of pretreatment, electroreduction, electrorefining and electrowinning. SFR (Sodium Fast Reactor) fuel is prepared from the electrowinning process which is composed of LCC (Liquid Cadmium Process) and Cd distillation et al. LCC is an electrochemical process to obtain actinides from spent fuel. In order to recover actinides inert anodes such as carbon material are used, where chlorine gas (Cl₂) evolves on the surface of the carbon material. And, stainless steel (SUS) crucible should be installed in large-scale electrowinning system. Therefore, the effect of chlorine on the SUS material needs to be studied.

LiCl-KCl-UCl₃-NdCl₃-CeCl₃-LaCl₃-YCl₃ salt was contained in 2 kinds of electrolytic crucible having an inner diameter of 5cm, made of an insulated alumina and an SUS, respectively. And, three kinds of electrodes such as cathode, anode, reference were used for the electrochemical experiments. Both solid tungsten (W) and LCC were used as cathodes. Cd of 45 g as the cathode material was contained in alumina crucibles for the deposition experiments, where the crucible has an inner diameter of 3 cm. Glassy carbon rod with the diameter of 0.3 cm was employed as an anode, where shroud was not used for the anode. A pyrex tube containing LiCl-KCl-1mol% AgCl and silver (Ag) wire having a diameter of 0.1cm was used as a reference electrode. Electrodeposition experiments were conducted at 500°C

at the current densities of 50 ~ 100 mA/cm². In conclusion, Fe ions were produced in the salt during the electrodeposition by the reaction of chlorine evolved from the anode and Fe of the SUS crucible and thereby LCC system using SUS crucible showed very low current efficiencies compared with the system using the insulated alumina crucible. Anode shroud needs to be installed around the glassy carbon not to influence surrounding SUS material.