Measurement of Evaporation Rates for Lanthanum and Neodymium Chlorides

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Abstract

Electrorefining is a key step in pyroprocessing. The electrorefining process is generally composed of two recovery steps – the deposit of uranium onto a solid cathode and the recovery of the remaining uranium and TRU elements simultaneously by a liquid cadmium cathode. Uranium deposit recovered from the solid cathode is a dendritic powder. It is necessary to separate the adhered salt from the deposits prior to the consolidation of uranium deposit. The adhered salt is composed of lithium, potassium, uranium, and rare earth chlorides. Distillation process was employed for the cathode processing. One of the operation methods is distillation of the salt at low temperature (900°C), and then melting of the deposit at high temperature to avoid a backward reaction.

For the development of the salt distiller, the distillation behavior of the low vapor pressure chlorides should be studied. Rare earth chlorides in the adhered salt of uranium deposits have relatively low vapor pressures compared to the process salt (LiCl-KCl). In this study, the evaporation rates of the lanthanum and neodymium chlorides were measured for the salt separation from electrorefiner uranium deposits in the temperature range of 825~910˚C. The evaporation rates of both chlorides increased with an increasing temperature. The evaporation rate of lanthanum chloride varied from 0.12 to 1.68 g/cm^2/h. Neodymium chloride was more volatile than lanthanum chloride. The evaporation rate of neodymium chloride varied from 0.20 to 4.55 g/cm^2/h. The evaporation rate of both chlorides are more than 1 g/cm^2/h at 900°C. Even though the evaporation rates of the both chlorides were less than that of the process salt, the contents of the lanthanide chlorides were small in the adhered salt. Therefore it can be concluded that 900°C is suitable for the operation temperature of the salt distiller.