Distillation of Cd- ZrO_2 and Cd- Bi in Crucible With Splatter Shield

S.W. Kwon*, Y.W. Kwon, J.H. Jung, S.H. Kim, and S.J. Lee

Korea Atomic Energy Research Institute, 111, Daedeok-daero 989beon-gil,Yuseong-gu, Daejeon, Republic of Korea

*swkwon@kaeri.re.kr

Abstract

The liquid cathode processing is necessary to separate cadmium from the actinide elements in the pyroprocessing since the actinide deposits are dissolved or precipitated in a liquid cathode. Distillation process was employed for the cathode processing owing to the compactness. It is very important to avoid a splattering of cadmium during evaporation due to the high vapor pressure. Several methods have been proposed to lower the splattering of cadmium during distillation. A multi-layer porous round cover was proposed to avoid a cadmium splattering in our previous study. In this study, distillation behavior of Cd - ZrO_2 and Cd - Bi systems were investigated to examine a multi-layer porous round cover for the development of the cadmium splatter shield of distillation crucible. It was designed that the cadmium vapor can be released through the holes of the shield, whereas liquid drops can be collected in the multiple hemisphere. The cover was made with three stainless steel round plates with a diameter of 33.50 mm. The distance between the hemispheres and the diameter of the holes are 10 and 1 mm, respectively. Bismuth or zirconium oxide powder was used as a surrogate for the actinide elements. About 40 grams of Cd was distilled at a reduced pressure for two hours at various temperatures. The mixture of the cadmium and the surrogate was distilled at 470, 570 and 620°C in the crucible with the cover. Most of the bismuth or zirconia remained in the crucible after distillation at 470 and 570°C for two hours. It was considered that the crucible cover hindered the splattering of the liquid cadmium from the distillation crucible. A considerable amount of the surrogate material reduced after distillation at 620°C due to the splattering of the liquid cadmium. The low temperature is favorable to avoid a liquid cadmium splattering during distillation. However, the optimum temperature for the cadmium distillation should be decided further, since the evaporation rate decreases with a decreasing temperature.

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