§67. Recovery of Metal Impurities in Pb-17Li Impeller Induced Flow

Kondo, M., Ishii, M. (Tokai Univ.),
Norimatsu, T. (Osaka Univ.),
Muroga, T.

Lead lithium alloy (Pb-17Li) is a candidate tritium breeder of the inertial fusion reactor KOYO-Fast. The compatibility of Pb-17Li with the structural materials is the one of critical issues. A reduced activation ferritic martensitic (RAFM) steel is the candidate structural material of the blanket system. The corrosion of the RAFM steels (Fe-9Cr-2W-0.1C) was based on the dissolution of the steel elements (i.e Fe and Cr) into the Pb-17Li. Then, the precipitation of these elements at the low temperature region of the blanket system can be large, and cause the loop plugging accident. However, the recovery method of the metal impurities from flowing Pb-17Li was not made clear so far. The purpose of the present study is to investigate the recovery methodology of metal impurities based on the mass transfer of Fe and Cr metal in flowing Pb-17Li at non-isothermal condition.

Figure 1 shows the non-isothermal type mixing pot used in the current work. The pot was made of SUS316 (Fe-18Cr-12Ni) steel. The rotating impeller induced the flow in the pot. The wire mesh was installed in the cold region in the pot where was cooled by a flowing air. The mesh opening of the wire mesh was 0.415mm. Four cylindrical specimens of JLF-1 steel were fixed to the test pot. The mass transfer experiments were performed at the conditions of Table 1. The inventory of the Pb-17Li in the apparatus was 200cc. The Pb-17Li was supplied from Santoku cooperation. The rotation speed of the impeller was 100 rpm, and the Reynolds number for mixing was 8567. The temperature difference in the mixing pot was estimated as 15K. The duration of the test was 500 hours. After the test, the cold trap was removed from the pot, and the cross section of the wire mesh was metallurgically analyzed by electron prove micro analyzer (EPMA).

Figure 2 shows the results of EPMA analysis for the elements of Fe and Cr on the cross sections of the wire mesh. The precipitations are mainly composed of Fe and Cr. Ni was not detected in the cold trap. This is because the solubility of Ni in Pb-17Li was large and the concentration in Pb-17Li around the cold trap did not reach the solubility. The results indicated that the Fe and Cr, which are the major metal impurity produced by the corrosion, can be recovered by the cold trap method.

Table 1 Conditions of mass transfer experiment

Pb-17Li inventory [cc]	200
Temperature [K]	TC (a) : 743 TC (b) : 760 TC (c): 725.5
Re number for mixing	8567
Duration [hour]	500

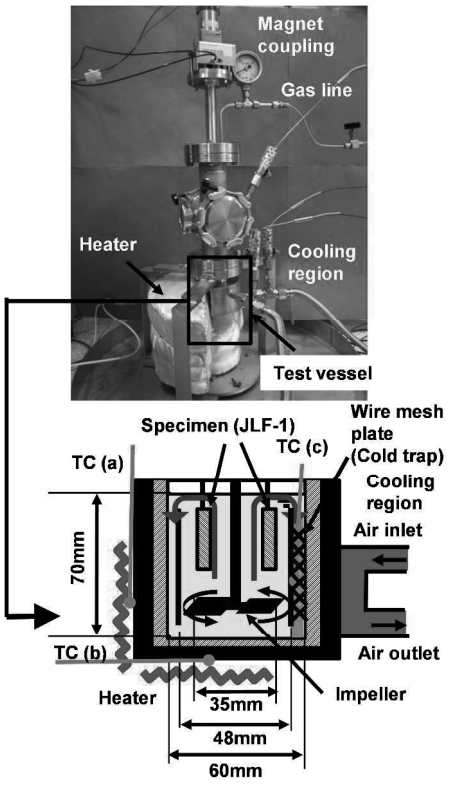

Fig. 1 Non-isothermal type mixing pot

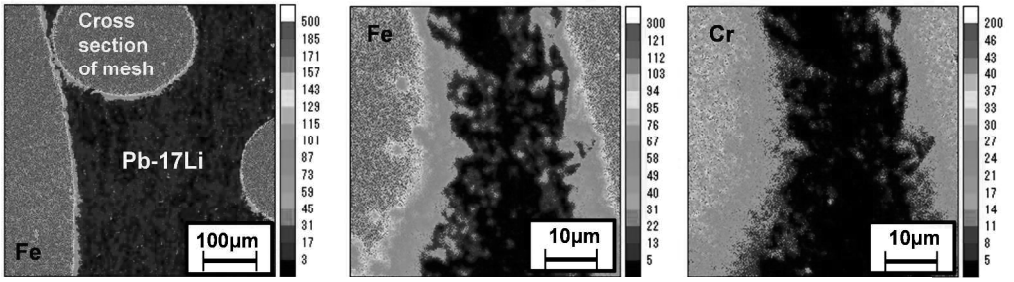

Fig. 2 Results of EPMA mapping analysis for cross section of cold trap
(a) EPMA mapping analysis for element of Fe (Low magnification),
(b) EPMA mapping analysis for element of Fe (high magnification),
(c) EPMA mapping analysis for element of Cr (high magnification).