

有機金属分解法で成膜したトリチウム透過低減被覆のリチウム鉛中腐食挙動  
**Corrosion behavior of tritium permeation barrier fabricated by metal organic decomposition with liquid lithium-lead**

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**1. Introduction:** For the realization of the liquid blanket systems, fabrication of a tritium permeation barrier (TPB) on pipe walls in a fuel system and blanket components has been studied. Metal organic decomposition (MOD) is one of the promising coating methods due to the capability of large reduction in hydrogen isotope permeation and a possibility to fabricate on the components with complicated geometries. Detailed hydrogen isotope permeation behaviors have been investigated in erbium oxide ( $\text{Er}_2\text{O}_3$ ) coatings prepared by MOD [1]. In the reactor environment; however, corrosion by liquid breeders will occur, resulting in a degradation of the TPB coatings. Despite the fact, there is a paucity of the report of the corrosion behavior with liquid lithium-lead (Li-Pb). In this study, corrosion behavior of the  $\text{Er}_2\text{O}_3$  coatings with liquid Li-Pb was investigated through static liquid Li-Pb immersion tests.

**2. Experimental:**  $\text{Er}_2\text{O}_3$  coatings on the RAFM steel F82H (Fe-8Cr-2W, 10-mm squares) were prepared by the MOD method. The fabrication parameters followed the previous study [1]. Liquid 15.7at.% Li-Pb of 30 cc was poured into a pure iron crucible under argon atmosphere. The sample was winded with an iron wire, immersed into the Li-Pb, and then the crucible was encapsulated into a stainless sample holder. The samples were heated in an electric furnace at 400–600 °C for 50–200 h. After the immersion tests, the samples were cleaned with a mixture of ethanol and acetic acid to remove adhered Li-Pb. The sample surfaces were observed using a field-emission scanning electron microscope (FE-SEM) with elemental analysis by energy dispersive X-ray spectroscopy (EDS) to elucidate corrosion behavior of the coatings.

**3. Results:** Er was partly detected on the surface of the samples after the Li-Pb immersion at 400–500 °C for 100 h as shown in Fig. 1. The surface morphology indicated that the coatings were peeled off after intrusion of Li-Pb into pores or corroded

regions. In the case of the sample after the immersion at 400 °C for 200 h, the coating also remained partly on the substrate. On the other hand, no Er was detected on the samples after the immersion at 550–600 °C for 50 h, and the sample surfaces became rough compared to those immersed at 400–500 °C. From these results, the extension of corrosion would be controlled by the temperature of Li-Pb. In particular, the coatings were completely peeled off by immersion at above 550 °C for only 50 h. No Er was detected after the immersion tests at 400–600 °C for 100 h for the samples encapsulated into the sample holder under a higher concentration of oxygen in the atmosphere (> 10%), suggesting that oxygen in Li-Pb would accelerate corrosion of the coatings.

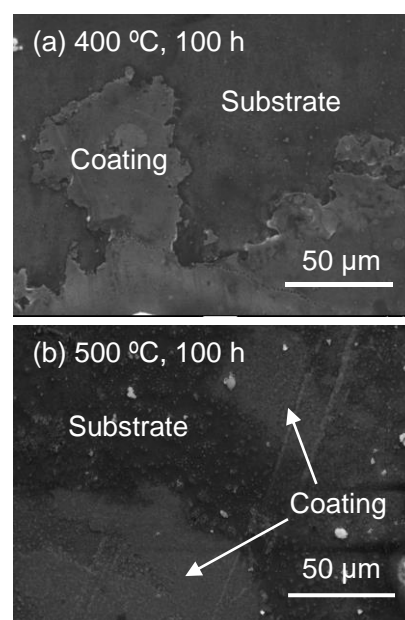


Fig. 1 SEM images after Li-Pb immersion (a) at 400 °C for 100 h and (b) at 500 °C for 100 h.

Reference

- [1] T. Chikada *et al.*, Journal of Nuclear Materials 442 (2013) 592–596