§5. Compatibility Model for Reduced Activation Ferritic Martensitic Steel in Flowing Liquid Breeders

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Study on compatibility model including flow assisted corrosion (FAC), erosion-corrosion and electro chemical corrosion of reduced activation ferritic martensitic steel JLF-1 (Fe-9Cr-2W-0.1C) in flowing liquid breeders of Li, Pb-17Li and Flinak was carried out. The corrosion tests in the flowing liquid breeders at 500˚C and 600˚C were performed in a stirring pot. The compatibility of JLF-1 steel with the liquid breeders was evaluated by the mass loss measurement of the specimens and metallurgical analysis of the surface after the tests.

It was found that the alloying elements of Cr in the JLF-1 steel were commonly dissolved into these melts [1, 2]. The mechanism of erosion-corrosion in the liquid metals was made clear as the removal of the corroded surface by the shear stress of the liquid metal flow (Figs. 1(a, b) and 2(a)) [3]. The specimens exposed to Flinak flow showed the trace of pitting corrosion caused by electrochemical corrosion (Figs. 1(c) and 2(b)) [2]. A compatibility model was developed which can evaluate the mass loss of the steel by the mass transfer: Δm_d, erosion-corrosion: Δm_e, and electrochemical corrosion: Δm_v as;

$\Delta m_{total} = \Delta m_d + \Delta m_e + \Delta m_v$ .The mass loss of the specimens in the corrosion experiments was evaluated by the model. The effect of erosion- corrosion on the total mass loss of the steel in the liquid metals could be larger than that of FAC estimated by mass transfer calculation. The mass loss of the steel by electro-chemical corrosion might be larger than that by the FAC in the Flinak.

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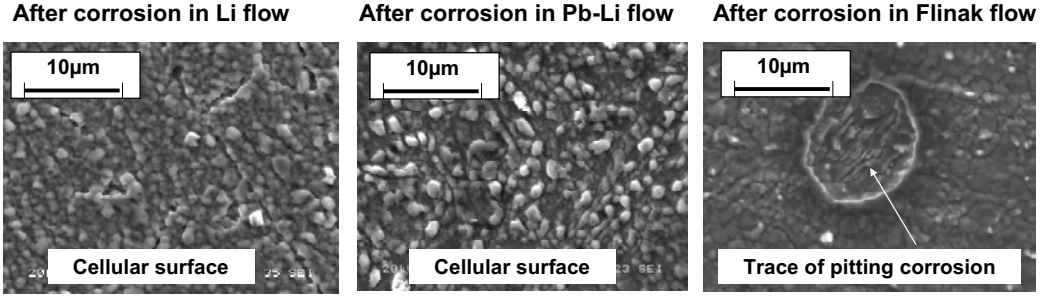
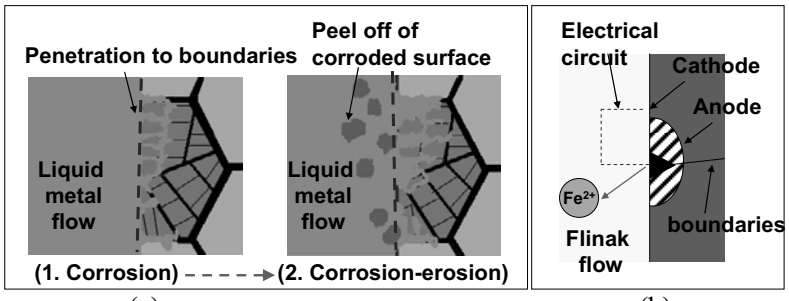


(a) (b) (c)

Fig.1 Surface image of specimens observed by SEM after immersion to (a) Li at 600ºC, (b) Pb-17Li at 600ºC, and (c) Flinak at 600ºC



(a) (b)

Fig.2 Mechanism of (a) erosion-corrosion in liquid metals and (b) pitting corrosion (electrochemical corrosion) in molten salt.