

§5. Corrosion Tests of RAFM Steel JLF-1 in Lead-lithium (Pb-17Li) for 3000 Hours

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1. Introduction

Lithium-lead alloy (Pb-17Li) has been one of candidate tritium breeding materials for the liquid blanket of the fusion reactor. One of key issues is the compatibility of structural materials with the Pb-17Li alloy. In the present study, the corrosion characteristics of the reduced activation ferritic/martensitic steel (RAFM) in static and flowing liquid Pb-17Li alloy was investigated experimentally by means of immersion for up to 3000 hours.

2. Experimental conditions

A series of static corrosion tests for RAFM: JLF-1 steel (8.92Cr-2W-0.1C-Fe balanced) was performed at 600°C for up to 3000 hours. A flowing test was performed for 250 hours using a stirred pot. The flow velocity around the specimen in the stirred pot was about 17cm/s. The quantity of the Pb-17Li used for each test at static and flowing condition was 100cc. The Pb-17Li crucible was made of JLF-1. The specimens after the exposure were rinsed in liquid Li at 300 hours for 6

hours. The weight change of the specimens before and after the exposure was measured. The corrosion of the specimens was metallurgically analyzed by SEM/EDX.

3. Results and Discussion

3.1 Weight loss of specimen in Pb-17Li

The weight loss of the specimens after the tests is shown in Fig.1. The weight loss at static condition showed an increase at a parabolic rate with the exposure time. The weight loss after the flowing test indicated that the corrosion rate was higher than that at static condition.

3.2 Morphological study

SEM image of JLF-1 surface after the corrosion tests were shown in Fig.2. After the static corrosion test for 783 hours, the surface showed the pores. The surface after 3000-hour tests showed rough surface. After the corrosion tests in flowing condition, the surface was cellular state. These results indicated that the selective corrosion occurred at the boundary of the microstructure of JLF-1 in Pb-17Li.

4. Summary

The corrosion tests were performed at static and flowing condition. The flow of Pb-17Li might accelerate the corrosion. The selective corrosion occurred at the boundary of the microstructure of JLF-1. This work was financially supported by NIFS08KFRF056

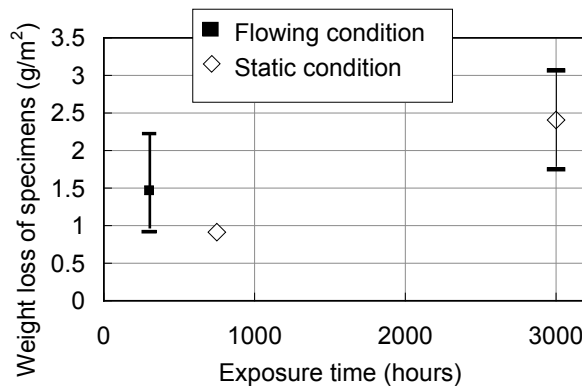


Fig. 1 Weight loss of JLF-1 steel after corrosion experiment at 600 °C

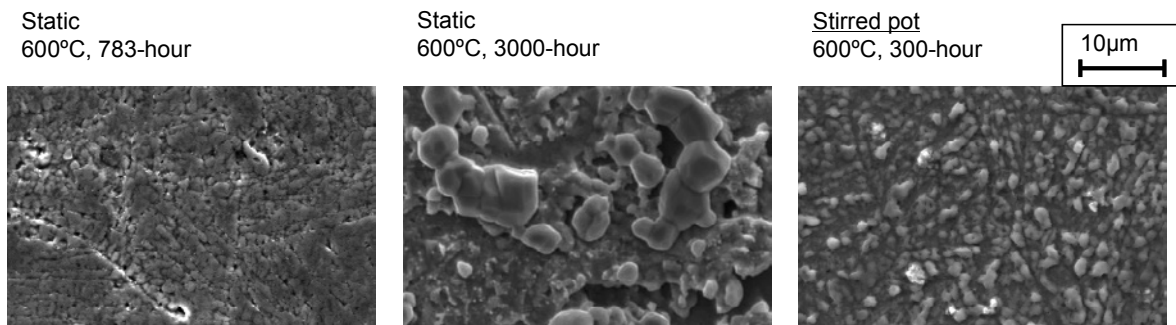


Fig. 2 SEM image of JLF-1 steel after corrosion test