

## §2. Corrosion Characteristics of Reduced Activation Ferritic Steel, JLF-1(8.92Cr-2W) in Molten Salts Flibe and Flinak

Kondo, M., Nagasaka, T., Sagara, A., Muroga, T., Oyama, D., Nagura, M., Suzuki, A., Terai, T. (Univ. Tokyo),  
Fujii, N. (Biko Chemical Company, Ltd.)

### 1. Introduction

Force Free Helical type Reactor (FFHR) with liquid blanket system has been designed. Molten salt Flibe (LiF-BeF<sub>2</sub>) is planned to be used as tritium (T) breeder and coolant of the blanket. Molten salt LiF-NaF-KF (Flinak) has similar characteristics with Flibe. Flinak has potential to be used as simulator fluid for the flowing corrosion tests, and Flinak is also one of candidates of the coolant and tritium breeder of the blankets. Corrosion of the structural materials in Flibe is one of critical issues. Static corrosion tests were performed in molten salts LiF-BeF<sub>2</sub> (Flibe) and LiF-NaF-KF (Flinak). The purpose is to investigate the corrosion characteristics of reduced activation ferritic steels, JLF-1 (8.92Cr-2W) in the fluids.

### 2. Experimental procedure

Conditions of corrosion tests are presented in Table 1. The material of crucible was one parameter to control the occurrence of electrical corrosion between the different materials. Exposure time was 1000 hours. HF concentration in Flibe and Flinak was measured by slurry pH measurement method. Initial concentration of HF in the melts was 180ppm in Flibe and 10ppm in Flinak. H<sub>2</sub>O concentration in the melts was measured by Karl-Fischer titration and it was found that the initial Flinak contained 16.1 wt% of H<sub>2</sub>O.

After the corrosion tests, specimens are extracted from the crucibles and rinsed in LiCl-KCl at 500°C to remove adhered molten salt. The mass losses of specimens were measured by electro reading balance with accuracy of 0.1mg. The corrosion of the surfaces was analyzed by using SEM/EDX.

### 3. Results

It was found that the corrosion in Flibe was mainly caused by dissolution of Cr into the fluids due to fluoridation. Carbon on the surface might be dissolved into

the fluids due to the corrosion, and this resulted to the decrease of carbide on the surface.

It was found that the grain and lath boundary were selectively corroded because the chemical component was different and became the anode due to less Cr concentration in the electro-chemical system.

In Flinak-JLF-1 system (Fig. 1), the grain and lath boundary were selectively corroded because the chemical component was different and became the anode due to less Cr concentration in the electrochemical system. Based on the galvanic series, Fe in JLF-1 was selectively dissolved in Flinak-Ni system. Nb dissolution in Flinak-Nb system might be caused by the formation of oxyion. Then, Nb crucible worked as sacrificial anode, and the specimen was not corroded.

The corrosion depth of the JLF-1 specimen, which was obtained from the weight losses, was 0.637μm in Flibe at 600°C and 6.73μm in Flinak at 600 °C.

### 4. Conclusions

The corrosion of JLF-1 in Flibe was mainly caused by Cr dissolution possibly due to the fluoridation by HF. Cr was also dissolved, and this decreased the number of carbide on the surface. The corrosion of Flinak was caused by electrochemical corrosion.

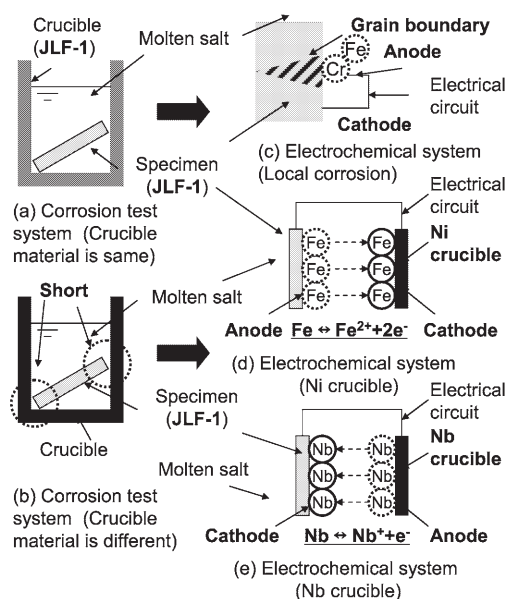


Fig. 1 Schematic of electrochemical corrosion in molten salt Flinak

Table 1 Corrosion test conditions

		Temp. (°C)	Materials		Number of capsules
			Specimen	Crucible	
Flibe	Test A	500	JLF-1	JLF-1	1
	Test B	600	JLF-1	JLF-1	1
Flinak	Test C	600	JLF-1	JLF-1	(1) Cleaned
					(2) Not cleaned
	Test D	600	JLF-1	Ni	(1) Cleaned
	Test E	600	JLF-1	Nb	(2) Not cleaned