§2. Metallurgical Study on Corrosion of Steels in Molten Flibe ($LiF\text{-}BeF_2$) for Design of Flibe Corrosion Test Loop

Kondo, M., Nagasaka, T., Muroga, T., Sagara, A., Noda, N.,
Nagura, M., Suzuki, A., Terai, T. (Univ. Tokyo)

For the purpose of verifying the feasibility of the flowing test in the Flibe blanket conditions, the design study on the forced convection loop was performed. Fig. 1 shows the bird's eye view of the designed loop. The corrosion of the loop tubes was considered to be one of the critical issues. The austenitic steels of SS304 and SS316L are the candidates of structural material of the forced convection loop. Corrosion characteristics of SS304 and SS316 were investigated by means of static corrosion tests.

Static corrosion tests for SS304 and SS316L austenitic steels in high purity $LiF\text{-}BeF_2$ (Flibe) were carried out at 500ºC and 600ºC for 1000 hours using the test capsule shown in Fig. 2. The chemical components of SS304 and SS316L are 0.05C-18.16Cr-8.79Ni-0.84Mn-0.51Si-0.025P -0.03S and 0.009C-17.16Cr-12.66Ni-2.05Mo -1.64Mn -0.56Si-0.018P-0.01S, respectively. One coupon specimen was placed in a crucible. The size of specimen was 10mm x 15mm x 0.5mm.

After the exposure, the steel surfaces were corroded due to the fluoridation by HF dissolved in Flibe (Fig.3). The grain boundary of the steel surfaces was preferentially attacked. The mechanism of corrosion including selective intergranular attack was discussed (Fig. 4). The corrosion rate of SS304 and SS316L in Flibe at 600ºC was estimated as 10.6 μm/year and 5.4 μm/year, respectively.

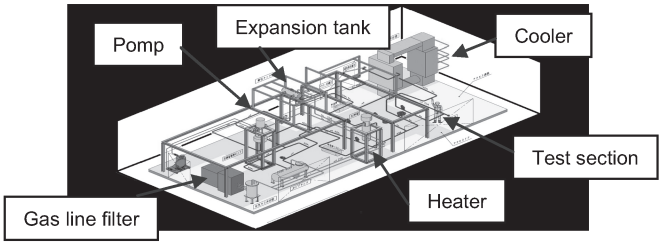

Fig. 1 Bird's eye view of loop

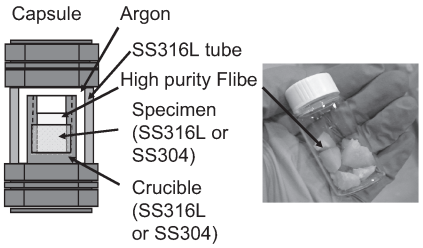

Fig. 2 Corrosion test capsule and high purity Flibe before exposure

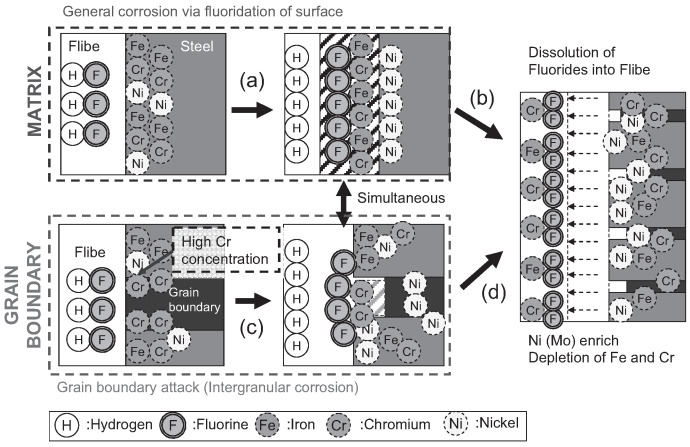

Fig. 4 Corrosion behavior of SS304 and SS316L steels in Flibe

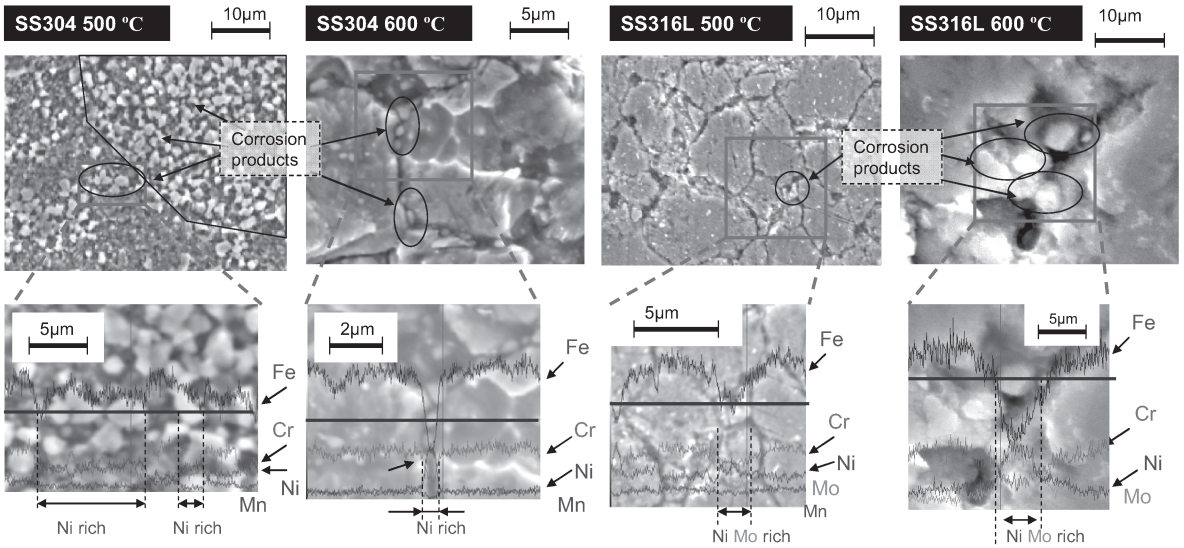

Fig.3 Results of SEM/EDX analysis for specimen surfaces : (a) SS304 tested at 500°C, (b) SS304 tested at 600°C, (c) SS316L tested at 500°C, (d) SS316L tested at 600°C