

§36. Corrosion of Steel with Fe-Al Coating in Liquid Pb-Li

Takahashi, M. (Tokyo Institute of Technology),
Kondo, M., Muroga, T.

The corrosion characteristic of JLF-1 (Fe-9Cr-2W-0.1C) with Fe-Al coating in a static Pb-Li was studied by means of an immersion test in stagnant Pb-Li. The coating on the steel surface was fabricated by the unbalanced magnetron sputtering method. The initial thickness was about 15 μ m. The corrosion test was performed at 600°C for 500 hours. The Pb-Li of 3cc was used. The test crucible was made of the JLF-1 steel. After the test, the tested specimen was analyzed without the removal of an adhered Pb-Li. The surface cross section of the specimen was analyzed by SEM/EPMA. The used Pb-Li was chemically analyzed to determine the changes in the concentrations of metal impurities during the immersion of the specimen.

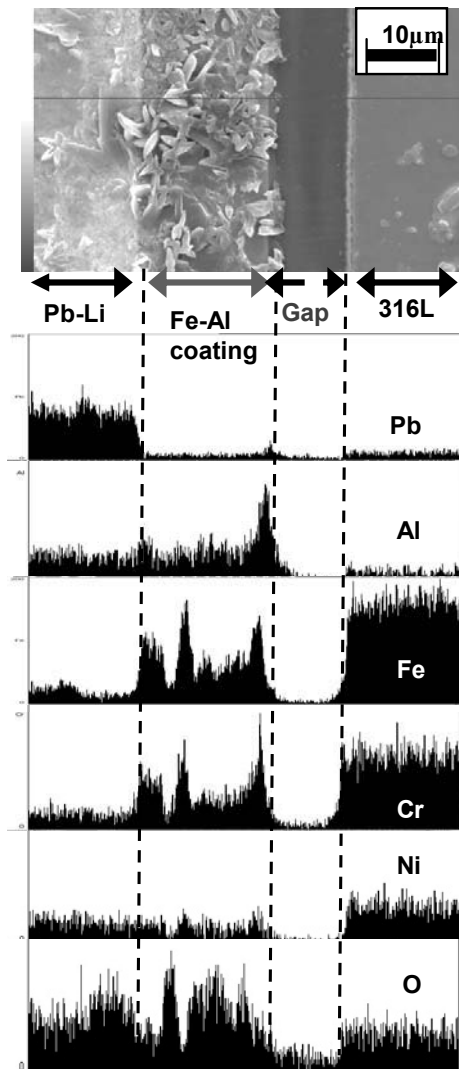
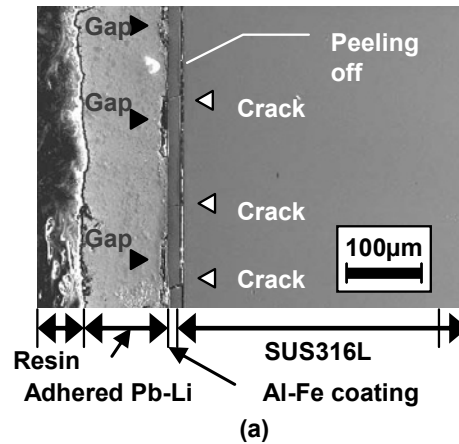
Figures 1 (a) and (b) show the results of the analysis for the cross section of the specimen near surface. It is found from deformation, peel-off and cracks at some regions that the coating was partially damaged. Some of the coating was lost by the peel-off during the immersion. The damage of the coating might occur in the cooling down process after the Pb-Li solidification due to the difference of thermal expansion coefficient between adhered Pb-Li and the coating layer. The impurity concentrations in the Pb-Li obtained by ICP-MS analysis are presented in Table 1.

Table 1 Concentrations of metal impurities in Pb-Li before and after immersion test (unit: wppm)

	Fe	Cr	Al
Before immersion test	2.2	0.17	6.8
After immersion test	33	8.3	5.5

The concentrations of Fe and Cr increased and that of Al did not increase, which suggests that Fe and Cr dissolved from the crucible with no dissolution of the coating layer. The depletion of the Cr and Fe of the substrate was not detected. Also, the thickness of the coating layer was the same as before the immersion. Therefore, the coating layer worked

well as a protection layer for element-dissolution type of corrosion.



(b)
Fig. 1 Cross sectional analysis on tested specimen, (a) low magnification, (b) high magnification