BL-27B/2020G606, 2022G618

Penetration behavior of cesium and iodine into epoxy coatings

Daiki FUJINO[1 *], Isamu SATO[1], Eriko SUZUKI[2] and Haruaki MATSUURA[1]

[1] Tokyo City University, 1-28-1, Tamazutsumi, Setagaya-ku, Tokyo, 1588557, Japan
[2] JAEA, Shirakata, Tokai-mura, Ibaraki, Japan

1 Introduction

In the decommissioning of the Fukushima Daiichi Nuclear Power Plant, it is necessary to treat and dispose of the associated dismantling waste safely and rationally. The decommissioning of the Fukushima Daiichi Nuclear Power Plant requires safe and rational treatment and disposal of the associated dismantling waste. For this purpose, it is necessary to accurately determine the properties and distribution of radioactive materials attached to or immersed in various structural materials of the reactor before and after dismantling, and to provide appropriate treatment and disposal accordingly. In this study, we focus on epoxy coatings used for concrete structures and CsI solution as a contamination source and aim to investigate the local structure of these elements by XAFS measurement to clarify the penetration behavior of Cs and I into epoxy resin coatings.

2 Experiment

Solidified epoxy resin E205 (Konishi Co., Ltd.) for civil engineering and construction was placed in a pressure vessel as an immersion sample, into which 1M CsI solution was poured, the lid was closed, and the vessel was placed in a constant-temperature oven at 110ºC for 5, 10, and 40 days, respectively. After the soaking period, the epoxy resin sample was dried, shaved down to 0.9 mm every 0.3 mm from the surface, and pellet-formed from powder form. Among them, the third layer (0.6~0.9 mm) sample immersed for 10 days, NaI reagent, and CuI reagent were selected as the I-edge specimens. On the other hand, two samples were selected for the Cs arrival: the first layer (0~0.3 mm) sample immersed for 5 days and the first layer (0~0.3 mm) sample immersed for 10 days. Cs and I were measured simultaneously by the fluorescence method focusing on the absorption edges L3.

3 Results and Discussion

Figure 1 shows the results of the derivation up to the radial structure function with respect to I. From these results, the only sample in which a prominent peak appeared was the CuI reagent, and the peak seen around 4 Å may be the correlation between I and I. However, no significant peaks were observed in the NaI reagent of the other two samples and in the third layer (0.6~0.9 mm) sample immersed for 10 days. We believe that this is largely due to the fact that the EXAFS oscillations for I were potentially weak.

On the other hand, the results for Cs up to the radial structure function are shown in Figure 2. Unlike the previous radial structure function for I, the result shows a pronounced peak.

Therefore, we considered the peak around 4 Å as the correlation between Cs and I bonding, and the peak around 2.5 Å as the correlation between Cs and O bonding, and performed fitting analysis. We found that the bonding correlations were correct, with the coordination number of CsI decreasing and the coordination number of Cs-O increasing with increasing immersion duration. This suggests that Cs itself does not permeate the epoxy resin, but that Cs that is unbound from the Cs-I bond gradually binds to O in the CsI solution or to O on the resin surface. On the other hand, we believe that the unbound I of CsI will cause penetration into the epoxy resin.

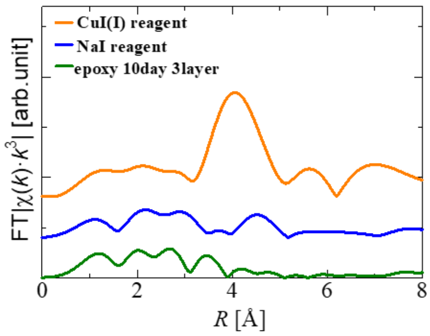

Fig. 1: Radial structure functions for I (yellow: CuI, blue: NaI, green: 3rd layer after 10 days of immersion)

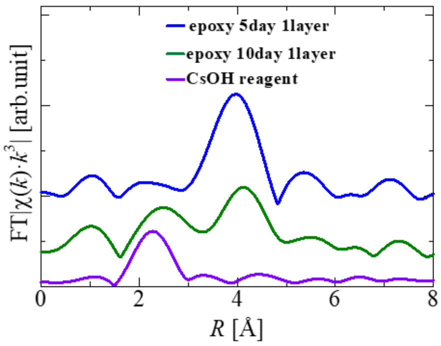

Fig. 2: Radial structure functions for Cs (blue: 1st layer after 5 days of immersion, green: 1st layer after 10 days of immersion, purple: CsOH reagent)

Acknowledgement

This research is part of the results of joint research with Tokyo City University and Japan Atomic Energy Agency.

*g2281813@tcu.ac.jp