BL-27B/2024G608

XAFS Analysis of Residue of Ru Adsorption Resin Produced from ALPS after heating in the Presence of Steam

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1 Introduction

Radioactive wastes containing water, such as operational wastes generated from the decommissioning of the Fukushima Daiichi Nuclear Power Plant(1F) and secondary water treatment wastes generated from the Advanced Liquid Processing System (ALPS), need to be stored in stable conditions for a long time. In addition, spent ion exchange resins used in coolant purification systems and other systems became complex forms due to the 2011 Great East Japan Earthquake. Other concerns include hydrogen generation due to radiolysis, and the need for volume reduction in consideration of potential composition changes and storage. In this study, the applicability of pyrolysis technology with steam, which is expected to have high volume reduction performance, stabilization, and suppression of volatilization of nuclides, was evaluated for waste resins affected by the earthquake.

2 Experiment

The resin-based adsorbent was prepared by dissolving $RuCl_3$ in ion-exchanged water, bringing it into contact with a cation exchange resin to adsorb Ru, and then mixing it with an anion exchange resin at a weight ratio of 2:1. EXAFS measurements of the Ru-K absorption edge of the prepared samples were performed at BL-27B, High Energy Accelerator Research Organization (KEK), using the fluorescence method, and the samples were heated to 500°C in an Ar atmosphere and a water vapor atmosphere with a temperature increase of 10°C/min by TG-DSC.

3 Results and Discussion

Figure 1 shows the XANES spectra of the Ru-K edge in the post-heat residue. Figure 2 shows the EXAFS structure functions of the Ru-K edge in the residue after heating. From Figure 1, it was present as a tetravalent oxide before heating. However, after heating, the coexistence of 0-valent metal and tetravalent oxide in both Ar and steam atmospheres is considered to be a coexistent system. In the heating in air atmosphere, they existed as tetravalent oxide state because of the presence of oxygen. The reason why Ru was reduced from oxide to metal by heating in Ar and water vapor atmosphere is thought to be that the resin became carbide by heating, and the carbide acted as a reducing agent to reduce Ru to metal.

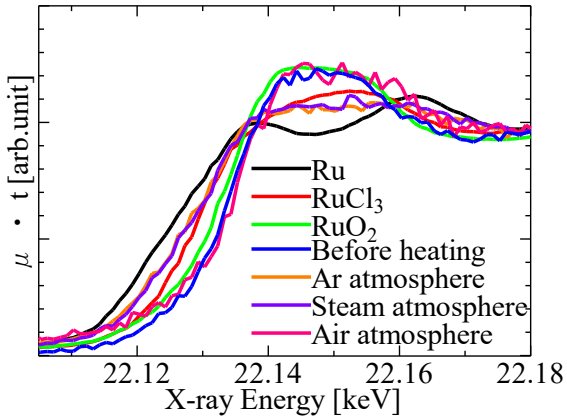

Fig.1: XANES spectrum of Ru-K edge in residue after heating

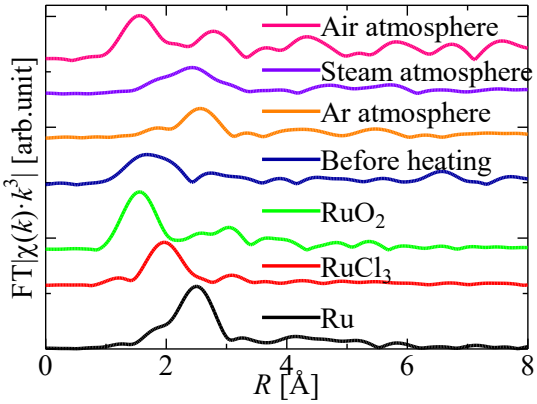

Fig. 2: EXAFS structure function of Ru-K edge in residue after heating

Acknowledgement

This study is part of the results of the FY2022 "Project for Decommissioning, Contaminated Water and Treated Water (Research and Development on Treatment and Disposal of Solid Waste)" of the Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry (METI).

References

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