

## Cobalt(II) oxide precipitate evaluated by XAFS

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### 1 Introduction

Spent nuclear fuels are generated with the operation of nuclear power generation. Through the reprocessing, nuclear fuel materials are recycled as nuclear fuel. The two kinds of reprocessing methods are wet reprocessing and pyro reprocessing. Molten salt electrolysis is used at the pyro reprocessing methods<sup>[1]</sup>. In pyro reprocessing methods, salt bath is used repeatedly, ultimately spent salt contaminated by a small amount of nuclear fuel materials is generated as a result. In terms of nuclear material safeguards, the nuclear fuel materials must be recovered and isolated. Therefore, we propose a nuclear fuel material recovery process that combines a precipitation and a distillation method. However, it has been suggested that spent salt is contaminated by other radioactivated materials derived from nuclear reactors, fuel structural materials, and molten salt electrolyzers used in pyro reprocessing. In this study, the behavior of these radioactivated substances during precipitate formation was evaluated<sup>[2]</sup>.

### 2 Experiment

LiCl–KCl eutectic salt or NaCl–2CsCl salt was placed in a quartz tube in an Ar circulation glove box (GB), and 10 wt% of CoCl<sub>2</sub> was added to the salt bath. The precipitant Li<sub>2</sub>O was added at chemical stoichiometric amounts of 50 %, 100 %, 150 %, and 200 % relative to the amount of Co(II), respectively. The quartz tube was placed in an electric furnace inside the GB and heated at 700 °C in the LiCl–KCl bath and 800 °C in the NaCl–2CsCl bath to melt the sample, respectively. After the sample was cooled and solidified in the quartz tube, the precipitate and supernatant salt were collected separately. The precipitate was crushed, mixed with BN, and formed into pellets, that was subjected to XAFS measurement. XAFS measurements were carried

out with BL-27B, PF, KEK. A portion of the supernatant salt was collected, dissolved in pure water, and analyzed using AAS. The precipitation ratio was calculated from the Co(II) content.

### 3 Results and Discussion

The XAFS analysis results of the Co(II) precipitate and the comparative sample are shown in **Figure 1**. In the XANES spectra (left), the precipitate was similar to the spectrum of the control sample CoO. In addition, in the EXAFS radial structure function (right), the first neighbor structural peak of the Co–O bond at approximately 1.8 Å not only coincides with the precipitate, almost the same behavior was observed at longer-distance correlations. From these facts, it is assumed that the precipitate is CoO.

Experiments revealed that Co(II) can be recovered as an oxide. Since the goal is to recover nuclear fuel materials as oxides, there is a high possibility that Co(II) will accompany with the nuclear fuel materials. In previous study<sup>[2]</sup>, Mn(II) was similarly recovered as an oxide, so we believe that it is necessary to add a process to separate Mn(II) and Co(II) from nuclear fuel materials.

### Acknowledgement

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### References

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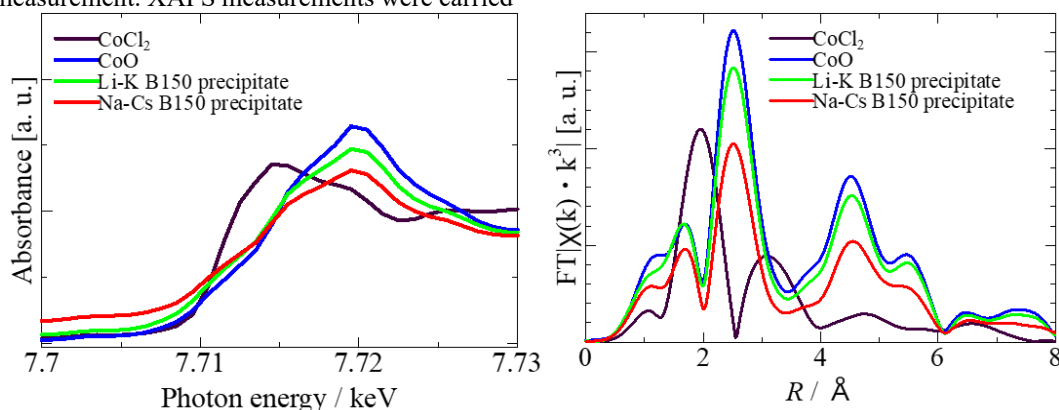


Figure 1; XAFS analysis. left: XANES spectra right: EXAFS radial structure functions.