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Structural analyses of insoluble residue (platinum group metals) in high-level radioactive waste

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1 Introduction

During reprocessing process of spent fuels, fine insoluble residue including fuel cladding materials are generated considerably. This residue is contained the high-level radioactive waste and is the alloy called as “platinum group metals”. The composition varies depending on the fuel fissile composition, irradiation history, reprocessing conditions and so on (e.g., high burnup fuel and MOX fuel, which are being considered for reprocessing in the future). And platinum group metals can have adversely affected vitrification process for the high-level radioactive waste.

Therefore, it is necessary to investigate the effect of platinum group alloys composition change is necessary to vitrify the stable waste.

In this study, platinum group metals simulated alloys with some compositions depending on fuel types were analyzed the structure to study the effect of platinum group alloys on vitrification such as, EXAFS structure analyses were performed to clarify the local structure of Mo, Ru in the platinum group alloys.

2 Experiment

The composition of platinum group alloys was determined by literature survey and others [1]. In the alloying process, pellets were made from the quantitative powder mixture, alloyed by the arc melting method (Ar atmosphere), and then embedded in epoxy resin and polished. These samples were collected at the High Energy Accelerator Research Organization (KEK) at the BL-27B beamline. The Mo-K and Ru-K absorption edges were measured by EXAFS using the fluorescence method with the SSD detector.

3 Results and Discussion

The EXAFS radial structure functions (RDF) of the alloy samples (Fig. 1) shows a peak at around 2.5 Å, which indicates the Mo and first neighbor metal correlation referring to epsilon phase (the hexagonal close-packing structure) [2]. However, the intensity of the peak in the larger percentage of Mo (Arc#3) is extremely smaller than the peaks in the less percentage of Mo (Arc#1 and 2), which is thought to be due to the distortion of the hexagonal closed packing structure in the alloy. This trend on structural variation depending on molybdenum composition must be affected to oxidation behavior by heating, thus we will evaluate the bulk samples after heating treatment by focusing on EXAFS of multi elements.

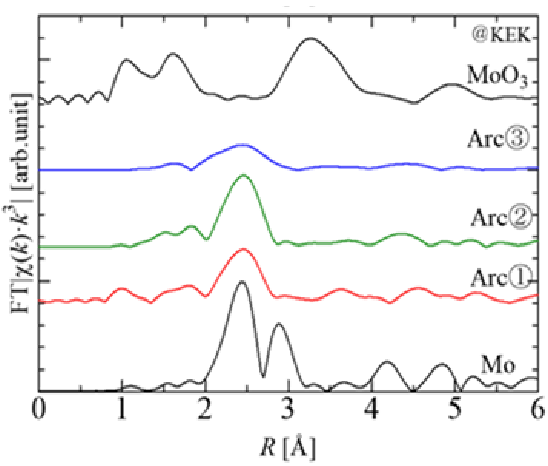

Fig. 1: EXAFS radial structure functions of various alloy samples. #1:$Mo_{20}Ru_{60}Rh_{10}Pd_{10}$, #2:$Mo_{15}Ru_{55}Rh_{15}Pd_{15}$,#3:$Mo_{40}$,$Ru_{45}Rh_{7.5}Pd_{7.5}$

References

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