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EXAFS of borosilicate glasses containing platinum group alloys

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1 Introduction

In the spent fuel reprocessing process, platinum group alloys (Mo-Ru-Rh-Pd-Tc) contained in the insoluble residue wastes are mixed with other wastes and fed to the glass melting furnace [1]. It is important to understand the behavior of the platinum group alloys in the vitrification process because the platinum group alloys affect the flowability of the glass in the glass melter due to the state of the cold cap in the initial stage of melting and settling to the bottom of the furnace. The platinum group alloys are expected to change in composition of the waste liquid due to changes in fuel specifications and irradiation conditions, so flexible measures are necessary in the vitrification process. Therefore, in this study, heating tests and various analyses using plate-type Platinum group alloys were conducted to elucidate the chemical states of Platinum group alloys, glass, and waste liquid components in a simulated vitrified product after heating in accordance with changes in spent fuel.

2 Experiment

The alloys used were MoRich(Mo:30,Ru:50,Rh:10,Pd:10wt%) ,Standard(Mo:20,Ru:60,Rh:10,Pd:10wt%) and MOX(Mo:15,Ru:65,Rh:10,Pd:10wt%).

Samples were made by combining dried liquid waste and glass beads in a weight ratio of 0.37:0.82 and adding solid alloys. The specimens were heated at a temperature rise rate of 10°C/min and a maximum temperature holding time of 3h. After heating, the glassy portions of the samples were measured in fluorescence mode using an SSD detector at the BL27B beamline.

3 Results and Discussion

The EXAFS structure function results for the various samples are shown in Figure 1,2. the characteristics of the EXAFS structure function suggest that Mo is mainly in the chemical form of molybdate and Ru is a mixture of metal and oxide. The ratio of metal to oxide in Ru is likely influenced by the alloy composition of Mo, with Mo less MOX is closer to an oxide, while MoRich with more Mo is closer to a metal. Therefore, it was suggested that the alloy composition affected the amount of oxygen consumed.

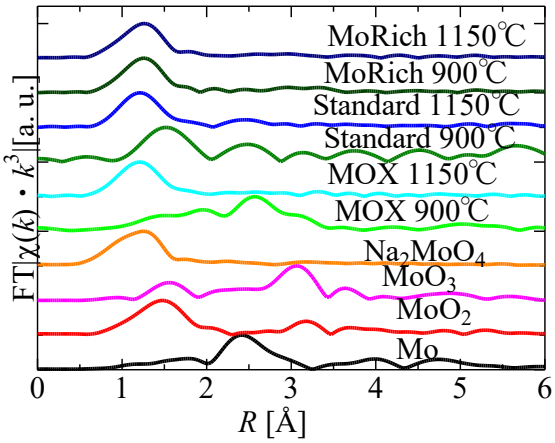

Fig. 1: EXAFS structure functions at Mo K-edge

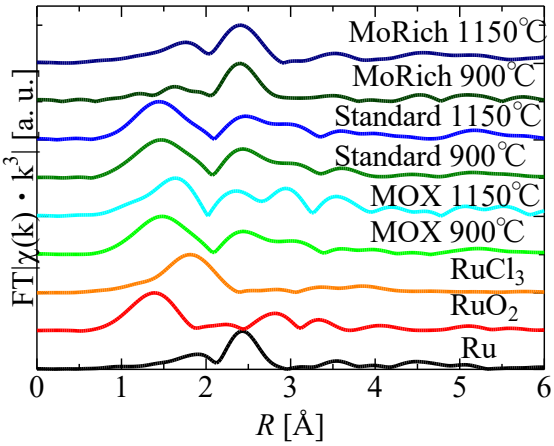

Fig. 2: EXAFS structure functions at Ru K-edge

Acknowledgement

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