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Local Structure of Simulated Radioactive Wastes in Molten Borosilicate Glasses Including Vanadium - Effect of Alkali Oxide Contents

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1 Introduction

At present, high-level liquid wastes are planned to be disposed below 300 meters underground as vitrified glass in Japan.

One of major fission products, Mo tends to turn into alkali molybdate, so called "yellow phase". It makes problematic not only at stable operation of glass melter, but also at less homogeneity of final product. It is known that adding vanadium in borosilicate glass increases the including amount of fission products and reduces alkali molybdate. Extended X-ray Absorption Fine Structure, which can be focused on the local structure around a targetted atom. Vanadium containing borosilicate glass with variated alkali contents have been molten in a furnace, and EXAFS spectra at various temperature have been obtained.

We have investigated which kind of alkali content is appropriate for making strucurally stable glass.

2 Experiment

EXAFS measurement by transmission method has been carried out using an electric furnace at BL-27B.

The temperature was gradually decreased from 1200 °C, 800 °C and room temperature, and the Mo - K absorption edge was used for obtaining data.

Data has been analysed by EXAFS analysis program WinXAS version 3.02. An EXAFS oscillation was extracted using the cubic spline method and the structure function was obtained by the Fourier transformation.

Structural parameters were derived from fitting based on EXAFS equation.

3 Results and Discussion

Alkali content 0.27 mol% of 1200 °C , 800 °C and RT, the distance of Mo - O is almost constant, so it was confirmed that local structure was kept constant from melting to solidification.

Fig. 1 shows structural functions of alkali content 0.23 mol% (all components) at each temperature.

In the case of alkali content 0.23 mol%, it is found that the distance of Mo - O is extended at 1200 °C with regard to 800 °C and RT, so it was observed that the glass structure was changed at solidified from molten state.

Therefore, it is found that the alkali content of 0.27 mol% is nearly kept constant from molten state until room temperature.

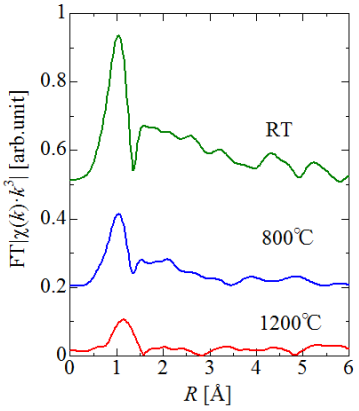

Fig. 1: Structural functions of alkali content 0.23 mol % (all components) at each temperature

Summary

It is considered that the glass with an alkali content of 0.27 mol% is more ideal glass which can be kept the same local structure from molten state up to solid state.

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Research Achievements

1. The 6th Asian Conference on Molten Salt Chemistry and Technology Gyeongju , Korea, June 13-16, 2017

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