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Structural Analysis of Molybdenum in Molten Lithium Fluoride Depending on Oxide Concentration

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1 Introduction

As a problem of development of molten salt reactor, there are several studies on the influence of metallic elements eluting from Hastelloy-N piping to the chemical species of molten salt due to irradiation embrittlement and oxygen contamination [1.2]. Therefore, we focused on Mo which is easily oxidized under high temperature, among the elements constituting Hastelloy-N, and the influence of MoO_3 on the chemical state of molten salt was investigated. Furthermore, measures to suppress elution of Mo in a molten salt reactor were presented.

2 Experiment

We have investigated the influence of MoO_3 on the chemical state of molten salt by X - ray absorption fine structure analysis (XAFS) which shows the local structure around the target atom. The measurement sample was a mixture of LiF–MoO_3, and in order to compare the concentration dependency when MoO_3 was eluted in the molten salt, samples were prepared by increasing the mixing ratio of MoO_3 at a molar ratio of 5% . Moreover, in order to reproduce the environment at high temperature such as a molten salt reactor, an electric furnace was installed in the beam line and measurements were carried out, and the temperature dependency of the structure function was also compared and examined.

3 Results and Discussion

Fig. 1 and Fig. 2 show the structural functions of LiF - MoO_3(95-5) mixture obtained by XAFS measurement before and after heating and the structural functions of LiF - MoO_3 mixture of various compositions at 600°C. In Fig. 1, since the structure function does not return to the original before and after heating, it is considered that Mo was partly fluorinated. In Fig. 2, when the mixing ratio of MoO_3 is more than 10% at the same temperature of 600℃, the peak related to the oxide is seen in the second coordination neighbor, so that the mixture is not completely molten. If the melting point of the mixture decreases, precipitation of impurities is concerned. Therefore, in the molten salt reactor, it is necessary to strengthen the measure against oxygen contamination and suppress the oxygen concentration in the bath to less than 10% to avoid MoO_3 eluting into molten salt.

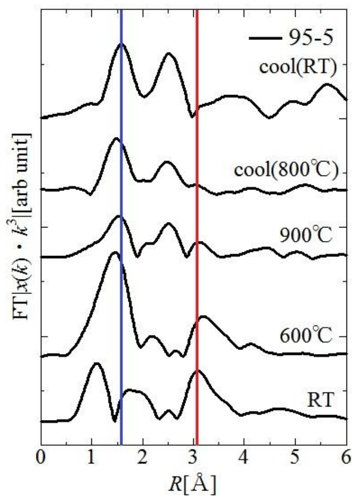

Fig. 1: Structural functions of LiF-MoO_3 (95-5) mixtures before and after heating

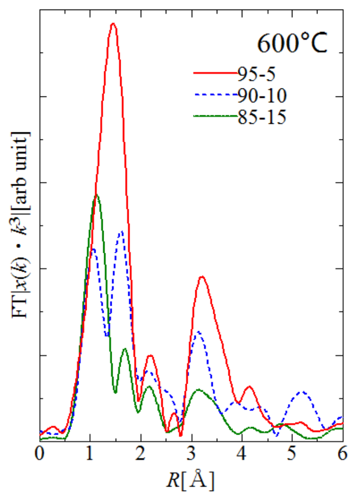

Fig. 2: Structural functions of LiF-MoO_3 mixtures at 600°C

References

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