

## Local structure in AgBr-doped chalcogenide glasses

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### Introduction

Many kinds of studies for ionic conducting glasses, especially for AgI-doped glass systems, have been carried out from academic and practical point of view [1]. The fast ion conduction in the AgI-doped glasses is attributed to their unique structure, which can be modeled as a mixture of conduction pathways similar to the fast ion conducting phase of crystalline AgI and rather rigid chalcogenide networks [2]. On the contrary, there are few reports on the glass systems containing other silver halides, such as AgBr and AgCl, in which a rock salt structure is stable under atmospheric pressure. This paper will present results of XAFS experiments in AgBr-As<sub>2</sub>Se<sub>3</sub> glasses and discuss the local structure in AgBr doped non-oxide glasses.

### Experimental procedure

Appropriate amounts of AgBr, As and Se, with those compositions expressed as (AgBr)<sub>x</sub>(As<sub>2</sub>Se<sub>3</sub>)<sub>1-x</sub> with  $x \leq 0.6$ , were sealed within an evacuated quartz ampoule and thoroughly mixed in a rocking furnace at 650 °C. Then, the melts were quenched rapidly in an ice-water mixture.

EXAFS studies for amorphous samples were carried out at BL-12C (for As and Se K-edges) and 10B (for Ag K-edge) stations in KEK-PF. The intensity of the incident beam,  $I_0$ , and that of the transmitted beam,  $I$ , were measured using ionization chambers.

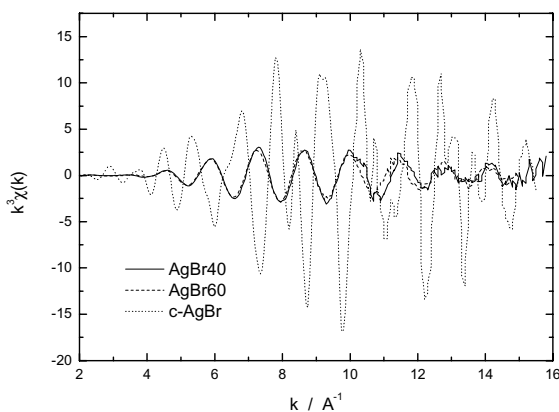


Fig. 1 Ag K-edge EXAFS functions for (AgBr)<sub>x</sub>(As<sub>2</sub>Se<sub>3</sub>)<sub>1-x</sub> glasses

### Results

Figure 1 shows the EXAFS oscillations observed around the Ag K-edge for (AgBr)<sub>x</sub>(As<sub>2</sub>Se<sub>3</sub>)<sub>1-x</sub> glasses

together with those for crystalline AgBr (c-AgBr). Because of the structural disorder of the glasses, signal intensities for the glasses were weaker compared with that for c-AgBr. Nevertheless, reasonably good signals were obtained up to 16 Å<sup>-1</sup>. The corresponding Fourier transforms  $F(R)$  has a main peak at round 2.3 Å for the glasses (Fig. 2), the position of which is very different from the case of c-AgBr. Moreover, it is worth remarking that the peak of a second coordination shell, which is clearly observed at around 3.9 Å in  $F(R)$  for c-AgBr (corresponds to the Ag-Ag correlation of sub-lattices), completely vanished in the glassy state. This fact seems to be attributed to the structural disorder of the sub cages in the glassy state.

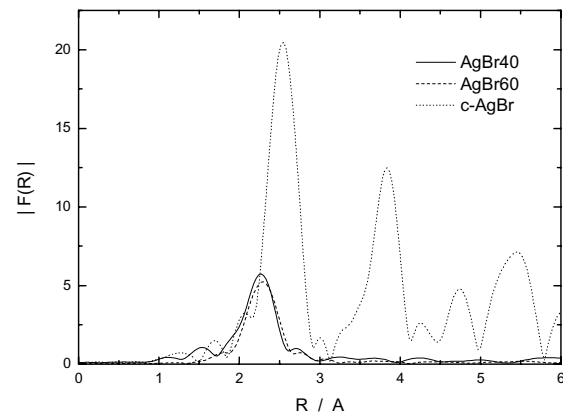


Fig. 2 Ag K-edge distribution functions for (AgBr)<sub>x</sub>(As<sub>2</sub>Se<sub>3</sub>)<sub>1-x</sub> glasses

The results of a least-squares fitting analysis for the EXAFS data including Ag, As and Se K-edges allow us to predict that the structure model for (AgBr)<sub>x</sub>(As<sub>2</sub>Se<sub>3</sub>)<sub>1-x</sub> glasses can be proposed as the pseudo-binary mixture of the AsSe<sub>3/2</sub> network matrix and tetrahedral AgBr units, where the short-range order around Ag and Br strongly differ from the case in crystalline AgBr which has a rock salt structure with the coordination number of 6.

### References

- [1] see for example, T. Minami, K. Imazawa, M. Tanaka, J. Non-Cryst. Solids 42 (1980) 469.
- [2] T. Usuki et al., J. Non-Cryst. Solids 312-314 (2002) 570.

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