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Local Structure in fast-ionic conductive AgI-As_2Te_3 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 points of view [1,2]. Recently, it was demonstrated that the $(AgI)_x(As_2Te_3)_{100-x}$ glass powders have surprisingly been obtained up to 80 mol% AgI content by the mechanical milling method. Furthermore the progression of amorphization and the appearance of fast ionic conduction in $(AgI)_x(As_2Te_3)_{100-x}$ system have been investigated. This paper will present preliminary results of XAFS experiments on AgI-As_2Te_3 glasses.

Experimental procedure

$(AgI)_x(As_2Te_3)_{100-x}$ (x = 20, 40, 50, 60, 70 and 80) samples were prepared at room temperature by means of the mechanical milling method (milling time = 0, 0.5, 1, 2, 10, 20 and 40 hours) using a planetary ball mill equipment.

EXAFS studies for amorphous samples were carried out for Ag, Te and I K-edges at NW10A station, KEK. The intensity of the incident beam, I_0, and that of the transmitted beam, I, were measured using ionization chambers. The measurement temperature was set to be 20K.

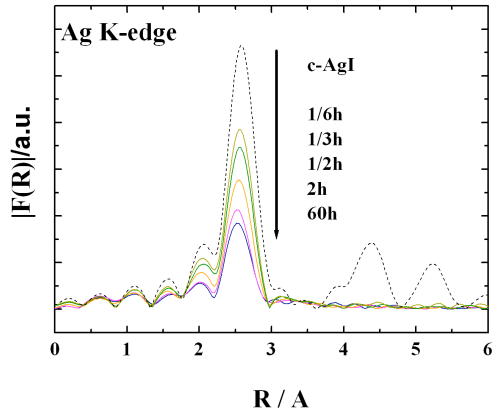

Fig. 1 Magnitude of Fourier transformation of the EXAFS oscillation function at the Ag K-edge for $(AgI)_{80}(As_2Te_3)_{20}$ glass.

Results

Figure 1 provides the magnitude of the Fourier transformation, $|F(R)|$, of the EXAFS oscillation function at Ag K-edge for the $(AgI)_{40}(As_2Te_3)_{60}$ samples at the different milling stages. The position of a main peak in $|F(R)|$ shifts slightly to shorter R with increasing milling steps. The intensity of this peak significantly decreases, implying the decrement of the coordination number of iodine atoms around the mobile Ag ions. These tendencies are reasonably confirmed by the result for I K-edge EXAFS data.

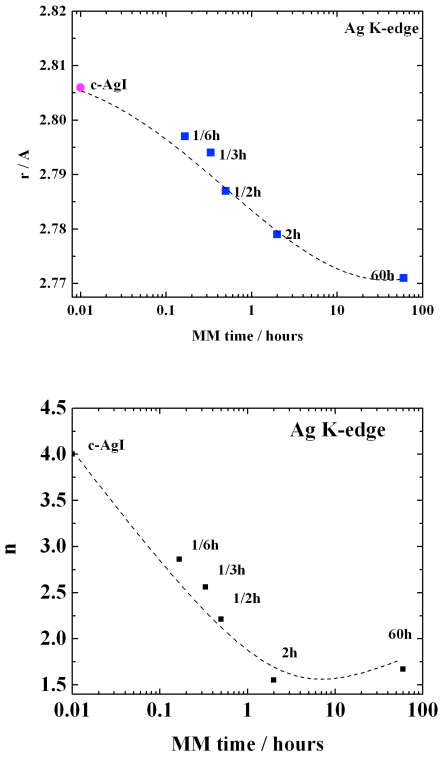

Fig. 2 Milling time dependence of the interatomic distance and the coordination number of Ag-I pairs in $(AgI)_{80}(As_2Te_3)_{20}$.

The milling time dependences of the interatomic distance, $r_{Ag\text{-}I}$, and the coordination number, $n_{Ag\text{-}I}$, of Ag-I pairs are illustrated in Fig. 2. The $r_{Ag\text{-}I}$ and $n_{Ag\text{-}I}$ decrease clearly with increasing milling time. The apparent decrease of coordination number of Ag-I pairs corresponds to the disordering of Ag ions in the glass (or distortion of AgI units in the glass matrix), which might be strongly related to the appearance of fast ion conduction in the present glass system.

References

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