ESRF	**Experiment title:** Investigation of the low temperature and high frequency acoustic properties of the $Li_2O+2B_2O_3$ glass.	**Experiment number**: HS-1452, 1453 and 1454
Beamline: ID28	**Date of experiment**: from: 21-04-01 to: 30-04-01	**Date of report**: 08-01
Shifts: 27	**Local contact(s)**: Dr. F. Sette	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

A. G.Monaco*, ESRF

B. A.Matic* Chalmers University of Technology, S-41296 Goeteborg, Sweden

C. J.Mattson* Chalmers University of Technology, S-41296 Goeteborg, Sweden

D. C.Masciovecchio*, Elettra, I-34012 Basovizza – Trieste, Italy

Report:

Utilizing very high energy resolution x-ray scattering we studied the temperature dependence of the dynamic structure factor, S(q,E), of the $Li_2O+2B_2O_3$ glass in the temperature range from 3.8 to 700 K thus covering temperatures across almost the whole glass phase. Three selected spectra at q = 2 nm^{-1} are shown in Fig. 1. We analysed them using a DHO model for the Brillouin peaks and a purely elastic contribution for the central line. We have fitted the model to the experimental data after convolution with the experimental resolution function.

We want to stress that these measurements are very difficult since the inelastic signal at low temperature is very low and almost buried under the tails of the elastic contribution. Consequently, the knowledge of the exact shape of the resolution function is the fundamental ingredient for a correct analysis.

We present here preliminary results on the most interesting of the parameters that can be extracted from the cited analysis, namely the FWHM of the Brillouin peaks. Specifically, this parameter (Fig.2, full squares) at q=2 nm^{-1} comes out to be only slightly temperature dependent, at variance with what is obtained for the same quantity when it is measured in the GHz frequency range with Brillouin scattering [1].

These preliminary results seem to confirm previous results obtained in the glycerol glass [2], and suggest: i) the presence of two different attenuation mechanisms active,

respectively, in the high- and low-frequency limits; and ii) the non-dynamic origin of the attenuation of THz sound waves.

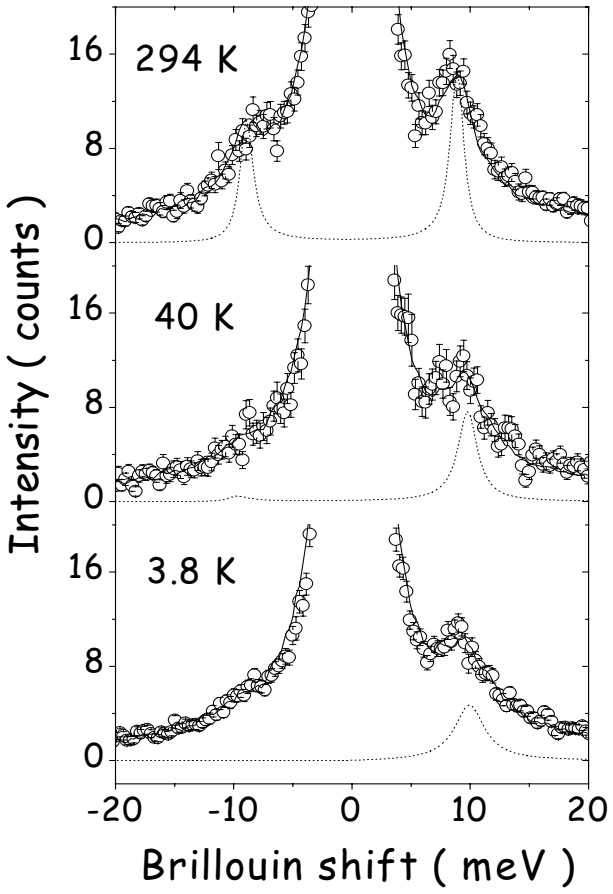

Fig. 1

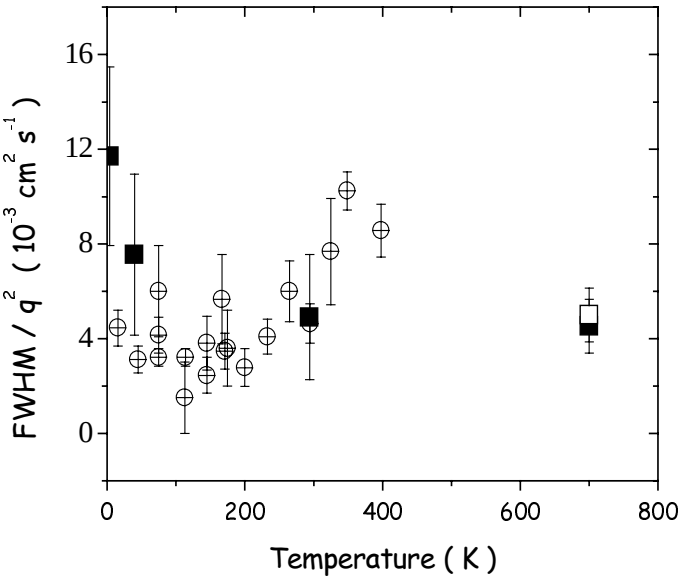

Fig.2

Fig. 1: Temperature dependence of inelastic X-ray spectra of the $Li_2O+2B_2O_3$ glass at the explored temperatures. The full line through the data points represents the best fit using the DHO model for the inelastic contribution and a delta function for the elastic one. The purely inelastic, resolution deconvoluted contribution is also reported (dotted line).

Fig. 2: Linewidth of the Brillouin peaks of the $Li_2O+2B_2O_3$ glass measured at q=2 nm^{-1} (full squares), and compared to the result of a previous experiment at 700 K [3] and with the results obtained in the glycerol glass [2]. In both the considered systems the linewidth comes out to be almost temperature independent, at variance with what is found at lower wave numbers [1].

References:

[1] L.Borjesson, Solid State Ionics 28-30, 770 (1988).
[2] G.Ruocco et al., Phys. Rev. Lett. 83, 5583 (1999).
[3] A.Matic et al., Phys. Rev. Lett. 86, 3803 (2001).