ESRF	**Experiment title:** An IXS study of glasses with a systematical change in the dynamical properties	**Experiment number**: HS-842
Beamline: ID16	**Date of experiment**: from: 8/7-99 to: 16/7-99	**Date of report**: 16/8-99
Shifts: 22	**Local contact(s)**: C. Masciovecchio	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

Prof. Lars Börjesson and *Aleksandar Matic,
Dept. of Applied Physics, Chalmers Univesrsity of Technology,
S-412 96 Göteborg, Sweden

*Dennis Engberg,
ISIS Divison R3, Rutherford Appleton Laboratory,
Chilton, Didcot, Oxon, OX11 0QX, England

*C. Masciovecchio
Inelastic scattering group/ESRF, BP 220
F-38043 Grenoble Cedex, France

Report: With the variation of the Li_2O-content in the Li_2O-nB_2O_3 glass system the low frequency dynamics changes dramatically. The Boson peak energy shifts continuously for this glass system from around 2.5 meV for n=∞ (pure B_2O_3) to 10 meV for n=2 and at the same time the sound velocity increases from 3200 m/s to 6840 m/s [1]. The aim of this work was to investigate the behaviour of collective excitations at intermediate wave vectors (1-15 nm^{-1}) in this system and to relate it to the changes in the low frequency dynamics (1-10 meV). We have investigated two samples, with n=2 and 4, using inelastic x-ray scattering IXS, extending our previous IXS-study on pure B_2O_3 (HS-195, 1997).

The experiments were performed at T=700 K for n=2 and T=600 K for n=4 which in both cases is below the glass transition temperature T_g. Typical spectra at different Q-values are shown in Fig. 1. The inelastic contribution can clearly be identified outside the experimental resolution function and one can directly observe a positive dispersion of the inelastic components indicating the propagating nature of these excitations. To extract the width and position of the inelastic components the spectra were fitted to the DHO-model, previously successfully used to describe IXS data from glassy systems [2], see Fig. 2. The obtained dispersion relation deviates from its low-Q linear behaviour already at low energies and momentum transfers. The propagating nature of the excitations seems to be lost for energies slightly above the Boson peak energy where the dispersion curve bends over and the width simultaneously becomes constant. The results will be discussed in terms of changes in the microscopic network structure of the glasses and compared with our previous study on B_2O_3.

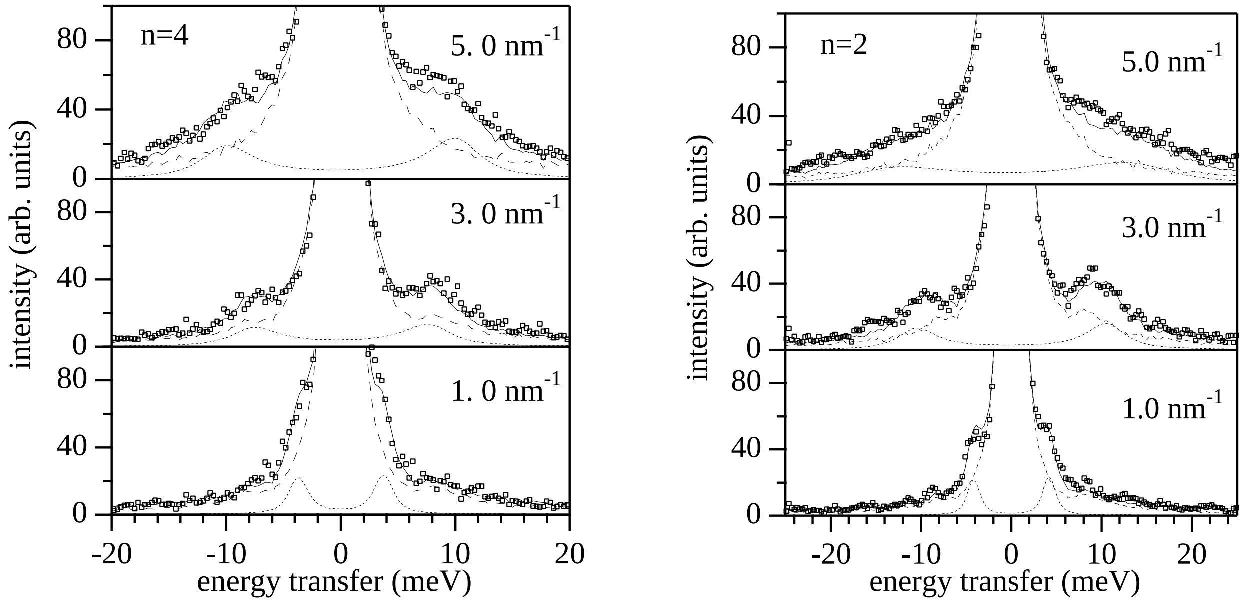

Figure 1. Experimental IXS spectra for the two glasses at different Q-values (symbols). Full line represents the DHO-fit and broken line the resolution function. The inelastic components of the DHO function convoluted with the resolution function are shown as dotted curves.

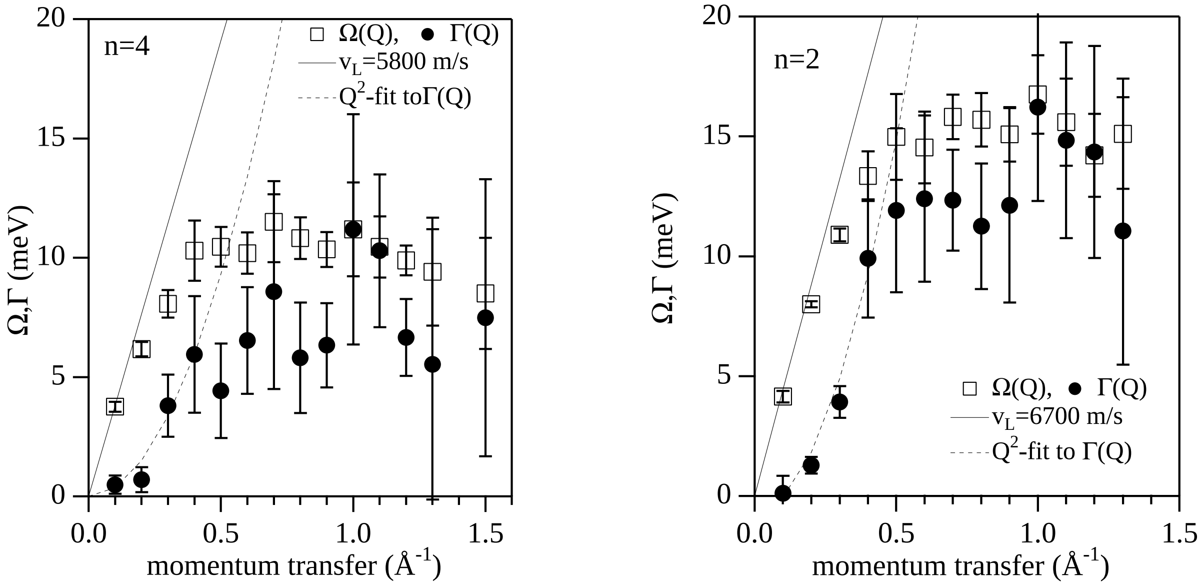

Figure 2. Position ($\Omega(Q)$) and width ($\Gamma(Q)$) of the inelastic contributions as determined from the DHO-analysis.

References

[1] J. Lorösch et al., J. Non Cryst. Sol. 69, 1 (1984)

[2] F. Sette et al., Science 280, 1550 (1998)