



Experiment title: Study of Infinite Frequency Sound Velocity in Glycerol by Very High Inelastic X-Ray Scattering

Experiment number:

HS-81

Beamline:

BL21

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Shifts:

36

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Report:

Inelastic x-ray scattering proved to be a powerful tool to explore the high frequency collective dynamics in disordered systems. The spanned $Q - \omega$ region is important for the study of the complex structural relaxation pattern of glassformers. As predicted by the recent mode coupling theory (MCT), the fragile glass-forming system should show a structural arrest in correspondence of a critical temperature T_c higher than the calorimetric glass transition temperature T_g .

Using very high energy resolution x-ray scattering, in the experiment HS-81 we determined the infinite frequency sound velocity $C_\infty(Q, T)$ in glycerol to investigate the possible existence of a discontinuity in correspondance of T_c . $C_\infty(Q, T)$ has been obtained from the dispersion relation of acoustic like excitations measured as a function of temperature from the liquid to the glass state.

Our results allow to establish the following points:

i) The observed phonon-like excitations at room temperature have a damping comparable with the extrapolation at large Q of the corresponding parameters observed in the hydrodynamic limit. In particular the inelastic width follows a Q^2 law. This may imply a dynamic contribution to the excitations width.

ii) The measured speed of sound as function of temperature shows a change in slope at a temperature which seems to correspond to T_c already measured by dielectric loss spectroscopy (see figure). This result has been recently confirmed by similar measurements on another glass-forming system: the OTP. These results calls for a further investigation on other systems in order to test their generality.

A scientific publication is being prepared.

