ESRF	**Experiment title:** Study of the dispersion curves in permanently densified silica samples	**Experiment number**: HD 496
Beamline: ID 28	**Date of experiment**: from: 07/07/2010 to: 15/07/2010	**Date of report**: 30/08/2010
Shifts: 18	**Local contact(s)**: Elena Borissenko	*Received at ESRF:*

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Report

The dynamic structure factor of two permanently densified silica sample has been measured by means of inelastic X-rays scattering (IXS) as a function of the exchanged wave-vector Q at a fixed temperature $T = 573$ K.

The samples were prepared starting from a commercial grade suprasil block purchased from Silo (Florence). Using an high pressure – high temperature apparatus we applied a selected pressure and then we heated to 773 K for ten minutes, obtaining homogeneus and permanentely densified samples. The obtained densities as a function of the choosen pressures are reported in the table below.

Applied Pressure	Density (g/cm^3)
4 GPa	$2{,}254 \pm 0.005$ g/cm^3
8 GPa	2.67 ± 0.01 g/cm^3

We chose an integration time of about 1 minute/point corresponding to a total time of 12 hours/spectrum. The measured spectra, see figure 1, are characterized by a signal to noise ratio which is sufficient to determine the speed of sound with a 1% accuracy.

The low Q spectra ($Q < 2$ nm^{-1}) have been fitted with one damped harmonic oscillator (DHO) function convoluted to the instrumental resolution plus an elastic line whose shape is given by the resolution itself. The effect of the analyzers slits finite aperture on the line shape has been carefully taken into account in the analysis of the spectra. The analyzer collects the intensity in a range of wave-vectors corresponding to its horizontal slit aperture and this contribution is non-negligible for wave-vectors $Q < 2$ nm^{-1}. For $Q > 2$ $nm^{-1,}$ where two excitations are visible, spectra have been fitted with two DHO convoluted with the resolution plus an elastic line.

The aim of the experiment was to explore the exchanged wave vector region below 5 nm^{-1}, so we planned to use mainly the analyzers 1 and 6. Unfortunately, during the experiment, the analyzers from 6 to 9 were not operative, then we could acquire only one spectra at a time in the region of interest. This problem has strongly limited the number of spectra and consequentely the number of Q – points in the dispersion relation.
In conclusion, the number of Q – points is not enough to obtain a detailed mapping of the acoustic branches which was the aim of this experiment. In order to complete the study of the density behavior of both sound velocity and attenuation in these permanently densified samples further beamtime is desirable.

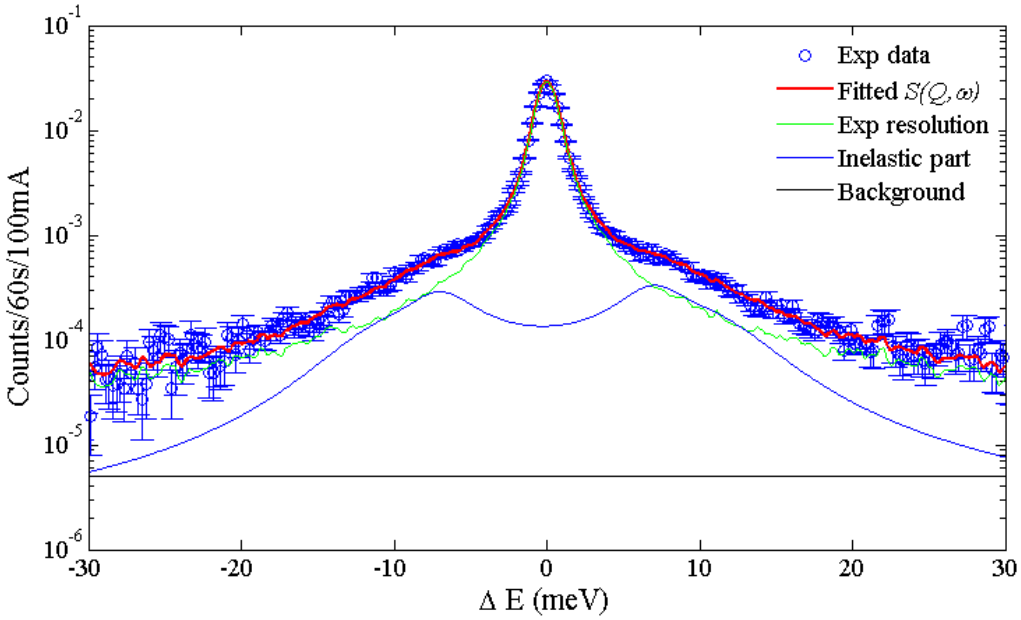

Figure 1: rappresentative IXS spectrum on the 4 GPa sample (open blue circles) at T = 573 K and Q = 2.4 nm^{-1}; the green line is the experimental resolution, the blue line rappresents the inelastic part, the red line is the fit function, and the black line is the background.

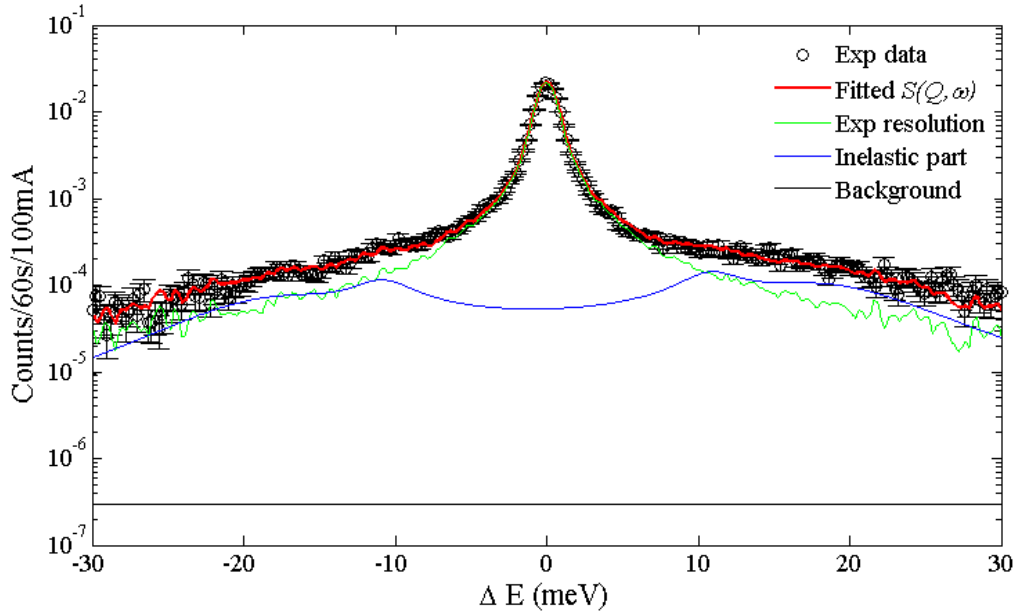

Figure 2: rappresentative IXS spectrum on the 4 GPa sample (open black circles) at T = 573 K and Q = 4.2 nm^{-1}; the green line is the experimental resolution, the blue line rappresents the inelastic part, the red line is the fit function, and the black line is the background.