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Beamline: BL 21	Date of Experiment: from: 21-3-96 to: 24-3-96 SCHEDULED 10-4-96 12-4-96 IN HOUSE RESEARCH	Date of Report:
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Report:

Evidence of high frequency propagating modes in vitreous silica

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A high energy resolution inelastic x-ray scattering study in the 1 ÷ 6 nm^{-1} momentum transfer (Q) region in vitreous silica (u $-SiO_2$) at T = 1050 K shows the existence of collective excitations propagating with a sound velocity of 5800 ± 200 m/s up to Q = 3.5 nm^{-1}. The linewidths of the excitations, which are found to obey a Q^2 law, are consistent with previous determination made at low Q and low T. The picture of the atomic dynamic in u — SiO_2 emerging from this study indicates that the boson Peak is associated to propagating rather than to localized or relaxational modes.

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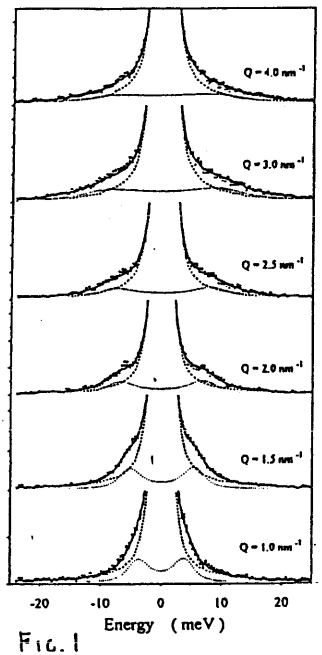

Fig. 1

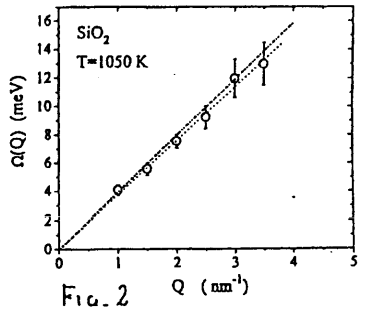

Fig. 2

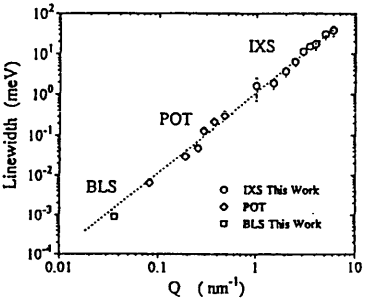

Fig. 3

FIG. 1 - **X-ray spectra of** $v-SiO_2$ **at T=1050** K taken **at** different Q-values. The data arc shown together with their best fits (full line) and the individual contributions to the fitting function: elastic peak (dashed line), and inelastic components (dotted line).

FIG. 2 - Excitations energy, $\Omega(Q)$, from the DHO model for the data taken up to' $Q \leq 3.5$ nm^{-1}, see text. The dotted line is the best fit to $\Omega(Q)$ and has a slope of 5800 m/s; the dot-dashed line has the slope of 6050 m/S, i.e. the sound velocity derived from the measured elastic constant at zero frequency.

FIG. 3- Full width at half maximum of the excitations as measured with different techniques. Open circles represent the parameter $\Gamma(Q)$ of the DHO model (eq. (1)) obtained from the fit of the MS data. The error bars for the data at Q = 4, 5 and 6 nm^{-1} represent the range of variability obtained for different choices of $\Omega(Q)$. Open diamonds refer data obtained using the picosecond optical technique (POT). The open square is from. Brillouin light scattering data (BLS). The dashed line is the best fit to the IXS data and has a slope of 1.95.