MS10.02.08 HIGH FREQUENCY COLLECTIVE EXCITATIONS IN LIQUID AND SOLID WATER BY INELASTIC X-RAY SCATTERING. G. Ruocco[1], U. Bergmann[2], M. Krisch[2], C. Masciovecchio[2], V. Mazzacurati[1], F. Sette[2], G. Signorelli[1], R. Verbeni[2]. [1]Universita' di L'Aquila and INFM, I-67100, L'Aquila, Italy; [2]ESRF, B.P. 220 F-38043 Grenoble Cedex, France

Since the development of intense and collimated synchrotron sources, inelastic x-ray scattering with meV energy resolution has attracted an increasing interest for its potential applications in the study of the high frequency collective dynamics in condensed matter. This is traditionally the domain of neutron spectroscopies. Neutron techniques, however, due to kinematc limitations, are difficult to use on systems with a speed of sound larger than 1000 m/s and without translational invariance. These limitations are overcome using x-rays with 10-20 KeV energy and 1-3 meV energy resolution. The performance of the ring at the European Synchrotron Radiation Source in Grenoble, with its unprecedented low emittance, and our development of new and performing perfect crystal optics, allowed us to construct an undulator based beamline for inelastic x-ray scattering, and to obtain 1.4 meV energy resolution and high flux. We will present an outline of the instrument and of the technique. We will then concentrate on a study of the dynamic structure factor, S(Q,W), of water in the Q=1-10 nm^{-1} region. We show i) the existence in the whole investigated Q-region of longitudinal collective dynamics propagating, at Q > 4 nm^{-1}, with a speed of sound of 3200 m/s, more than a factor of two larger than that in the hydrodinamic limit (fast sound phenomenon); and ii) the existence, in the Q=4-10 nm^{-1} region, of a second, weakly dispersing excitation with 4 meV peak energy. The fast sound phenomenom is discussed in view of existing theories, previous neutron data, and in connection to our study on solid water (ice Ih), were we point out that exists a mesoscopic wavelength region where the collective dynamics in the solid and in the liquid show striking similarities. The transition between the fast sound and the normal (hydrodynamical) behaviour of the density fluctuations takes place when the energy of the sound-like excitations equals that of the second mode, that it is show to be the reminescent of a transverse optical branch in ice Ih.

PS10.02.09 2-D SAXS INVESTIGATION OF POLARIZING GLASSES. S. Polizzi, P. Riello, G. Fagherazzi, Universita di Venezia (Italy), M.Bark, Universitat Ulm & Hasylab, Hamburg (Germany), N. F. Borrelli, Corning Glass R. & D., Corning, (N.Y.-USA)

The investigated materials (Polarcor™) are alkali aluminoborosilicate glassy platelets where an Ag(Cl,Br) microcrystalline phase (~ 1 wt.%) was thermally developed at 725°C. Redrawing these samples, at temperature above their softening point, causes the microcrystalline particles to assume very elongated ellipsoidal shape with the major axis parallel to the stretching direction. A chemical reduction of this phase with H_2 at 430°C, gives rise, inside the superficial layers of the platelet, to Ag oriented particles which are responsible for the observed polarizing properties. Because of the higher density of Ag in comparison with Ag(Cl,Br), particles are expected to shrink or broken up during reduction. The present structural investigation has characterised this process by means of a bidimensional SAXS study accompanied by WAXS analysis. The elliptic bidimensional section of the ellipsoidal object obtained in the the reciprocal space of measure using the X-ray Hasylab synchrotron source (point-like beam), was scanned with a 2D-detector. These experimental intensities, properly corrected, were fitted with the following equation:

$$I(\mathbf{h}) = \iint D(a, b) I_o(\mathbf{h}, a, b) da db$$

where $I_o(\mathbf{h},a,b)$ is the scattering intensity of an ellipsoidal particle with semi-axes a and b, D(a,b) is a Weibull distribution function ($|\mathbf{h}|=4\pi\sin(\theta)/\lambda$ with 2θ the scattering angle). Since upon strecthing the volume of the original droplets must keep constant, we introduced a constraint between a and b based on fluidodynamic arguments (T. P. Seward, J. Non-Cryst. Sol. 15, 1974, 487).

The so-obtained particle distribution functions before chemical reduction have volumetric average dimensions of 25 x 370 nm, with the distribution of the major axis skewed up to length values of 1200 nm. After reduction, a second distribution of aligned short particles (average dimensions of 15 x 30nm) grows up to the detriment of the main distribution, whose shape however remains practically constant in the un-reduced core of the glassy platelet.

PS10.02.10 STRUCTURAL TRANSFORMATIONS OF HEATED FERRO-BASED AMORPHOUS ALLOYS. A.S. Veksler, G.A. Kuznetsova, V.I. Boldyrev, A.L. Ivanovsky. Irkutsk State University, Institute of Applied Physics. 20 Gagarin Blvd. Irkutsk, 664003 ,Russia.

The X-radiographic investigation of thermal transformations of the structures of ferro-based X-ray amorphous alloys $Fe_{81}B_{13}.^5Si_{3,5}C_2$. $Fe_{73}Co_{12}B_{15}$, $Fe_{64}Co_{21}B_{15}$ was made. The alloys were produced by the single-roll melt quenching method in the form of ribbons 30 mkm thick, 10 mm wide. The thermal processing was being done in the mode of isothermic annealing with the air present with in the temperature range of 150-700° C. The phase composition of the annealed ribbons and the degree of crystallinity (the quantity of amorphous phase) were X-radiographically controlled. The functions of radial distribution of atomic density were calculated, the coordination numbers were defined.

It was stated that if the T of the heating of the ribbons is increased, the process of crystallization begins to develop, the progress of which depends on the element composition of the alloys.

Depending on the composition of the alloys at different temperatures the crystalline phases α-Fe, FeSi, $FeSi_2$, Fe_2BC; γ-Fe, FeB,Fe_3C; α-Fe,γ-Fe, FeSi, $FeSi_2$, FeB and Fe_2B are registered. If the amount of admixture elements is diminished, the amount of α-Fe in the annealed substance is increased. When the T of the heating is increased from 350 to 700° C the sizes of crystals are significantly increased which is shown by the diminishing of the half-width of the correspondent reflections three times approximately. The process of crystallization is very intensive at the initial stages, but when the T is 600-700° C, it slows down and with the modes of thermal processing applied at 700° C this process is not complete. The received data are in on agreement with the results of the investigation of photothermostimulated exoelectronic emission and differential thermal analysis.