IXS study of secondary modes in the high frequency dynamics of liquid Gallium

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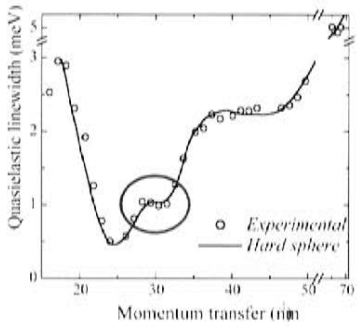
The main purpose of the experiment was to ascertain the presence of secondary modes in the dynamic structure factor of liquid Gallium, just above the melting temperature. The experiment was somehow motivated by previous Neutron Scattering measurements performed at high temperature in which evidence of optic-like modes, beside the usual acoustic branch, had been reported [1].
Our experiment (performed at room temperature) did not show any trace of inelastic modes around momentum transfers comparable above the first sharp diffraction peak, although evidence for an acoustic branch had been previously reported [2].
This notwithstanding, we observed the presence of a diffusive mode, the so called extended heat mode, which can be rationalized within kinetic theory applied to hard sphere fluids.
For hard spheres, indeed, a connection exist between the structure (the static structure factor) and the dynamics (the full width half maximum of the quasielastic mode), which only relies on the value of the Enskog's diffusion coefficient and the hard sphere diameter.
Although Gallium has a structure which strongly deviates from the one of an hard sphere system, it seems possible to define an effective hard sphere diameter and to reproduce the full width of the quasielastic mode utilizing the prescription holding for hard spheres.
A more detailed analysis will help to clarify the connection between non simple liquids like gallium and an elemental fluid like the hard sphere liquid.



[1] F. J. Bermejo et al., Phys. Rev. E, 56, 3358, (1997).
[2] T. Scopigno et al., Phys. Rev. Lett. 89, 255506, (2002).

Study about the mechanisms of action between in production of ROS(reactive oxygen species) by trace elements and inflammation processes using SR(Synchrotron Radiation) micro beam

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Stimulated neutrophils generate reactive oxygen species(ROS). Human neutrophil-like cells, dimethylsulfoxide-differentiated HL60 (DMSO-HL60) generate ROS, too. It has been suggested that ROS caused various diseases. Especially, hydroxyl radical(OH・) reacts with most biomolecules. OH・ is produced by the the Fenton reaction between H_2O_2 and transition metal. When this reaction is caused, It is possible that the oxidation state of transition metal changes. If the oxidation state of transition metal changes, we could confirm the Fenton reaction visibly. This time, we have investigated the iron oxidation state in DMSO-HL60 and stimulated DMSO-HL60. We have used 100nM PMA(Phorbol myristate acetate) for stimulation. We have analyzed the X-ray absorption near edge structure(XANES) in fluorescence mode for the determination of the iron oxidation states in samples. Fig.1,2 shows results. Fe^{3+} were major oxidation state in both samples. As a result, it is possible that the iron oxidation state hardly change by the Fenton reaction in DMSO-HL60.

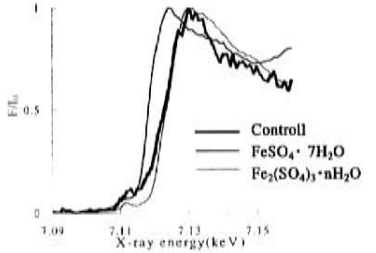

Fig.1.Fe K-edge XANES spectra of DMSO-HL60(Controll)

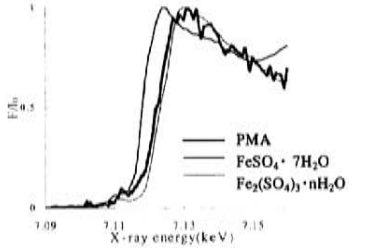

Fig.2 Fe K-edge XANES spectra of stimulated DMSO-HL60 (PMA)
I_0:The strength of incidence X-ray
F:The strength of the iron X-ray fluorescence