	Experiment title: Structural studies of expanded liquid alkali metals	Experiment number: HS–1083
Beamline: ID30	**Date of experiment**: from: 1 Oct. 1999 to: 4 Oct. 1999	**Date of report**: 4 Sept. 2000
Shifts: 9	**Local contact(s)**: Mohamed Mezouar	*Received at ESRF:*

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Report:

Liquid Alkali metals are typical examples of fluids with state dependent structural and electronic properties. On expanding them along their liquid-vapour coexistence curves, a density driven metal-insulator transition takes place close to their critical points. This phenomenon has already been subject of a number of studies on electrical-, optical-, magnetic- and structural properties, as well as equation of state data of these systems.

Elastic scattering experiments can provide information on density dependent structural changes. Attempts using elastic neutron scattering on liquid Rb [1] was not satisfactory due to the small neutron scattering cross section, too low flux, and limited machine time. As shown in our ESRF report and paper [2], the accuracy in our previous x-ray scattering experiments, made it possible to pricisely investigate the scattering law. In this report, we present our improved structural data obtained during the recent beamtime.

The experiments were carried out in a transmission mode using monochromatized high-energy x-rays of about 50 keV and a fast imaging plate detector. The experimental conditions of high temperatures up to 1300 °C and high pressures up to 40 bar were achieved using an internally heated high-pressure vessel. The liquid sample was contained in a single-crystal sapphire cell having a sample thickness of 2 mm and a wall thickness of 0.25 mm. Typical measuring times for one thermodynamic condition in our experiments were only two or three minutes until getting reasonable statistics. Several improvements will be applied to the setup to solve the problems found in the last experiment as given in the proposal.

Figure 1 depicts *S*(*Q*)s of liquid Rb up to 1300 °C and 40 bar along the liquid-vapour coexistence curve. As is also shown in ref. [2], the improvement in staistics is significant compare to the neutron data [1]. Moreover, missing points in the results of the previous x-ray experiment due to impurities in the Be window [2] was almost covered in the present results. Figure 2 exhibits the density dependence of the nearest-neighbour distance r_1 and the coordination number N_1 obtained from *g*(*r*)s. Circles indicate the present results, and triangles the neutron results [1]. In accord with the older results, we found that the density effect in r_1 is very small, while N_1 decreases rapidly during expansion. Closer inspection revealed that N_1 deviates from linear decrease with decreasing density.

[1] G. Franz, W. Freyland, W. Gläser, F. Hemsel, and E. Schneider, J. Phys. (Paris) **41**, C8-194 (1980).

[2] S. Hosokawa, W.-C. Pilgrim, F. Hensel, J.-L. Hazemann, D. Raoux, M. Mezouar, T. Le Bihan and D. Häusermann, J. Non-Cryst. Solids **250-252**, 159 (1999); ESRF Reports SC-366.

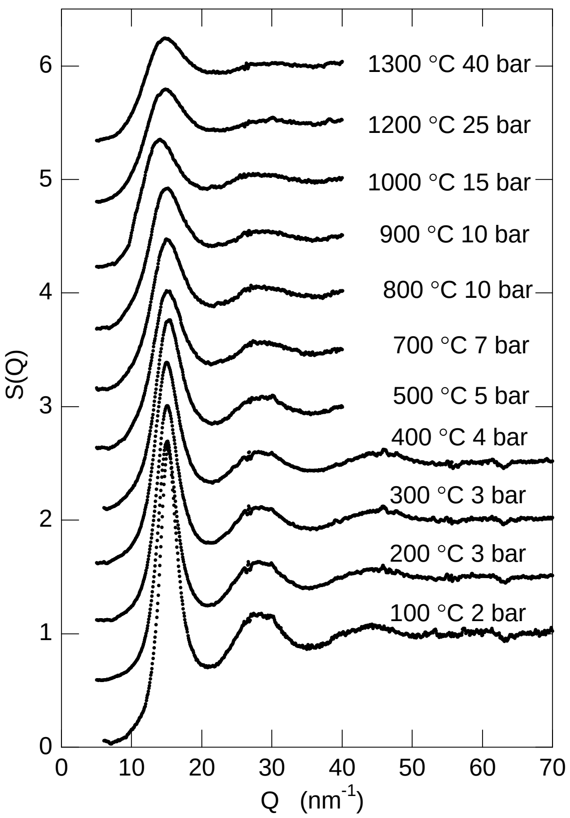

Fig. 1

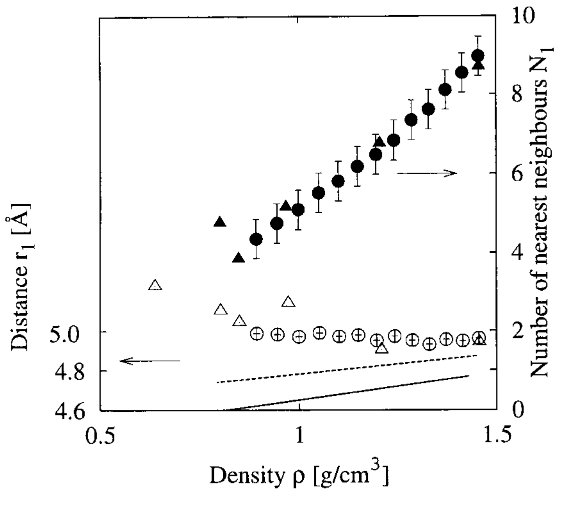

Fig. 2