ESRF	**Experiment title:** Dynamics of polymer gels using coherent X-rays	**Experiment number:** SC371
Beamline: ID10	**Date of experiment:** from:26/11/97 to:30/11/97	**Date of report:** 26/02/98
Shifts: 15	**Local contact(s):** D.Abernathy	*Received at ESRF:* 02 MAR. 1998

Names and affiliations of applicants (* indicates experimentalists):

E. Geissler Laboratoire de Spectrometrie Physique, UJF Grenoble
C.Lartigue Laboratoire de Spectrometrie Physique, UJF Grenoble
A.M.Hecht Laboratoire de Spectrometrie Physique, UJF Grenoble
F.Livet LPTCM, INPG Grenoble
F.Bley LPTCM, INPG Grenoble
J.Mainville University of Siegen, Germany

Report:

This experiment was to measure the relative intensities of the dynamic and the static contributions to the light scattered by a polymer gel. First, the coherence characteristics and stability of the beam were calibrated using a silica aerogel, which provides good contrast and whose signal extends beyond 0.1Å. An 8μm pinhole and the S2 slits were adjusted to maximize the intensity and stability of the resulting beam. The droplet algorithm was used to remove background noise and also to reduce the size of the image files. Scattering patterns, collected every 0.5 seconds for periods of about 2000 seconds, were analysed in circular arcs around the beam centre. By sequencing these spectra the correlation functions of the intensity I(t) were calculated over the range of $0.002 \leq q \leq 0.01$ $Å^{-1}$. The resulting optical coherence factor $\beta = (\langle I^2 \rangle - \langle I \rangle^2)/\langle I \rangle^2$ was roughly 0.25. This is a great improvement over the value found in April 1996, $\beta \approx 0.05$. During the course of this experiment, however, β fell to about 0.16. This loss seems to be due to mechanical drift of the different elements in the beamline.

The second step in these observations involved measuring the time variation of the speckle pattern scattered from a melt of poly(dimethy1 siloxane) containing the silica filler. Again, images were collected every 0.5 s for periods of about 2000s. The time

correlation functions were constructed as a function of wave vector q. These decayed with a characteristic rate Γ. Figure 1 shows the resulting values of Γ/q plotted as a function of q; in this figure these values are compared with those obtained from the same system by dynamic light scattering. The latter measurements were performed at large angles only (110° and 150°) on account of the very long time constants. Good matching is found between the two techniques. In the observed range of q, the fact that Γ is proportional to q and not to q^2 shows that it is not translational diffusion of the silica clusters that is being measured, but rather internal modes. In addition, since the light scattering measurements were performed in the homodyne mode, the agreement between these measurements confirms that the detection mode in the X-ray case is also homodyne.

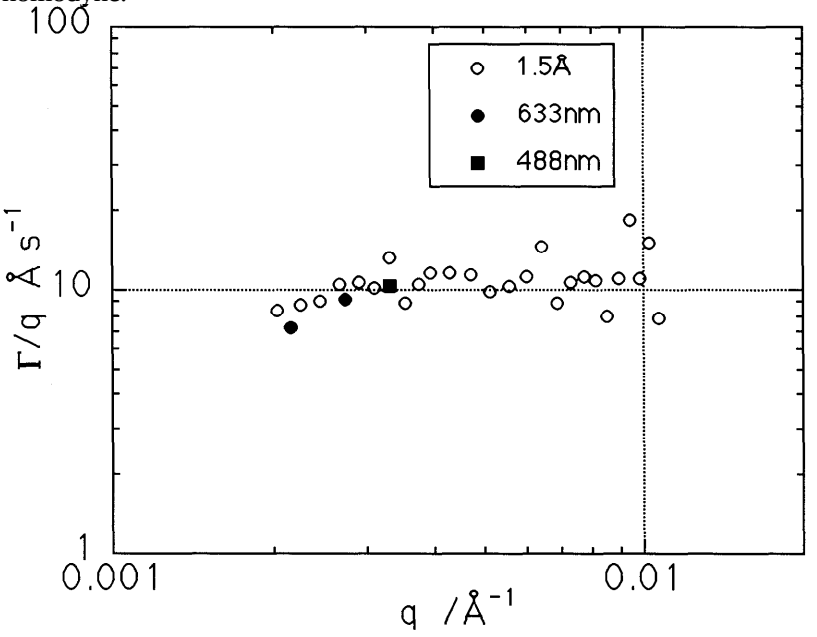

Figure 1 Reduced relaxation rate Γ/q of homodyne intensity correlation functions from silica-PDMS suspension as a function of transfer wave vector q; open symbols: IDlO, λ=1.5Å, filled symbols: dynamic light scattering; filled circles: λ=6328Å, filled square λ=4880 Å.

The third step of this experiment involved measurement of the response of the fluorinated gel swollen in acetone. The signal from this sample, although much stronger than from other gel systems, is nonetheless considerably weaker than that from specimens containing silica particles. These results are still undergoing analysis.