ESRF	**Experiment title:** Irreversible precipitate coarsening of $Al_{0.91}Li_{O.09}andspeckleflfluctuations.$	**Experiment number:** HS-484
Beamline: ID10A	**Date of experiment:** from: 06 April 1998 to: 13 April 1998	**Date of report:** 11 Sept 2002
Shifts: 18	**Local contact(s):** D. ABERNATHY	*Received at ESRF:*

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Report:
After quench from the high temperature disordered state at room temperature, the single crystal of $AlLi$ was "in situ" aged. at $220C$. The X-ray beam was coherent, and the time evolution of the speckle structure was observed with a "Direct Illumination" CCD detector. The overall degree of coherence of the experimental setup was $\beta \simeq 0.25$.

Typical (incoherent) results The observed scattering in this system is isotropic, if the speckle structure is suitably averaged, as observed in classical (incoherent) Small Angles X-ray Scattering (SAXS).

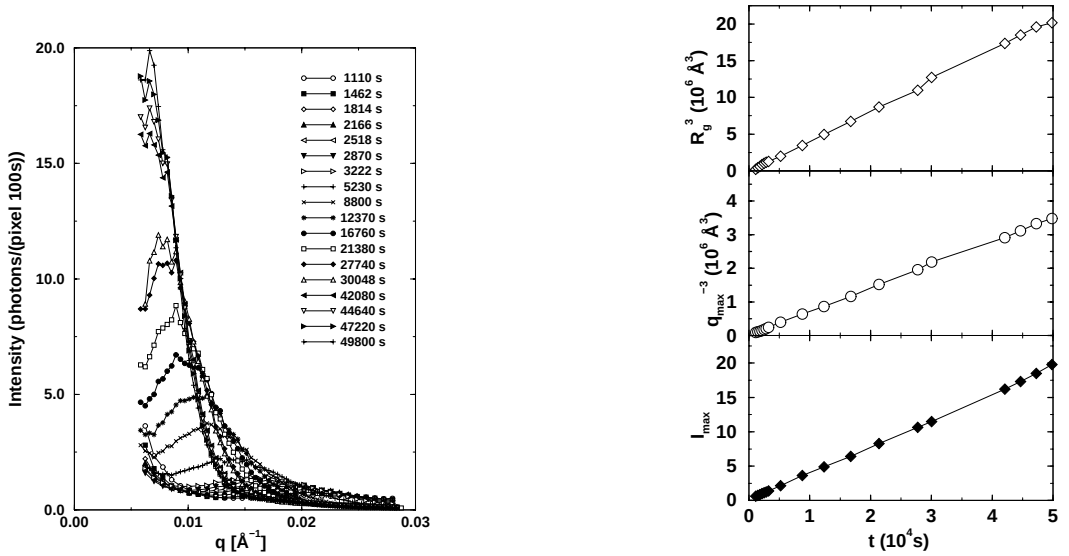

Figure 1: time evolution of the cylindrically averaged intensity observed and of various estimates of the average radius

The system studied clearly shows a $t^{1/3}$ increase of the average radius R of the spherical preciitates.

Coherent scattering During the irreversible evolution of the sample, the speckle structure has been followed. A normalization of the scattering by the averaged intensity of Fig. 1 was carried out, and a normalized scattering was obtained.

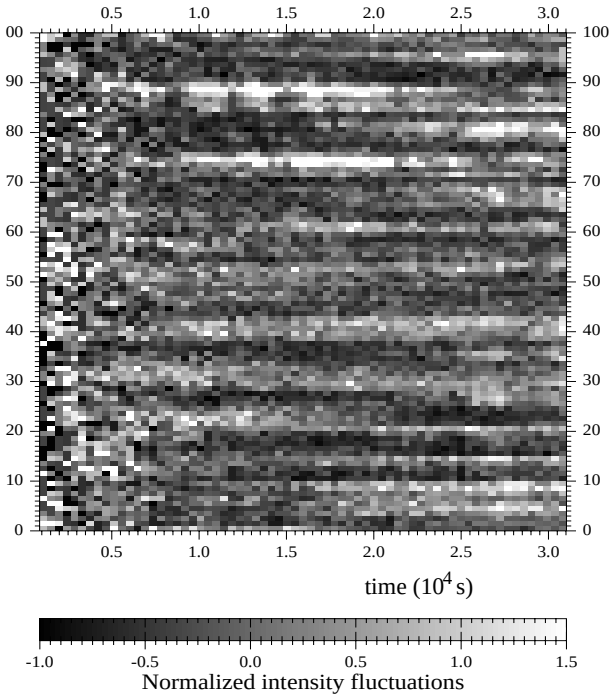

Figure 2 Time evolution of the speckles during the quench process after normalization by average intensity

In Figure 2 are shown the time evolution of this normalized intensity for a set of pixels corresponding to the same $|q|$ value ($q = 0.0117\text{Å}^{-1}$). Main feature obeseved is the large peristence of this speckle structure, irrespective to the large evolution of the alloy. The time evolution is longer and longer, and increses roughly like the duration of the unmixing process. Notice that such results correspond to a $\simeq$ 10 hours of stabilty of the experiment for the measurement of the speckle pattern.

Discussion Main explanation for this persistence is in the coarsening process itself: preciptates increase size by redissolution of the smallest, but their relative position, which induce speckle interferences, do not change. Only for long time some contribution of surface fluctuations can be observed. All these results are discussed in details in Ref. 1.

We have to mention the high stability of the setup

References

F. Livet, F. Bley, R. Caudron, E. Geissler, D. Abernathy, C. Detlefs, G. Grübel and M. Sutton, Phys. Rev. E, **63**, p. 036108