



Experiment title: Coherent scattering from static and dynamic steps on a Ge(111) surface	Experiment number: SI-3 14	
Beamline: ID3	Date of experiment: from: 26/11/97 to: 4/12/97	Date of report: 23/2/98
Shifts: 18	Local contact(s): S. Ferrer	<i>Received at ESRF:</i> - 3 MAR. 1998

Names and affiliations of applicants (* indicates experimentalists):

S.A. de Vries* and E. Vlieg*, FOM-institute AMOLF, Kruislaan 407, 1098 SJ Amsterdam
M. James*, Dept. of Chemical Physics, University of Groningen, Nijenborgh 4,9747 AG Groningen, The Netherlands
J. Alvarez* and S. Ferrer*, ESRF

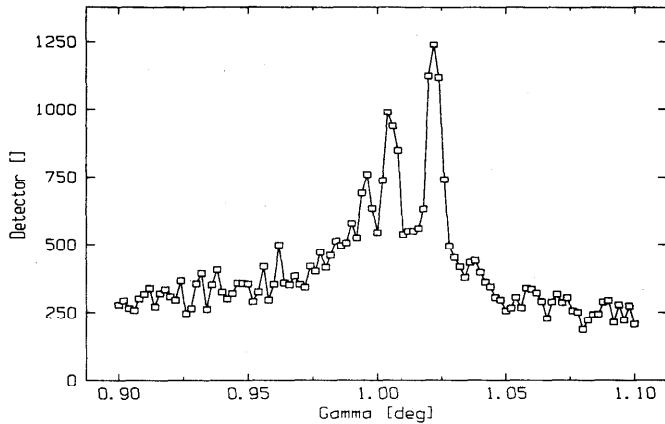
Report:

The aim of this experiment was the observation of coherent scattering (speckle) from the steps of a Ge(111) surface. The idea was to see initially the speckle pattern from static steps and then to observe the step dynamics by depositing Ge or by sublimating the surface. For a number of reasons (briefly described below) we unfortunately never reached that stage of the experiment.

In an earlier run on ID-3 (experiment SI-162) we had successfully tested adjustable slits as an alternative to static pinholes for the generation of a coherent X-ray beam. These results have been published [1]. An important potential advantage of these slits is that one can easily change from coherent conditions (μm -size slit settings, low flux) to incoherent conditions (mm slit sizes and normal flux). This in principle allows one to quickly optimize and characterize the sample. Most unfortunately, however, the slits that had before performed flawlessly now gave numerous problems. With significant loss of beamtime we were able to use these slits in an improvised and less efficient manner. (Micro-Controle, the manufacturer of the slits, claims to have solved the problems with our slits in the meantime).

A second drawback concerned the CCD camera. It turned out that the spatial resolution was less than expected and insufficient to resolve the speckle pattern that we anticipated. This again required some improvisation using 'pin-hole slits' in front of the normal scintillation detector. Sample preparation gave no problems.

Using this set-up we saw a pattern (see figure) resembling the speckle patterns that were observed by Libbert et al. on Si wafers [2]. This occurred only a few hours before a one day shut down in our run. We were not able to do consistency and reproducibility checks, so we are uncertain about the exact nature of these peaks. We have not given up hope to finish this experiment successfully in the future, but will only try another time if we are fully confident in the repaired slits and if a more suitable detector system is available.



A detector scan along the gamma (= out-of-plane) direction through a specular reflection of Ge(111). The spikes in the profile resemble a speckle pattern, but no time was available to reproduce these results.

References:

- [1] Slits as adjustable pinholes for coherent X-ray scattering experiments, E. Vlieg, S.A. de Vries, J. Alvarez and S. Ferrer, J. Synchrotron Rad. 4 (1997) 210.
- [2] Speckle in coherent x-ray reflectivity from Si(111) wafers, J.L. Libbert, R. Pindak, S.B. Dierker and I.K. Robinson, Phys. Rev. B56 (1997) 6454.