ESRF	**Experiment title:** **Anomalous diffuse scattering on Si_xGe_{1-x} single crystals.**	**Experiment number**: Hs 1398
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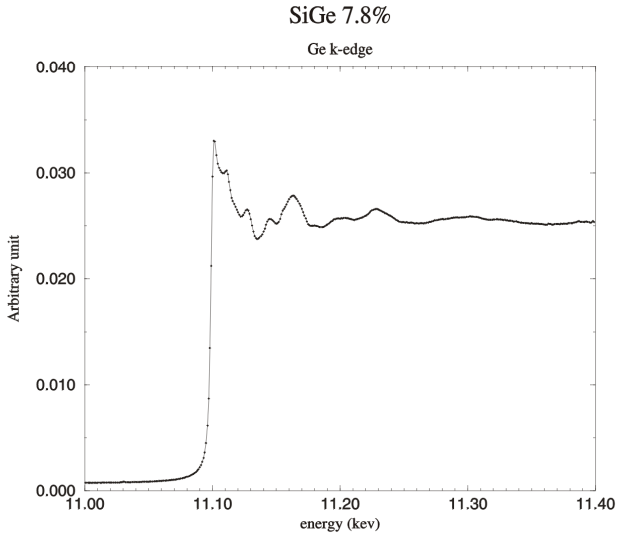
Report:

The SiGe system has been extensively studied because the carrier mobility is much higher than in pure silicon which gives rise to considerable gain in performance [1]. The study of the local atomic environment is a fundamental problem and gives rise to controversy. Several theoretical studies predict a miscibility gap in the Si-Ge, supported by experiments on a polycrystalline $Si_{0.5}Ge_{0.5}$ solid solution or long-range ordered structures (observed in thin films). Thus it was not at all clear whether chemical short range order in our bulk crystals would favor ordering, clustering or total randomness.

For a more fundamental understanding of the Si-Ge alloy system, a study of the equilibrium phase *bulk* specimens has been carried out on id01.



Several samples have been studied: $Si_{92}Ge_8$, $Si_{90}Ge_{10}$ and $Si_{85.5}Ge_{14.5}$ single crystals. The experiment has been divided as follows:

1. Diffuse intensity has been measured at small wave vectors (Q_{min} =10^{-3} $Å^{-1}$) and room temperature, using a CCD (Princeton camera) located at 1.75m from the sample in a complete vacuum environment and a 1mm in diameter beamstop (transmission geometry at E=10.5 keV). Despite those good experimental conditions, no significant diffuse intensity has been measured even at larger Q: no clustering tendency exists in the $Si_{92}Ge_8$ sample.

2. Exafs measurements have been carried out on the $Si_{92}Ge_8$ single crystal (see figure above). The nice fine structure should give the conditional probability of the presence of a given atom for the first shell. The data analysis is not finished yet.

Except those 2 results, the experiment was very disappointing. The main goals of the proposal could not be completed because of technical problems:

a. Problems with the analyser: the (400) Bragg reflection of the graphite analyser displays a bad profile at 11 keV. The parasitic reflections could be due to the high penetration depth at this energy and the bad quality of the crystal in depth.
b. Problem with the chi motor of the diffractometer: bad resolution and problems with the power supply.
c. Network problem with SPEC.
d. Finally, the cryostat has not been used because of a lack of time and problems with the setup.

3. At wide angles, the diffuse intensity around Bragg reflections throughout the first Brillouin zone has been investigated. However, because of technical problems described above and problems with the cryostat, only the (100) plane has been investigated at room temperature.

In the same way, anomalous scattering at the Ge K-edge (in order to separate size effects from the Huang and TDS) could not be done. Only radial scans showing the clear presence of size effects (already displayed in our last paper) have been observed.

This lack of measurement does not allow us to get any quantitative measurement about the chemical short range order
and the size effects in our sample. This question (which was the main goal of our proposal) remains unsolved.