ESRF	**Experiment title:** Diffuse scattering from decagonal AlNiCo: Investigation by anomalous scattering	**Experiment number:** HS 287
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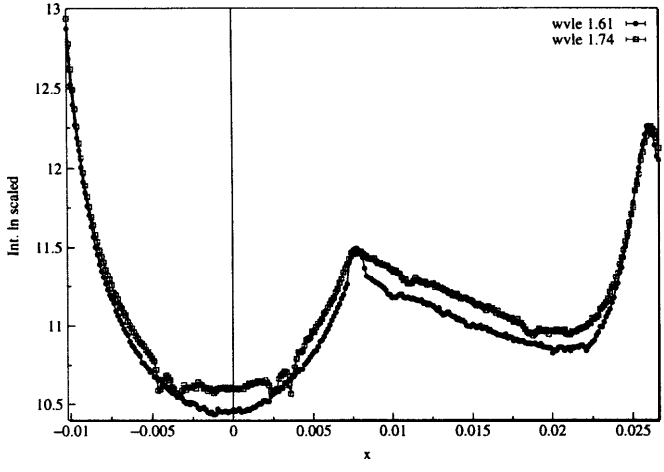
Report: Quasicrystalline decagonal AlNiCo has been found to exhibit structural variations dependent on the precise composition and annealing conditions. Structure analysis of X-ray data should be complemented by results of anomalous dispersion measurements, investigating the largely unknown distribution of the TM (Co, Ni) atoms in the structure. **Apart** from Bragg reflections one observes additional super- and disorder phenomena, for instance satellite reflections around strong Bragg peaks [1]. The role of the TM atoms for disorder and superorder phenomena can be examined by this method. Beamline ID01 has an experimental setup well suited for experiments with this objective, as an evacuated sample chamber and an analyser crystal (graphite) provides low background, so that weak phenomena can be observed. For each wavelength (λ_1=1.61, close to the Co-K edge and λ_2 = 1.74Å) a series of Bragg reflections with varying Q_{perp} and Q_{par} values and satellites were measured for a well characterised sample of $Al_{70}Ni_{15}Co_{15}$.

Preliminary results are: (1) Integrated Bragg intensities show a basic trend towards higher intensities at higher wavelength, the differences of the intensities have yet to be interpreted with structure factor calculations.

(2) 1st and 2nd order satellite reflections (around different Bragg peaks) were measured by ω- type scans for both wavelengths, their positions could be precisely determined.

(3) A comparison of Q-scans across the diffuse streak connecting the satellite and Bragg reflections shows a higher relative (scaled to the intensity of the satellite) difference, suggesting a strong Co contribution for this phenomenon. (cf. fig.)



(4) Due to the low background it was possible to observe 3rd order satellites for the first time.

(5) The 1st and 2nd order satellites are positioned very close to Bragg peaks. Until now, a clear separation had not been possible, which had led to doubts about their actual existence. The ratio of the integrated intensities of the satellites of different orders can now be used to refine the model describing the underlying superorder [2].

(6) ω- scans reveal diffuse scattering near the Bragg reflections, a phenomenon well known for icosahedral phases [3] and recently reported in decagonal AlMnPd [4]. This can be interpreted as being caused by phason disorder, which would lead to a relative increase of the diffuse intensities beneath Bragg peaks with higher Q_{perp} component. The results of the experiment are in agreement with this theory.
The evacuated sample chamber, whilst greatly advantageous in improving the signal to noise ratio, caused problems with some motors evidently not suited to the vacuum conditions.

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