| ESRF | **Experiment title: Initial stages of Cu growth on Ni(OO1) surfaces** | **Experiment number:** SI-358 |
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**Report:**

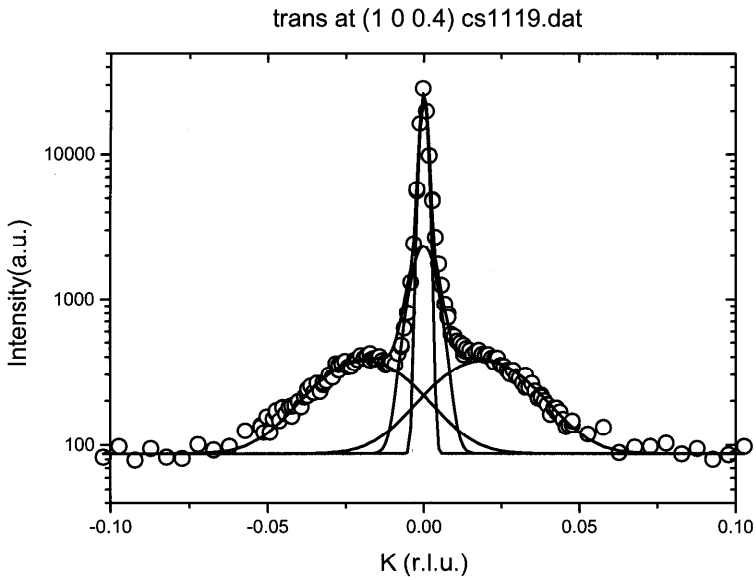
The objective of this experiment was to study the heteroepitaxial growth of Cu on Ni(001) at low Cu coverages.

According to a recent STM-work by Müller *et al.* [ 1 ] irregular Cu islands with a ramified shape are observed on Ni(001) for Cu coverages around 0.2 -0.5 monolayer( This is most unusual as generally compact islands are observed on square lattices. The ramified shapes are characterized by a typical armwidth of around 20 atoms and this was taken as evidence that strain relaxation plays a major role in the growth of Cu on Ni(001) [ 1 ] .

The Ni substrate was prepared by cycles of Ar-ion sputtering and annealing and characterized by (1 0L) and (11 L) rod scans (LEED coordinates). Then Cu was evaporated *in situ* using a Knudsen Cell while monitoring the growth by recording the intensity of scattered x-rays close to the out of phase condition at (001). From the obtained growth curve a calibration of the Cu source was obtained.

The growth of Cu was studied by interrupting the growth after deposition of a small amount of Cu (-0.05 ML) and recording transverse and longitudinal scans in k-space before continuing growth. Several growth experiments were performed all starting with a clean Ni crystal and continuing to coverages above 1 ML.

A typical transverse scan at (1 0 0.4) after deposition of 0.27 ML is shown in the figure.




The scan is characterized by a sharp peak and a broad bell shaped foot. The sharp peak is the crystal truncation rod of the Ni substrate whereas the broad peak is the distinct feature of the Cu islands observed even at coverages as low as 0.05 ML.

Through detailed analysis of the aquired data in combination with model calculations we conclude that the Cu islands are epitaxial with the Ni substrate and characterized by two different length scales (rectangular islands). The Cu atoms are located at substrate lattice sites and no relaxation of the islands with respect to the substrate is observed although the data does allow for a small(<2%) relaxation of the outermost atoms around the rim of the islands,

The results obtained in this study confirm the basic picture put foreward by Müller et ***al.*** [1], providing direct information of the epitaxi on the Cu islands with the substrate and giving a quantitative upper limit on the strain relaxation of the Cu atoms. This last point is important with regard to the origin of the ramified island shapes and allows for a direct comparison with Effective Medium Theory calculations [1].

[ 1 ] : B. Müller, L. Nedelmann, B. Fischer, H. Brune, J. V. Barth and K. Kern, Phys. Rev Lett.,80,2642, (1998).