SI1406 Experimental report

Experiment from 27 January to 5 February 2007

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Report

We report on the surface crystallography of (R)-(-)-2-amino-1-propanol (C_3H_9NO, also known as alaninol) deposition on Cu(001) surface. The diffraction measurements were performed at 8.84 keV, slightly below the Cu K-edge to minimize the radiation damage to the molecules from scattered electrons. The synchrotron ring was operating in 16 bunch mode (maximum ring current 90 mA). The beam size before the sample was 60 microns (H) x 160 microns (V) full width at half maximum (FWHM) with a flux of 7.4 10^{12} photons/s at 80 mA. A PG (002) analyzer was used to reduce the background. Clean Cu(001) surface was prepared using sputtering and annealing cycles. The surface quality was checked with Auger spectroscopy and CTR measurements. A monolayer of alaninol molecules was then deposited at room temperature on the clean surface. Diffraction peaks were observed at the predicted position from previous LEED measurements. The (4 -1) x (1 4) reconstruction was confirmed with an intensity of 1200 cts/s in the (2 0 0.2) peak of the molecule reciprocal lattice as shown in Fig. 1. The width of the peak is around 0.02 rlu which gives an ordered size of the domain of more than 500 Å. The evolution of the (2 0 0.2) integrated intensity and FWHM during the deposition is given in Fig. 2.

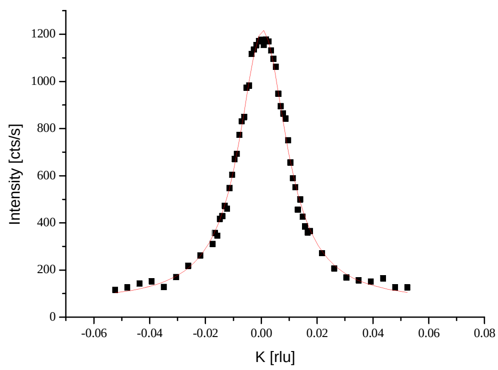

Figure 1. Surface diffraction peak from the (2 0 0.2) reflection of the alaninol film on a clean Cu(001).

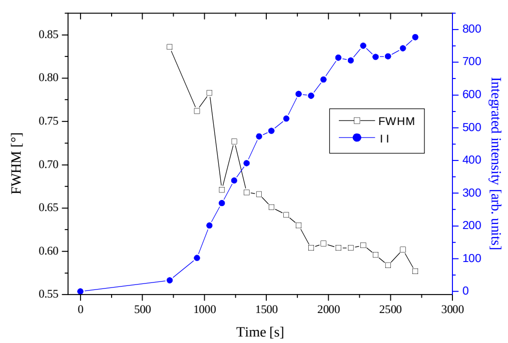

Figure 2. Integrated intensity and FWHM of (2 0 0.2) reflection as a function of time during alaninol deposition.

We also looked at the film as a function of the substrate temperature. The film, stable for more than a day under X-ray exposure disappears within seconds when the Cu is heated above 60 °C. The intensity of the (2 0 0.2) reflection as a function of the substrate temperature is shown in Fig. 3.

Figure 4 shows the intensity of the (2 0) and (2 2) surface peaks as a function of L. The period of the two reflections is different. A set of reciprocal lattice reflections at different L values was carefully measured to extract the exact configuration of the molecules on the surface. The analysis is under way.

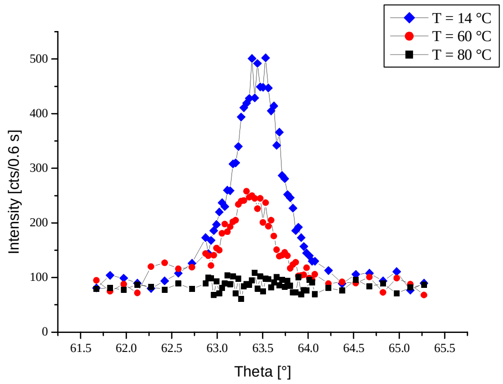

Figure 3. Rocking scans of the (2 0 0.2) reflection as a function of the Cu(001) substrate temperature.

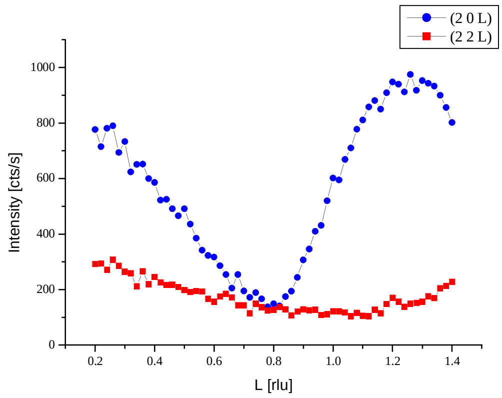

Figure 4. L-scans along two reflections originating from the ordered surface alaninol film.

In conclusion, we successfully perform X-ray surface diffraction study of alaninol deposited on clean Cu(001) surface; the analysis of the obtained experimental data, in progress, will permit to determine the adsorption geometry of the molecules on the surface.