Self-assembled structure of glycine on Cu(111) surface

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SUMMARY:

In this study, we performed scanning tunneling microscopy/spectroscopy (STM/STS) on the self-assembled structure of glycine molecules adsorbed on a Cu(111) surface. From the results, we found some interesting phenomena, suggesting that self-assembly of molecules can realize the novel low-dimensional properties on metal surfaces.

INTRODUCTION:

Molecular self-assembly on surfaces plays a promising role in the rapidly growing area of nanotechnology, especially within the area of the realization of future molecular devices. Control of interactions on the molecular scale is a key factor in designing nanostructures and their properties for the application. The simplest amino acid, glycine, is one of the most favorable adsorbates that initiate a research to understand the mechanism of the interactions between the organic nanostructures and solid substrates. In addition, a well-defined Cu(111) single crystal surface is a good candidate as a substrate for the purpose, which originally has two dimensional free electronic gas states (2DEG) around the Fermi energy level, and strong interactions are expected between molecules and the substrate [1,2].

EXPERIMENTALS:

A clean Cu(111) surface was prepared by Ar^+ sputtering and annealing (820 K) cycles in ultra high vacuum. Glycine molecules were evaporated from an Al_2O_3 crucible (350 K) to a Cu(111) substrate kept at room temperature. STM/STS measurements were performed at 5 K using an electrochemically sharpened tungsten tip (Φ= 0.3 mm).

RESULTS AND DISCUSSION:

Figure 1 shows a typical STM image observed at 5 K. A hexagonal structure consisting of six trimers is clearly shown. The adsorbed molecules make a periodic structure through the balance of the interactions among the trimers and the substrate. A remarkable point is that the STS spectra measured on the Cu surface in the hexagonal structure is completely different from that of the bare Cu surface (Fig. 2). Especially, the difference in the sample bias region from -400 mV to –100 mV shows that the original 2DEG on Cu(111) surface were changed by surrounding molecules. Details will be discussed at the colloquium.

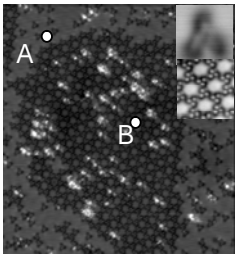

Fig.1 STM image

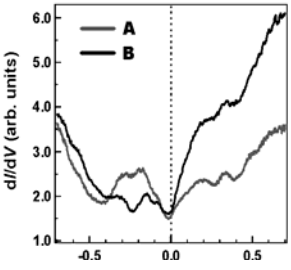

Fig.2 STS spectra

CONCLUSIONS:

Using STM/STS, we observed a self-assembled structure of glycine molecules and modified Cu(111) surface states by the molecular structures . This seems to indicate a way of realization and controlling novel low-dimensional properties to result in better performances of molecular devices.

REFERENCES:

(1) Kanazawa, K. *et al*.; *Phys. Rev. Lett*. **2007**, 99, 216102.
(2) Kanazawa, K. *et al*.; *J. Am. Chem. Soc*. **2007**, 129740-129741.