

Chiral-selective growth of amino acid molecules self assembled on Cu(111) studied by STM

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Recently, formation and control of the novel low-dimensional structures by using self-assembled organic molecular structures have been energetically studied. In order to control them desirably, interaction among molecules and between molecules and substrates, which are induced by functional groups of organic molecules, must be investigated in detail. For this purpose, we have studied molecular structures of amino acids adsorbed on Cu substrates using scanning tunneling microscopy (STM).

Previously, we reported that glycine molecules adsorbed on a Cu(111) surface form two types of homochiral trimer network structures. However, since their chirality was determined when the molecules are adsorbed on the surface, we could not completely conclude that it is a chiral-selective self-assembly of amino acid molecules. Therefore, in order to understand the mechanism of the chiral-selective self-assembly in detail, we have investigated growth process of glycine trimer network on Cu(111) surface with pre-adsorption of small amount of L-alanine molecules. A clean Cu(111) surface was prepared by Ar⁺ sputtering (5 mins) and annealing (800 K) cycles in ultra high vacuum. L-alanine and glycine were evaporated from an Al₂O₃ crucible (about 350K) to a Cu(111) surface kept at room temperature. STM measurements were performed at 77 K.

Figure 1 shows a STM image of glycine molecules adsorbed on L-alanine/Cu(111) surface. In this image, all glycine molecules self-assembled into L-type chiral trimer networks and no D-type networks existed. This result is in contrast to the case of glycine adsorbed on bare Cu(111) where both L and D type chiral networks formed on the surface. These results suggest that small L-alanine networks prior to glycine adsorption served as nucleation centers and triggered chiral selective growth of glycine molecular networks.

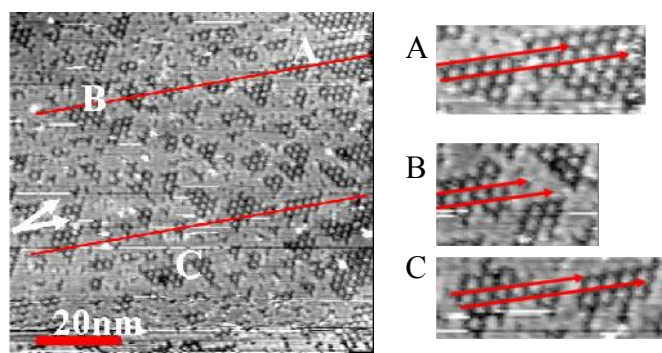


Fig.1 : STM image of glycine adsorbed on alanine/Cu(111) ($V_s=-1V$,
 $I=0.1nA$. Arrows are the guide for the orientation of network structure