STM/STS on the standing wave of anisotropic dispersion relations observed in self-assembled glycine monolayers on Cu(100)

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Control of electronic states in organic molecular films, for example, by chemical modification of functional groups, is one of the key technologies for realizing future novel molecular devices. On the solid surfaces with two-dimensional nearly free electronic gas states (2DEG), the wave nature of electrons produces standing waves. In addition to the analysis of electronic confinements such as lifetimes of surface states and Kondo effect, controlling the electronic structures, for example, by adsorbates has been attracting considerable interest. However such experiments have been performed for only a few limited materials like Au, Ag, and Cu(111) surfaces.

In this study, as the first step to investigate the 2D electronic states of organic films, we have performed scanning tunneling microscopy/spectroscopy (STM / STS) measurements on a self-assembly of the simplest amino acid, glycine molecules adsorbed on a Cu(100) surface.

Figure 1 shows a topographic STM image with a *p*(2x4) super structure and its d*I*/d*V* mapping obtained at +200 mV sample bias voltage under low temperature (5 K) condition, which represents a spatial distribution of local density of states (LDOS). As shown in the d*I*/d*V* mapping, there is a standing wave pattern with a larger periodicity than that of the molecular structure, indicating the existence of a 2DEG. This is the first demonstration of the standing wave observed for self-assembled molecular structure on a Cu(100) surface. As shown in Fig.2, an anisotropic dispersion relation was successfully obtained from the analysis of the standing wave measured at various sample bias voltages. Since the original Cu(100) surface has rotational symmetry through 90 degrees, this anisotropy reflects the molecular arrangement in the *p*(2x4) film. Details will be discussed.

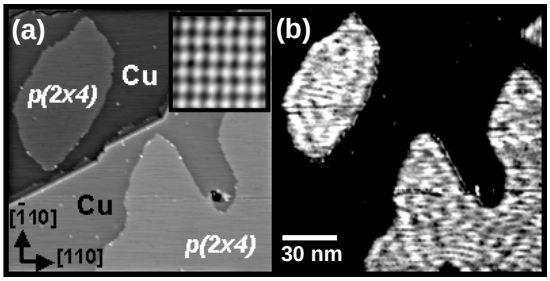

Fig.1 (a) STM topographic image
(b) dI/dV mapping at +200 mV.

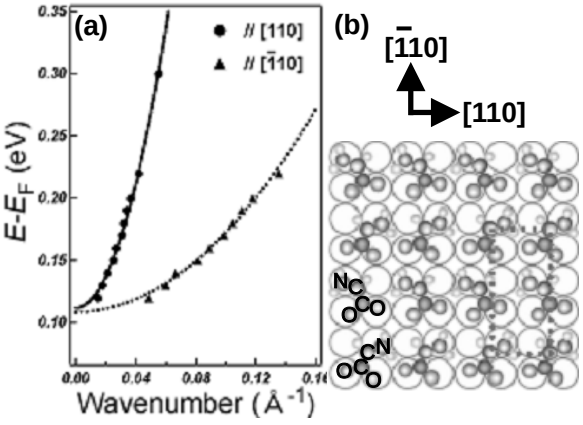

Fig.2 (a) Anisotropic dispersion relations obtained.
(b) Molecular arrangement of the *p*(2x4) structure

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