

Structural Change of SAM-Covered Au(111) Surface by STM Tip and Sample Interaction

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A morphological change on the surface, self-assembled monolayer (SAM) -covered Au(111) surface was investigated by a scanning tunneling microscopy (STM). The SAMs are molecular films that chemisorb spontaneously on a substrate surface and have received considerable attention because of their simple preparation, stability and ordered structure. The monolayer films have wide range of potential applications, for example, corrosion inhibitors, wetting controllers, lubricants and biocompatibility. The STM is well known as a unique tool for the analysis of surfaces as well as a promising system for modifying the surface structure on the nanometer scale. The tip-sample interaction during tip scanning is usually ignored in most STM studies of surface modifications. However, from the previous studies, we have reported that local atomic diffusion on the Au(111) surface was induced by the tip-sample interaction upon repeating tip scanning [1]. In the observation of SAM-covered Au(111) surface, the mobility and structural change of the surface was studied by the tip-sample interaction.

In the observation of Au surface with a hexadecanethiol ($C_{16}H_{33}SH$) film, the protrusion was observed at the step edge after tip scanning, and the protrusion disappeared by continues tip scanning. Unlike the growth of fingerlike stripes on the Au surface, the protrusion was not quite regular interval. The protrusion was reasoning from the extra atoms through the rearrangement of Au surface atoms during the SAMs adsorption of the surface. Disappearance of the protrusion was processing, as the unstable extra atom should be evaporated by the tip-sample interaction. Therefore, the thiol would be displaced from the extra Au atoms to the Au atom on one-layer lower surface. In addition, the phenomenon was not observed in the case of the short chain of octanethiol ($C_8H_{17}SH$), since its low energy level could not be affected from the tip-sample interaction.

References

- [1] J. Kim, H. Uchida, K. Yoshida, H. Kim, K. Nishimura and M. Inoue, *Jpn. J. Appl. Phys.* **42**(6A), 3616 (2003).