Three-dimensional probe of molecular conformation effect on single molecular conductance

T. Katayama[1], Y. Sugita[1], S. Yoshida[1], O. Takeuchi[1] and H. Shigekawa[1]
[1]Institute of Applied Physics, University of Tsukuba, Tsukuba, Ibaraki 305-8573, Japan.

With the development of various techniques to fabricate single molecular junctions, tremendous effort has been devoted to elucidate the transport properties of single molecules. A single molecular conductance is known to be strongly affected by the change of their conformational change, however experimental efforts has been yet insufficient to understand the molecular conformation effect due to the lack of an appropriate measurement method.

In this study, we report a new methodology for realizing a three dimensional (3D) dynamic probe of single-molecule conductance which enables elaborate 3D analysis of molecular conformation effect using scanning tunneling microscopy (STM).[1] Fig. 1 shows the schematic of the experimental set-up. The current I flowing through a benezenedithiol (BDT) single molecular between a Au tip and Au(111) surface was measured with a fixed bias voltage V_s applied between the STM tip and the substrate, while the STM tip, which was moved back and forth in the z direction in accordance with a sine function, was scanned two dimensionally (x and y directions). For example, the current through BDT single molecule as a function of xyz position of STM tip was reconstructed in 3D space and visualized as equicurrent (I = 78nA) surface in fig.2. Two equicurrents surface appear in 3D map due to a sinusoidal shape of IZ curve shown in the bottom of fig.2. The detail will be discussed in the presentation

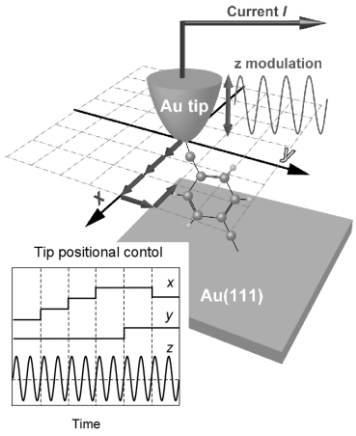

Fig. 1 Schematics of measurement setup and tip control scheme.

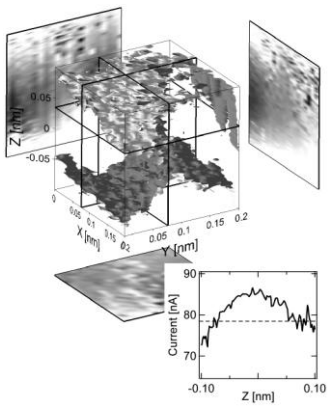

Fig. 2 3D conductance map of BDT single molecular junction.

[1] M. Nakamura, *et al.*, Nature communication, 6, 8465 (2015)