Precisely Determination of Surface Structure by using Positron Diffraction - Total-Reflection High-Energy Positron Diffraction, TRHEPD -

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For structural determination (i.e. the determination of three-dimensional positions and atomic species) of supra-molecules, enzymes, etc., X-ray diffraction with synchrotron radiation is successfully used. For the structural determination of surfaces, however, a definitive method has not been established.

Positron diffraction, total-reflection high-energy positron diffraction (TRHEPD) in particular, has been recently demonstrated to be a promising method for this purpose. It precisely determines the topmost- and the subsurface-structures of a crystal. It is proposed, first realized, and rapidly developing in Japan. The world's only experimental apparatus is operating at the slow-positron facility, IMSS, KEK.

We have successfully determined the structure of complicated catalyst surfaces [1], monatomic layer materials such as graphene [2] and silicene [3] by TRHEPD (Figure 1). The TRHEPD station at KEK will continue to be used for the analysis of the atomic arrangement of the surfaces showing interesting properties, and the complicated surfaces which have long-standing debates.



Figure 1: Complicated catalysts surfaces (above) and monatomic-layer materials (below)

Reference

[1] I. Mochizuki, et al.; Phys. Chem. Chem. Phys. 18, 7085 (2016).

- [2] Y. Fukaya et al.; Carbon, 103, 1 (2016).
- [3] Y. Fukaya et al., 2D Materials 3, 035019 (2016).

Web page

http://pfwww.kek.jp/slowpos/