AC-01

Three dimensional reciprocal-space mapping by electron diffraction

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Electron diffraction techniques such as low-energy and reflection high-energy electron diffraction (LEED, RHEED) have played an important role in surface crystallography. However, as dynamical effects are inherent in electron diffraction, a time-consuming dynamical analysis was usually required to fit the diffraction pattern. The constant momentum-transfer averaging (CMTA) method is an approach to suppress the dynamical effect by using a large amount of data set [1]. Both incident angle and energy were changed to obtain multiple reciprocal-space maps for CMTA-LEED. We will show how CMTA work effectively on the LEED structure analysis with the aid of the recent imaging and computer technology [2]. RHEED is suitable to survey the reciprocal-space because of a short wavelength of the high-energy electron. When the sample rotation is combined, it becomes a powerful method to map the reciprocal-space [3,4]. The principle is identical to that of a Weissenberg camera for X-ray crystallography. A three-dimensional reciprocal-space map, up to the temperature limit, can be obtained within a few hours using this “Weissenberg RHEED” method [4]. The map is very useful to understand crystal structure on surfaces. It is demonstrated that a surface structure is directly determined from a simple analysis based on a Fourier transformation of the obtained reciprocal data.

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