

Electrochemical Scanning Probe Microscopy for Microscopic Understanding of Electrified Solid–Liquid Interfaces

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In the last thirty years, electrochemist succeeded in developing a molecular picture of the electrified solid–liquid interfaces by using electrochemical STM (EC-STM). Atomic resolution images can be easily obtained as in the case of STM measurements in air or vacuum. EC-STM, however, has its own limitations; (i) EC-STM images reflect not only the physical topography but the electronic structure, thus complicating the quantitative analysis, and (ii) EC-STM can only detect the information very close to the solid surface (< a few nm). To obtain complementary information and overcome above limitations of EC-STM, electrochemical AFM (EC-AFM) is useful technique. But it has been not commonly used presumably due to the lower spatial resolution.

In this seminar, the basic concept of the electrified interfaces, so-called electrical double layer (EDL) is introduced at first, and our fundamental EC-STM and EC-AFM studies of aqueous solution / solid interfaces will be discussed in detail. Recent our progress in ionic liquid / solid interfaces, which are technologically important for practical applications such as batteries and electronic devices, are also presented. Finally, future prospects in this field, especially “beyond imaging” for atomistic understanding of electrochemical reactions, are discussed.