第43回 OPERA研究交流セミナー
第39回 ISIT有機光エレクトロニクス研究特別室セミナー
第102回 未来化学創造センターセミナー

日時：2012年2月14日（火） 15:00-16:30

場所：九州大学 最先端有機光エレクトロニクス研究棟 3F会議室

“Study of electrostatic field effect at interface: the application to organic field-effect transistors”

Dr. Wei Ou-Yang

Solutions Research Laboratory, Tokyo Institute of Technology

Compared with inorganic materials, organic molecules exhibit many unique properties, the most important one of which is flexibility. Therefore, it is possible in the near future to substitute organic devices for the conventional inorganic devices in certain areas such as the processing, the transmission or the storage of information, etc.

The interface monolayer composed of organic molecules with a layer thickness of one molecule is quite important in science as well as in engineering. It has unique properties in comparison with the bulk counterpart, such as spontaneous polarization and interesting molecular ordering. The Langmuir monolayer at air-water interface, as one of important interface monolayers, is an ideal model to study two-dimensional (2D) physics and applicable to wide fields by the Langmuir-Blodgett (LB) deposition method. The strong electrostatic field across the thin film up to now has not been well studied and recently it has been shown that for organic devices the interface between organic active layer and gate insulator or metal electrode is pretty crucial. Thus it is expected the interface monolayer could play an important role there.

In this talk, I focused on the electrostatic field effect in two kinds of interface monolayers, namely the Langmuir monolayer at air-water interface and the LB monolayer at pentacene-SiO2 interface. For the former case, I studied the charge effect on phase transition of a dielectric monolayer by adding divalent ions (as charge source) into water subphase, and the dipolar effect on phase transition of a ferroelectric monolayer at air-water interface. The newly founded reorientation effect of the dielectric monolayer in the presence of divalent ions was employed to further study how the strong local electric field influences performance of pentacene organic field-effect transistors (OFETs). Experimental results and modeling show the local electric field is the main reason for the large threshold voltage shift in the presence of interface monolayer, and some predictions based on the proposed model are also confirmed. In addition, the observed low critical temperature of ferro-to-paraelectric phase transition of the ferroelectric monolayer was used for optimal LB deposition, and the created pentacene OFETs with the thin monolayers were found to be tunable in hysteresis by changing local electric field or layer thickness. All these studies have shown that the strong local electric field generated by the interface monolayer is quite important and special attention should be paid especially for organic devices using the interface monolayer.

主催：九州大学 最先端有機光エレクトロニクス研究センター
：財団法人九州先端科学技術研究所（ISIT）
共催：九州大学 未来化学創造センター