Field Effect on the Inner Electronic States of Organic Molecular Devices

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In order to develop highly-designed molecular devices, it is desired to observe *in situ* electronic states in the operating devices that should be performed under applied bias. The organic molecular devices have recently been investigated with great efforts to respond to various requirements for future electronic devices, in which molecular devices may not only be simple replacement from current inorganic devices but also reinforcement with the other functions using molecular properties. For understanding of operation principle of new organic devices, therefore, the direct observation of electronic states under operation conditions has been required.

One of typical desired molecular devices is the organic field effect transistor (OFET) that controls conductivity by injection of carriers into the organic thin film under the applied electric field. We have attempted the direct observation of inner electronic states of pentacene-based OFET using X-ray absorption spectroscopy in a bulk-sensitive fluorescence yield mode (FY-XAS). The developed measurement system has enough potential to observe the inner electronic states of organic layers even beneath metal electrode. Then, an XAS spectrum change depending on the gate bias was recently detected. We discuss the origin of the spectrum change and the inner electronic states of pentacene-based OFET.