Band alignment of Alq_3/Nb:$SrTiO_3$ interface using *in situ* photoemission spectroscopy

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Organic semiconductors (OSCs) have attracted enormous attention in the past few decades because of their potential applications to organic-based devices, such as organic light-emitting diodes. In these devices, the formation of interfacial dipole layers between OSCs and metal electrodes dominates device performance and a great number of studies have been devoted for understanding the origin of the interface dipole [1]. Conductive perovskite oxides are expected as a candidate for electrode materials in organic devices, since they possess the advantages of high transparency and high chemical stability. However, there are few studies on the band alignment at OSC/oxide interfaces.

In this study, we report on the band lineup at the interface between tris(8-hydroxyquinolinato)aluminum(III) (Alq_3) and conductive Nb-doped $SrTiO_3$ (Nb:STO) determined by *in situ* photoemission spectroscopy. The Alq_3 films with various thicknesses were deposited by vacuum vapor deposition, and subsequently spectroscopic measurements were carried out *in situ*.

The valence band spectra show systematic changes with increasing the Alq_3 film thickness, and finally become bulk Alq_3 spectra at 14-nm thickness. The several distinct peaks originated from Alq_3 molecular orbital (MO) were clearly observed and these energy positions were in good agreement with the MO calculation [2]. The difference of work function between Alq_3 and Nb:STO was estimated to be 0.6 eV from secondary electron emission spectra. Furthermore, corresponding peak shift was observed in core level spectra with increasing the Alq_3 thickness. From these experimental results, we determined the band diagram of the Alq_3/Nb:STO interface and found the formation of interface dipole with 0.6 eV.

[1] H. Ishii *et al.*, Adv. Matter. **11**, 605 (1999).

[2] K. Sugiyama *et al.,* J. Appl. Phys. **83**, 4928 (1998).