Sonderforschungsbereich 595
Elektrische Ermüdung in Funktionswerkstoffen

TECHNISCHE UNIVERSITÄT DARMSTADT

Sonderkolloquium

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Formation of low carrier injection barrier at the novel inorganic electrodes / organic semiconductors interfaces studied by photoelectron spectroscopy

Carrier injection barriers at electrode/organic semiconductor interfaces are in general large (e.g. > 1 eV) in organic light emitting diodes (OLEDs) and a serious obstruction for stable and low power consumption device operation. To reduce an electron injection barrier (*E*EIB), a low work function material is suitable for a cathode because electron affinities of electron transport organic layers are smaller than the work functions of typical cathode materials. On the other hand, indium tin oxide (ITO) is widely used as a transparent anode in OLEDs with a relatively small hole injection barriers (*E*HIB) of 0.6–1 eV although ITO is an n-type conductor. The low EHIB is attained by oxidizing the ITO surface to reduce the Fermi level, but it increases the contact resistance. In this sense, using p-type materials would be more adequate for lowering EHIB, because higher work function is expected.
12CaO·7Al2O3 electride (C12A7:e-) is a good candidate for a high-efficiency cathode because C12A7:e- has a small work function of ~2.4 eV and chemical stability at the same time [1]. On the other hand LaCuOSe and Cu2Se are possible candidate of anodes: LaCuOSe is a p-type transparent degenerate semiconductor [2]. Cu2Se film deposited at room temperature shows high p-type conductivity [3]. Interfacial electronic structure between these inorganic materials and typical organic semiconductors were studied by photoelectron spectroscopy. Small *E*EIB of ~0.8 eV (at C12A7:e-/Alq3 interface) and *E*HIBs of ~0.3 eV (at LaCuOSe/NPB) and ~0.4 eV (Cu2Se/NPB) were obtained by optimizing surface treatment conditions. Finally, prototype OLEDs were fabricated by using these electrode. The combination of C12A7:e- and Cu2Se was effective to fabricate high efficient inverted top-emitting OLED.

[1] Matsuishi *et al*. Science, **301**, 626 (2003); S.W. Kim *et al*. Nano Letters, **7**, 1138 (2007); Toda *et al*. Adv. Mater., **19**, 3564 (2007).
[2] Hiramatsu *et al*. Phys. Status Solidi (a) **203** 2800 (2006).
[3] Hiramatsu *et al*. Phys. Stat. Solidi (a), **205**, 2007 (2008).

Der Vortrag findet um **11:00** im Gebäude der Materialwissenschaften, Lichtwiese, Petersenstr. 23, **Raum 77** statt