

## Sym. I : Polymers for Electronics

LED - I

### D-TUE-02

**EFFECTS OF IONOMER IN HETEROSTRUCTURED POLYMER LIGHT EMITTING DEVICE**, T. ZYUNG, H.-M. LEE, K.-H. CHOI, D.-H. HWANG, L.-M. DO, H.-Y. CHU (ETRI, Taejon 305-600, Korea) and J.-K. PARK (Dept. of Chem. Eng., KAIST, Taejon 305-701, Korea)

We investigate the effects of the ionomer which is used as an electron injecting and hole blocking material in the heterostructured polymer light emitting diode (LED). The emissive polymer is poly[2-methoxy-5-(2'-ethylhexyloxy)-1,4-phenylenevinylene] (MEH-PPV) and an ionomer is sodium sulfonated polystyrene (SSPS) containing 10 mol% ionic groups. When an electric field higher than  $2.7 \times 10^7$  V/m is applied, SSPS in the ITO/MEH-PPV/SSPS/Al system causes a bridging effect between sodium ions and the Al cathode at the SSPS/Al interface, leading to excellent electron injection. Furthermore, the ionomer has a high band-gap energy of  $\sim 5$  eV, resulting in hole blocking. The operating voltage for the ITO/MEH-PPV/SSPS/Al is reduced by  $\sim 60$  % and the relative quantum efficiency is enhanced by three orders of magnitude compared with those of the corresponding single-layer MEH-PPV device.

### D-TUE-03

**BLUE LIGHT-EMITTING DIODES OF STATISTICAL COPOLYMERS BASED ON ALKYL-FLUORENE**, DONG YOUNG KIM, J.K. KIM, J.W. YU, H.N. CHO, C.Y. KIM (Polymer Materials Lab., KIST, Seoul, Korea), Y.S. KIM, AND H.W. LEE (Dept. of Chemistry, Hanyang Univ., Seoul, Korea)

Light-emissive statistical copolymers were synthesized between 9,9'-dihexylfluorene and a mixture of meta- and para-divinylbenzene by the Heck reaction. The copolymers were soluble in organic solvents and thermally stable. The absorption spectra of copolymers showed two peaks at 382 and 410 nm revealing the existence of both the alternating copolymers with the meta- and para-linkage. However, the PL spectra showed the single emission peak at 480 nm of the lower energy state due to the electronic energy transfer. The intramolecular energy transfer mechanism of copolymers was confirmed from the time-resolved PL spectroscopy experiment of a very diluted solution in the order of  $10^{-5}$  mol/L, in which the possibility of intermolecular energy transfer was excluded. The highest PL quantum yield was observed from the copolymer with 30% of the para-linkaged moiety. LED of the copolymers and their blends sandwiched between aluminum and ITO coated glass emitted blue-light with the highest quantum efficiency of 0.1 % photons per electron. The turn-on voltage was significantly lowered when polypyrrole layer was introduced between ITO glass and emissive layers to improve the hole injection from the anode.

### D-TUE-04

**TEMPERATURE DEPENDENCE OF ELECTRO- AND PHOTO-LUMINESCENCE OF A SILYL-DISUBSTITUTED PPV DERIVATIVE**, C. H. LEE

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We have studied the temperature dependence of the current-voltage (I-V) characteristics, electroluminescence (EL) and photoluminescence (PL) of light-emitting diodes fabricated with poly(2,5-bis(dimethyloctylsilyl)-1,4-phenylenevinylene) (BDMOS-PPV), sandwiched between ITO and Al electrodes. The devices emit bright green light under both forward- and reverse-biases with the EL spectra similar to the PL spectra. The transient picosecond PL spectra show two peaks at about 505 and 540 nm and the emission peaks show a slight red-shift with time. The current and EL intensity under a constant bias voltage are observed independent of temperature below  $\sim 270$  K and the I-V characteristics fit to the Fowler-Nordheim tunneling formula at high fields.

### D-TUE-05

**EFFECTS OF OXIDE LAYER ON THE ELECTRONIC STRUCTURE OF THE INTERFACE BETWEEN METAL AND LIGHT EMITTING ORGANIC MATERIALS**, Y. PARK, Y. SO, G. LEE (KRISS, Taejon, 305-600, Korea), E. CHO (Dept. of Physics, Chonnam National University, Korea), S.-J. CHUNG and J.-I. JIN (Dept. of Chemistry, Korea University, Korea)

With intense recent interests in organic light emitting devices (OLEDs), it has been demonstrated that inserting an insulating layer between organic layer and metallic electrode greatly improves the performance of the OLEDs. There is, however, no clear understanding on how and why the improvements occur. We have employed laboratory and synchrotron radiation photoelectron spectroscopy techniques to investigate if the improvements have its origin in interface electronic structures. By observing the creation and removal of gap states near the interface upon deposition and oxidation of the metal layer, respectively, on PPV oligomers and Alq3 thin films, we show that the improvements is at least partly due to the alteration of interface electronic structures. We also discuss the role of electronic level rearrangement at the presence of an insulating layer on OLED performance in terms of carrier injection efficiency improvements. Other changes that occur upon the formation of oxide layer and their implication on OLED performance are also examined.