**608a New Emissive Materials for Efficient and Stable Blue Organic Light Emitting Diodes**

*Samson A. Jenekhe, Abhishek P. Kulkarni, Yan Zhu, Christopher J. Tonzola, and Angela P. Gifford*

Organic light-emitting diodes (OLEDs) based on organic semiconductors and conjugated polymers are being developed for full color, flat panel displays which require efficient bright electroluminescence (EL) of the three primary colors, red, green and blue. Achievement of stable blue EL with high efficiency and good color purity at practical device brightnesses ($\geq$ 100 cd/m$^2$) remains a challenge, both in small molecule and polymer OLEDs. One of the main reasons for the poor device performance of blue OLEDs is the low electron affinities ($\leq$ 2.5 eV) in most current blue-emitting materials that make it difficult to inject electrons efficiently into them. New thermally stable blue-emitting organic materials that are also capable of facile electron injection and transport (*n-type*) are thus needed for developing high performance blue OLEDs. In this talk, we present two examples of new blue-emitting materials with enhanced electron injection and transport characteristics for blue OLEDs. First, we report on a series of new copolymers of 9,9'-dioctylfluorene and 2,3-bis(p-phenylene)-quinoxaline wherein the electron-deficient quinoxaline moiety enhances the electron injection and transport properties in the predominantly hole-transport (p-type) poly(9,9-dioctylfluorene) (PFO) [1]. The glass transition temperature increased from 67 °C in PFO to as high as 160 °C in the alternating copolymer. Stable blue EL with CIE coordinates of (0.16, 0.06) and varying performance was achieved from the copolymer LEDs with luminances of 240–520 cd/m$^2$ and external quantum efficiencies of up to 1% at brightnesses over 100 cd/m$^2$. Enhancement in LED performance by factors of 3–6 compared to PFO was achieved in the copolymer containing 5 mol% 2,3-bis(p-phenylene)-quinoxaline. These results demonstrate that composition can be used to optimize the light emitting properties of electroluminescent copolymers and also suggest that introducing electron withdrawing groups into the polyfluorene backbone is a useful approach to improving its spectral stability and achieving blue polymer OLEDs with enhanced performance. Second, a series of n-type, blue-light-emitting oligoquinolines based on the 6,6'-bis(4-phenylquinoline) core has been synthesized and used as emissive and electron transport materials for blue OLEDs [2]. The new oligoquinolines emit blue light in thin films, show good thermal stability (glass transition temperature, $T_g$ > 100 °C) and possess facile reversible electrochemical reductions (electron affinity = 2.6–2.8 eV). Simple bilayer diodes of the type ITO/PEDOT/PVK/oligoquinoline/LiF/Al gave stable blue EL with maxima at 450-460 nm, CIE coordinates at (0.15, 0.12), luminances of 470-4000 cd/m$^2$ and luminous efficiencies of 3-8 cd/A (at brightness > 100 cd/m$^2$). These results represent the best efficiency of blue OLEDs from fluorescent organic emitters reported to date. The high $T_g$s render the materials very stable in the amorphous form leading to good EL spectral stability.

[1] Kulkarni, A. P.; Zhu, Y.; Jenekhe, S. A. *Macromolecules* **2005**, *38*, 1553. [2] Kulkarni, A. P.; Gifford, A. P.; Tonzola, C. J.; Jenekhe, S. A. *Appl. Phys. Lett.* **2005**, *86*, 061106.