Tuning the emitting color of organic light-emitting diodes by dispersing the red dye DANS in the green emitter for biosensing applications

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Since the pioneering works on organic light-emitting devices (OLEDs) by the Kodak and Cambridge groups, extensive research works have been carried out to bring OLEDs into commercial applications in flat panel displays in the past decade [1,2]. Apart from optimizing device structure, another key approach for developing marketable OLEDs is the development of high-performance materials with additional desirable properties, such as the sensing ability [3]. In this work, we fabricated biosensors by using the changes in the emission spectrum of an OLED. In particular, the red emitting dye 4-dimethylamino-4'-nitrostilbene (DANS) embedded into an anthracene layer (M21), which is a wide bandgap organic green emitter served as the active layer of the device. Upon the addition of the fluorescent dye DANS into the M21, efficient Förster energy transfer takes place changing the green emission of M21 to red. For biosensing application, red OLED with M21+DANS active layer was fabricated and used as sensor to recognize analytes generated during meat spoilage. Analytes, such as acids diffused into the active layer of the OLED and led to change of color emission from red to green. This color change is attributed to the protonation of amine nitrogen atom in the amine group of the DANS occurring in an acidic environment resulted in the quenching of the intense red emission of the DANS molecule.

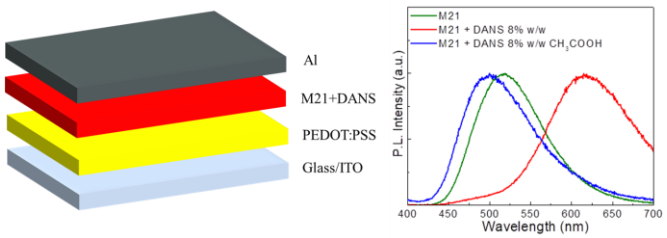

Figure 1: OLED architecture and photoluminescence spectra of emission layers showing color changes.

References

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