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THE SCOPE OF OLED TECHNOLOGY: A REVIEW

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ABSTRACT: *This is the review on the OLED technology. Here the evaluation of OLED has been discussed. Along with this the existing researches related to OLED has been discussed. Comparison of ORGANIC LIGHT EMITTING DIODE with LCD has been made here. More over the application of OLED TECHNOLOGY along with its future scope has been discussed.*

Keywords: OLED, LED, EQE, HTL,EML, HIL

[1] EVOLUTION OF OLED

The first report of a simple and efficient OLED structure was presented by Tang and Van Slyke in 1987 [1]. While working at Eastman Kodak, they were able to show electroluminescence from a two-layer organic stack, between an ITO bottom anode and silver cathode. Their organic structure consisted of the aromatic amine TAPC as a hole conductor and AlQ_3 as the electron transport material and emitter. This fluorescent device produced an external quantum efficiency (EQE) of 1%, a power efficiency of 1.5 lm/W and achieved a maximum luminance of over 1,000 cd/m^2**.** Electroluminescence from organic materials had been presented in the past but this structure was the first to achieve an EQE above 1% and produce high luminance values. Fluorescent emitters remained the state-of-the-art until 1998, when Forrest and Thompson reported the first use of iridium and platinum complexes to harvest triplet state excitons for phosphorescent emission. This breakthrough allowed the industry to realize 100% internal quantum efficiency (IQE) and paved the way for the development of highly efficient OLEDs [19]. Since their report, a wide variety of iridium and platinum based emitters have been developed that produce EQE's over 25% for blue-, green- and red emitting doped structures, with both vacuum and solution processed techniques.

These state-of-the-art OLED structures are multi-layer organic hetero structures. Each material/layer is chosen to reduce the energetic barrier between the electrodes and the recombination zone, and also improve carrier balance in the device. This design phase is critical in developing high efficiency devices with low voltage operations. In general, these layers consist of injection and transport layers. Hole-injection and electron injection layers (HIL and EIL, respectively) are used to modify the work function of the adjacent electrode to improve injection of holes and electrons into the organic layers. Hole transporting and electron-transporting layers (HTL and ETL, respectively) aid in the transport of holes and electrons into the emissive layer (EML) of the device. The EML, or host, material is carefully chosen to promote efficient formation and radiative relaxation of excitons for light emission [24]. Because phosphorescent emitters are doped in this host material, careful consideration must be made to the triplet energies of both materials to ensure an efficient exothermic energy transfer between the two triplet states. In order to realize high EQE devices, the host material must have several key properties. It must have a larger triplet energy than the dopant material. This becomes difficult for blue dopants, where triplet energies greater than 2.75 eV are necessary. It must have suitable energy levels to match the cathode and anode for efficient charge injection.) It must ensure a balanced charge distribution across the EML. Charge balance is critical because charge accumulation at the interface leads and to exciton quenching and maximizes the exciton formation zone across the EML, while also reducing device efficiency roll-off . Am bipolar host materials are materials that have similar hole and electron mobility values, thus promoting carrier balance and recombination in the EML. The design and development of new am bipolar materials is very important for improving device performance. Hole-injection and electron injection layers (HIL and EIL, respectively) are used to modify the work function of the adjacent electrode to improve injection of holes and electrons into the organic layers. This becomes difficult for blue dopants, where triplet energies greater than 2.75 eV are necessary. It must have suitable energy levels to match the cathode and anode

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