Abstract

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Design, Implementation and Characterization of Organic Light Emitting Diode (OLED)

Organic Light-Emitting Diode (OLED) is one of the most interesting areas of scientific research in the field of optoelectronic devices. OLEDs are appealing for use in next generation display and lighting technologies. In display applications, OLEDs offer a wide range of emission colour and high power efficiencies in flexible substrates. In lighting applications, OLEDs offer attractive features such as broadband emission and low-cost manufacturing methods. OLED has two types which are Polymer LEDs (PLED) and Small Molecules LED (SMOLED). The purpose of this thesis is to design and characterize single and double layers of two types of OLED, investigate the electrical and optical characteristics of double layer OLED, and finally fabricate both single and double layer PLED. The two types of devices are simulated using ATLAS from SILVACO. Main design parameters are swept in the device to optimize the OLED performance, such as anode and cathode work functions, thickness of layers and number of layers. Simulation results show that the PLED device has higher luminance and current density than SMOLED. The maximum current density of PLED single layer is 105 mA/?mm?^2 for cathode and anode work functions are 3.6 eV and 4.7 eV respectively. The Luminance Power is 1.11*?10?^(-15) W/?m. The thickness of the polymer layer is100 nm. The maximum current density of SMOLED single layer is 0.0026 mA/?mm?^2for cathode and anode work functions are 3.6 eV and 4.7 eV respectively. The Luminance Power is 3.11*?10?^(-24) W/?m. The thickness of the Emissive layer is 100 nm. The maximum current density of PLED double layers is 0.17 µA/?mm?^2 while for SMOLED double layers are 7.4 x?10?^(-8) mA/?mm?^2. Two PLED structures, single and double layers, are fabricated using spin coating technique. The substrate is glass coated with Indium Tin Oxide (ITO) as anode. The polymer material used is Poly [2-methoxy-5-(2-ethylhexyloxy)-1, 4-phenylenevinylene] (MEH-PPV).The used materials were purchased from Sigma-Aldrich. PLED double layer device has better performance than Single layer.