UNIVERSITI TEKNOLOGI MARA

ELECTRICAL PROPERTIES OF SPIN COATED MEH-PPV: ZnO NANOCOMPOSITES FOR ORGANIC LIGHT EMITTING DIODES

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

The instability of organic material is an important issue faced by the organic device caused by degradation and low conductivity due to high operating voltage of OLED's device. In this study, deposition of MEH-PPV has been studied by varying several parameters such as weight of powder and annealing temperature using low cost and simple method of spin coating. The MEH-PPV thin films dissolved in aromatic solvent (toluene) to produce *p*-type conducting active layer. It was found that the optimum MEH-PPV thin films prepared at 5 mg/ml and annealed at temperature of 50°C. The optimum preparation parameter of MEH-PPV thin films have been identified. It was revealed that the MEH-PPV thin films showed highest conductivity of 3.29 x 10^{-5} S. cm^{-1} and highest red emission intensity. In addition, the growth of ZnO nanotetrapods has been studied in order to synthesize uniform ZnO nanotetrapods by varying its evaporation temperature and gas flow rate using double furnace thermal chemical vapor deposition (CVD) method. The optimum condition for growth of ZnO nanotetrapods where the first furnace was placed with zinc powder and empty boat was placed on the second furnace at 750°C and with oxygen flow at 5 sccm. The surface morphology of ZnO showed uniform ZnO nanotetrapods at low temperature at 750°C. It was found that diameters and lengths of nanotetrapods were in the range 60 to 90 nm and 0.34 to 1.15 μm. From the electrical characterization, it was found that the ZnO nanotetrapods showed high conductivity of ~ 4.84 x 10^{-2} S. cm^{-1} at highest (1 0 1) crystalline structure and highest visible (green) emission intensity. It can be seen that the ZnO nanotetrapods had good electrical properties which can transport the electron efficiently in the nanocomposites thin film. The ZnO nanotetrapods has been dissolved into the MEH-PPV polymer matrix. Furthermore, the optimum parameter for ZnO nanotetrapods and MEH-PPV deposition was selected and used to fabricate MEH-PPV: ZnO nanocomposites thin film using the spin coating method. This condition was achieved by preparing ZnO nanotetrapods weight composition of 0.2 wt% in MEH-PPV solution which produced a smaller length of ZnO nanotetrapods (~600 nm). The ZnO weight composition of 0.2 wt% showed highest visible emission due to high-energy transfer from particle to the polymer. The conductivity was also examined by varying the metal electrode using aluminum (Al) and gold (Au) in order to evaluate the electrical properties of nanocomposites thin film. An aluminum electrode shows the highest current density of MEH-PPV: ZnO nanocomposites thin film which is 0.10073 mA/cm^2 and highest conductivity of 7.40 x 10^{-1} S. cm^{-1}. From the obtained result, aluminum is the best candidate for the electrode in OLEDs application. The MEH-PPV: ZnO nanocomposites thin film improved the performance of electrical properties compared to a single layer of MEH-PPV thin film for OLEDs application.

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TABLE OF CONTENT