MASTER'S THESIS

Molecularly doped organic electroluminescent diodes

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Molecularly Doped Organic Electroluminescent Diodes

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Abstract

Organic light emitting diode (OLED) is a strategic important item in both academic and commercial laboratories because of its potential to dominant in the future display market. Molecularly doped OLED has the advantages that it can be easily fabricated and its ability to be doped by numerous chemical compounds for enhancement of brightness and colour tuning.

The goals of this research works are to fabricate OLED using the guest-host approach and to improve its performance so that it is comparable to the hetro-junction type OLED. Our OLEDs are basically comprised with an electron transporter and emitter, (Alq_3), a hole transporter (TPD), and a binder (PVK) for the organic layer sandwiched between two metal electrodes.

In this thesis, enhancement of light intensity, stability and colour tuning for the molecularly doped OLED were being studied. Single-layer OLED (L1-OLED) with the cell structure: ITO / doped PVK layer / cathode was examined in details. Light emission from the L1-OLED was studied based on the dependence of composition and film thickness. Meanwhile comparison of the OLED to a space-charge limited conduction model was performed.

Colour tuning of the L1-OLED was studied by using three different dyes at a loading of 5 wt%. The dyes were rubrene, DCM1 and perylene. Concentration dependence was further examined for rubrene from 0.1-100 wt%. Besides, the charge transport and energy transfer between Alq_3 and rubrene was studied using a double-layer OLED (L2-OLED) with a cell structure: ITO / doped PVK layer / Alq_3 / cathode.

Enhancement of emission and stability for the L1-OLED were also analyzed

by doping the OLED with different sensitizers (anthracene, naphthalene and p-terphenyl) and stabilizers (Chim 81®, Chim 944® and hydroquinone).

Enhancement of charge injection was further studied with an 1 nm thick LiF layer deposited at different positions of the L1- and L2-OLEDs. Besides, charge injection effect using three different inorganic compounds (LiF, CaF_2 and MgO) was compared. Preparation of the ITO anode was also tested by using different cleaning methods.

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