

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 hetero-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, CaF₂ and MgO) was compared. Preparation of the ITO anode was also tested by using different cleaning methods.

Table of Contents

Declaration	i
Acknowledgements	ii
Abstract	iii
Table of Contents	v
List of Tables	ix
List of Figures	xii
List of Symbols and Abbreviations	xxi
List of Appendices	xxiv
1. Introduction	1
1.1 Development of OLED	1
1.2 Energetic species in organic molecules	11
1.3 Charge transport in organic molecules	12
1.3.1 Tunneling	13
1.3.2 Space charge limited conduction	15
1.3.3. Others	17
1.3.3.1 Schottky and Poole-Frenkel conduction	17
1.3.3.2 Onsager theory	18
1.4 Mechanism for photon emission	18
1.4.1 Charge recombination	18
1.4.2 Förster energy transfer	20
1.4.3 Work function	21
1.4.4 Efficiency of OLED	22
1.5 Chemicals	24

1.6 Degradation of OLED	28
2. Experimental	30
2.1 Fabrication of OLED	30
2.1.1 Preparation of solvents and other reagents	31
2.1.2 Preparation of doped polymer solutions	32
2.1.3 Surface preparation of the ITO glass	33
2.1.4 Film Casting	34
2.1.5 Drying process	35
2.1.6 Vacuum deposition	36
2.2 Solubility of the organics	36
2.3 Purification of Alq ₃	37
2.4 Synthesis of TNF	38
2.5 Measurement of I-V-L characteristics and half-life	39
2.6 Measurement of electroluminescence, photoluminescence and UV-visible absorption spectra	41
2.7 Thermal degradation	43
2.8 Absolute intensity and quantum efficiency	44
2.8.1 Calculation of absolute intensity and external quantum efficiency	44
2.8.2 Calibration of luminescence intensity	45
3 Results and discussion	48
3.1 Chemical analysis and OLED thin film preparation	48
3.1.1 Solubility of organic compounds	48
3.1.2 Analysis on Alq ₃	49
3.1.3 TGA analysis	50
3.1.4 Analysis on UV-visible and photoluminescence spectra	51

3.1.5 Thin film preparation	55
3.1.6 J-V-L characteristics of OLED	59
3.2. Composition dependence analysis	62
3.3 Thickness dependence analysis	67
3.3.1 J-V relationship	67
3.3.2 Light intensity dependence	84
3.3.3 Electroluminescence spectra	93
3.4 Dye doped OLED	101
3.4.1 Effects of adding a second dye	101
3.4.2 Concentration dependence using rubrene as a dopant	106
3.4.2.1 Rubrene doped L1-OLEDs	106
3.4.2.2 Rubrene doped L2-OLEDs	112
3.4.2.3 Charge transport of L2-OLED	126
3.5 Other Additives	130
3.5.1 OLED doped with sensitizers	130
3.5.2 OLED doped with stabilizers	136
3.5.3 Hole transporters	142
3.5.4 TNF as a dopant	144
3.5.5 Phase transfer catalyst	145
3.6 Incorporation of charge injection layer (CIL)	148
3.6.1 L1-OLED with LiF as the CIL	148
3.6.2 L2-OLED with LiF as the CIL	149
3.6.3 Comparison of charge injection layer (CIL) based on L2-OLED	154
3.6.4 Comparison of silver and aluminum cathode	158
3.7 Study on the charge injection of OLED	161
3.7.1 Selection of ITO glass	161

3.7.2	Comparison of substrate preparation methods	162
4.	Conclusion	167
5.	Bibliography	170
6.	Appendices	178
	Curriculum Vitae	229