

MASTER'S THESIS

Transport and device application of triarylamine-based organic semiconductor

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**Transport and Device Application of
Triarylamine-based Organic Semiconductor**

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for the degree of
Master of Philosophy

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Abstract

This thesis presents the charge transport properties and device application of triarylamine-based organic semiconductors. The hole and electron mobilities of *N,N'*-diphenyl-*N,N'*-bis(1-naphthyl)(1,1'-biphenyl)-4,4'-diamine (NPB), a key hole transporter in organic electronics, was extracted by time-of-flight (TOF) technique. In general, NPB has a stronger electron conducting capability than hole. The charge conducting ability of NPB in relation to the Marcus theory from quantum chemistry will be discussed. The study was further investigated by using doping. Some general observations on the effects of dopants on the hole transport properties in NPB will be explored. To demonstrate the presence of electron transport in NPB, a NPB single layer Organic light emitting diode (OLED) was fabricated. By doping NPB with different RGB fluorescent dyes, the device performance has notable improvement. The doping effects on the device performance will also be analyzed.

Another well-recognized hole transporter *N,N'*-diphenyl-*N,N'*-bis(3-methylphenyl)-(1,1'-biphenyl)-4,4'-diamine (TPD) was employed to fabricate OLEDs with single and bilayer structures. Doping technique was again adopted to improve the device performance. The thickness of the doped layer was tuned for optimization. To further improve the device thermal durability, a higher glass transition temperature (T_g) spiro-linked compound, spiro-TPD, was employed to replace TPD as the active material. The details of the spiro-linked compound and the device performance of spiro-TPD based OLEDs will also be presented.

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