MASTER'S THESIS

Effects of surface modification on metal-phthalocyanines based organic thin film transistors

Chow, Chi Mei

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CHOW Chi Mei

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Abstract

The first part of this thesis mainly presents the charge transport properties of metal phthalocyanine based organic thin film transistors (OTFTs). Copper phthalocyanine (CuPc) and zinc phthalocyanine (ZnPc) were employed to be the active materials. The device performance was optimized by using different configurations (top or bottom contact), substrate temperatures and electrode materials. The field effect mobility was found to be about 10^{-3} $cm^2V^{-1}s^{-1}$. The details of carrier transport mechanism were investigated by performing temperature dependent measurements. Thermal activation conduction was analyzed by the multiple trapping and release (MTR) model.

In the second part of our work, two methods were introduced to modify the gate dielectric in OTFTs. The first one is to use polymeric gate dielectrics. Three polymers: polycarbonate (PC), polyetherimide (PEI) and polystyrene (PS) were employed to the CuPc based OTFTs. The second method is to treat the ZnPc based OTFTs with self-assemble monolayers (SAMs). We found that both methods can clearly improve the device performance. The field effect mobility increased to 10^{-2} $cm^2V^{-1}s^{-1}$, while the activation energy was reduced significantly. The effects of gate dielectrics on the film morphology were studied by X-ray diffraction experiments. Besides, the effects on film growth were investigated by thickness dependent measurements.

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