Synthesis of Poly[(2-phenyl-3-fluorenyl)-1,4-phenylene vinylene] and Poly[2,3-bis(*p*-fluorenylphenyl)-1,4-phenylene vinylene] and Their Copolymers for Polymer Light Emitting Diodes

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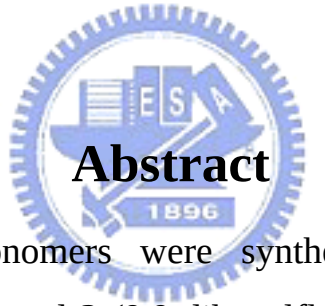

Abstract

Three kinds of monomers were synthesized in this study, i.e. 1,4-bis(chloromethyl)-2-phenyl-3-(9,9-dihexylfluoren-2-yl)benzene (M1), 1,4-bis(chloromethyl)-2,3-di-[4-(9,9-dihexylfluoren-2-yl)phenyl]benzene (M2), and 1,4-bis(chloromethyl)-2-[*p*-(3,7-dimethyloctoxy)phenyl]-3-phenyl benzene (M3). Monomers were polymerized via Gilch route using *t*-BuOK as base to gave substituted PPV derivatives (P1~P19). Polymer P1 and P3 were homopolymers, which were polymerized by M1 and M2 where both of them show a PL peak at 498 nm emitting blue-green light. This could be due to its large steric hindrance of fluorenyl substituents on the phenylene ring.

In the second part of this thesis , monomer (M1、M2) was

copolymerized with M3, 1,4-bis(chloromethyl)-2,5-dimethoxybenzene (DMeO-PPV), 1,4-bis(bromomethyl)-2-(2-ethylhexoxy)-5-methoxybenzene (MEH-PPV), to form copolymers (P2 and P4~P14) . All copolymers show blue green to yellow green light emition from 496 to 556 nm. Double-layer light-emitting devices consist of a simple ITO/PEDOT/Polymer/Ca(Al) configuration were fabricated and characterized. Most of the polymers exhibited very high molecular weights and good thermal stability. As far as the EL properties, most of the polymers show obvious blue-shift as the driving voltage increases. For example, polymer P5 emits green light at 536 nm at 5V. However its emitting light shifts to 496 nm at 12V. The maximum brightness and maximum external quantum efficiency of P17 can reach to 14070 cd/m^2 and 1.51 cd/A. The EL λ_{max} of P17 shows higher efficiency and good green color saturation compared to P19. The results demonstrate that introducing fluorenyl substituents into the PPV side chain can not only effect the blue-shift emitting color but also control emitting color by voltage variation.