Synthesis of Poly(2,3-diphenylphenylene vinylene) Derivatives Containing Dendritic Side Groups for the Application of PLED Devices

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Abstract

In this study, three kinds of dendron containing monomers, i.e., G1-DPM, G2-DPM and G3-DPM were synthesized. The monomers were copolymerized with 1,4-bis(bromomethyl)-2,5-dimethoxybenzene (DMe-M) and 1,4-bis(bromomethyl)-2-phenyl-3-[*p*-(3,7-dimethyloctoxy)phenyl] benzene (OC_{10}-DPM) via Gilch route using excess *t*-BuOK as base to yield dendron-containing poly(2,3-diphenyl-1,4-phenylene vinylene) (DP-PPVs) derivatives P1~P6. Polymers P1~P6 emitted yellow-greenish light between 538 and 548 nm.

In the second part of this study, monomer G3-DPM was copolymerized with 1,4-bis(bromomethyl)-2-methoxy-5-(3,7-dimethyl octyl)benzene (MDMO-M), 1,4-bis(bromomethyl)-2,5-methoxybenzene (DMe-M), or 1,4-bis (bromomethyl)-2-methoxy-5-(3-ethylhexyl)benzene (MEH-M), to yield the dendron containing DP-PPV derivatives, P7~P12. Polymers P7~P12 exhibited yellow-greenish to yellow light from 549 to

568 nm. The results demonstrate that the incorporation of dendron groups into DP-PPV main chain could efficiently reduce the phenomenon of red-shift for these DP-PPV derivatives from solution to thin film state. All polymers synthesized in this study exhibited high molecular weights and excellent thermal stabilities.

The double layer polymer light-emitting diode (PLED) devices with the configuration of ITO/PEDOT/emitting polymer/Ca(Al) were fabricated. A high efficient PLED device which was fabricated by using P1 as the emitting polymer. Its maximum external quantum efficiency and brightness are 4.53 cd/A and 2114 cd/m^2. The results show that introducing dendron groups into the DP-PPV main chains can avoid chain aggregation, and therefore improve the performance of the device. The best PLED device was fabricated by using P7 as the emitting layer. Its maximum brightness and external quantum efficiency of P7 can reach 5068 cd/m^2 and 0.64 cd/A. The results above reveal that MDMO-M was incorporated in the polymer main chains, which enhances the hole mobility of polymer P7.