以多面體矽氧烷寡聚物為中心核之星狀聚芴高分子之合成及其光電性質研究

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摘要

本研究係用Suzuki coupling方法合成出藍光(P1)、綠光(P2)及紅光(P3)的聚芴共軛高分子材料，並導入Octa(2-(4-brom-ophenyl)ethyl)-octakis (dimethylsilyloxyl)silsequioxane (POSS)，成功合成出以多面體矽氧烷寡聚物為中心核之星狀共軛高分子材料(POSS-P1～POSS-P3)。從TGA和DSC的資料顯示，以多面體矽氧烷寡聚物為中心核之星狀高分子材料(POSS-P1～POSS-P3)其熱裂解溫度(T_d)和玻璃轉移溫度(T_g)比不含多面體矽氧烷寡聚物的高分子材料(P1～P3)高。將此六個高分子材料(P1～P3 和POSS-P1～POSS-P3)進行薄膜迴火的實驗，當溫度加熱到 200℃時，藍光高分子材料在PL螢光光譜約 540nm處開始出現綠光的放射峰，然而POSS-P1 綠光的放射峰強度比P1 弱，由此可證明在高分子材料中導入多面體矽氧烷寡聚物除了可以增加高分子材料的熱穩定性外，並可降低高分子的堆疊和酮化缺陷的產生。本研究亦製作結構為ITO/PEDOT/polymer/Ca(Al)的雙層發光二極體元件，高分子材料POSS-P1 有最大亮度 1580cd/m^2(電壓為 15V)，最大效率為 0.28 cd/A；POSS-P2 有最大亮度 3274cd/m^2(電壓為 11V)，最大效率為 1.14 cd/A；POSS-P3 有最大亮度 1263cd/m^2(電壓為 16V)，最大效率為 0.24 cd/A，此外，並利用摻混的方法去改善元件的性質，以多面體矽氧烷寡聚物為中心核之星狀高分子材料(POSS-P1～POSS-P3)其最大亮度和最大效率均比高分子材料P1～P3 佳。因此，在高分子材料(P1～P3)中導入多面體矽氧烷寡

聚物形成星狀高分子材料(POSS-P1～POSS-P3)可增加高分子材料的熱穩定性，並使其亮度及效率提升，對於高分子電激發光二極體材料方面提供了一個新的方向。

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Synthesis of Electro-optical Properties of Star-like Polyfluorene with a Silsequioxane(POSS) Core

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Abstract

The goal of this study is aimed at synthesizing fluorene-based conjugated polymers that emit blue(P1) , green(P2) , and red(P3) light via Suzuki coupling method . We had successfully synthesized the star-like conjugated polymers (POSS-P1 ～ POSS-P3) by incorporating the silsesquioxane core into polyfluorene derivatives. The TGA and DSC data showed that the thermal decomposition temperatures (T_d) and glass transition temperatures (T_g) of POSS containing conjugated polyfluorene(POSS-P1～POSS-P3) are higher than those of the conjugated polyfluorene(P1～P3) without POSS core. All six polymers films were annealed at 200℃ for 1 hr. The results demonstrated that the incorporation of the silsesquioxane core into the conjugated polymers could enhance the thermal stability of polymers, hence reduce the aggregation and keto defect. Two-layer light emitting devices with a simple ITO/PEDOT / polymer/Ca (Al) configuration were fabricated and characterized. The relevant results showed a maximum brightness of 1580 cd/m^2 (at a driving voltage of 15 V) and a maximum yield of 0.25 cd/A for POSS-P1, while a maximum

brightness of 3274 cd/m^2 (at a driving voltage of 11 V) and a maximum yield of 1.14 cd/A for POSS-P2, whereas POSS-P3 showed a maximum brightness of 1263 cd/m^2 (at a driving voltage of 16 V) and a maximum yield of 0.24 cd/A. Besides, we used the blending method to improve the devices properties. The maximum luminescence intensity and the maximum yield of all the star-like conjugated polymers with a silsequioxane core were better than those of conjugated polymers electroluminescent device. Hence the incorporation of the silesquioxane core into polyfluorene derivatives could provide a new methodology for preparing light-emitting diodes with significantly improved thermal stability and electroluminescent characteristics.

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