

含三氮唑側基聚芴高分子衍生物之合成及其在 電激發光元件上之應用

研究生：劉韋伯 指導教授：許千樹 教授

國立交通大學應用化學研究所

摘要

在高分子有機電激發光元件的研究中，聚芴高分子是常用的發光材料，但由於其本質上以電洞傳輸為主，故在側鏈上導入了具有傳電子能力的 1,2,3-三氮唑官能基，以期望能增加其電子傳輸的能力，並有利於電子與電洞注入的平衡。在本研究中，我們成功的合成了在芴分子九號碳位置上具有 1,2,3-三氮唑官能基的單體，並以之合成了一系列的聚芴高分子材料，橫跨了可見光區中的藍、綠、紅三原色。P1 與 P2 系列為藍光材料，P3 系列為紅光材料，而 P4 系列為綠光材料。

合成的材料皆具有不錯的熱穩定性，熱裂解溫度介於 357 ~ 433 °C 之間，玻璃轉移溫度則介於 109 ~ 127 °C 之間。所有材料對一般常用的溶劑，如 THF、Toluene 等，皆有良好的溶解度，以利於旋轉塗佈成膜。而在電荷遷移率的量測方面，亦顯示出 1,2,3-三氮唑官能基確實為不錯的電子傳輸材料。本研究亦製作了結構為 ITO/PEDOT/Polymer/Ca/Al 的雙層元件，以探討各個材料的電激發光性質，P1 ~ P4 系列於元件上皆有不錯的表現，其中以綠光材料 P4-TAZ5-TPA0 具有最佳的元件效果，其最大放光波長在 524 nm，驅動電壓為 7V，最大亮度可達到 15760 cd/m²，最大效率為 1.80 cd/A，而 CIE' 1931 座標值位於 x = 0.31, y = 0.58，為相當不錯的綠光區域。

Synthesis and Electroluminescent Properties of Novel Polyfluorene Derivatives Containing 1,2,3-triazole Side Groups

Student : Wei-Po Liu

Advisor : Prof. Chain-Shu Hsu

Institute of Applied Chemistry
National Chiao Tung University

Abstract

Polyfluorene (PF) is a well-known emitting material for polymeric light-emitting diodes (PLEDs) application. However, most of the PF-based polymers have been found to be hole-transport dominating materials. Attempts have been made to improve the electron-transporting properties of the polymers by introducing electron-deficient 1,2,3-triazole moieties into the side chains of the polymers. In this work, we have successfully synthesized three series of polyfluorene derivatives, containing 1,2,3-triazole groups attached to the C-9 position of fluorene units, which emit light throughout the visible region. P1 and P2 emit blue light, while P3 and P4 emit red and green lights, respectively.

These copolymers exhibit good thermal stability with decomposition temperatures (T_d) from 357 to 433 °C and glass transition temperature (T_g) from 109 to 127 °C. They are also readily soluble in common organic solvents such as THF and Toluene. In aspect of the charge mobility, it shows that 1,2,3-triazole group has good electron-transporting ability. Double-layer light-emitting diodes with the configuration of ITO/PEDOT/Polymer/Ca/Al were fabricated to evaluate their potential applications. The device using P4-TAZ5-TPA0 as active layer showed the best EL performance with max emission band at 524 nm and turn-on voltage at 7 V. The maximum brightness is 15760 cd/m² and the maximum efficiency is 1.80 cd/A. The CIE' 1931 coordinates are located at (0.31,0.58).