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# 含PPV與Fluorene衍生物之PVK混合系統在分子發光二極體元件之研究與應用

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## 摘要

含三苯環與五苯環的小分子與高分子 *p*-phenylene-vinylene 衍生物經由不同的側邊與末端基軟段取代基予以特性分析，經由相同共軛段上所接的不同的軟段 (alkoxy) 發光性質能被有效的調整；這些發光材料摻雜於 poly(*N*-vinylcarbazole) (PVK) 中，並加上 [tris(8-quinolinolato)-aluminum(III) (Alq) 或 2,2',2''-(1,3,5-phenylene)-tris[1-phenyl-1H-benzimidazole](TPBI)] 的電子傳輸層能使發光二極體元件產生高的亮度與效率。在另一系列中，發光體含兩端 pyridyl 環的質子受體與其氫鍵錯合物也被探討其液晶與光物理性質；在 photoluminescent (PL) 光譜上，配氫鍵後的錯合物比純的雙 pyridyl 發光質子受體紅位移；electroluminescent (EL) 元件經過適當加熱後，可改良亮度並使半高寬變窄。此外藍光性質的 fluorene 衍生物混摻於 PVK 中，經由 electromer (或 electroplex) 的產生可製備成紅光與白光的元件；摻雜 9-ethyl-*N,N'*-diphenyl-*N,N'*-dipyren-yl-9*H*-carbazole-3,6-diamine (Carb9) 於 PVK 混合系統中，並加入 bathocuproine (BCP, hole-blocking 層) 與 Alq (電子傳輸層) 後，可大幅調控 electromer (或 electroplex) 的形成並得到高亮度的元件。

# Studies and Applications of PVK Blends Containing PPV and Fluorene Derivatives in PLED Devices

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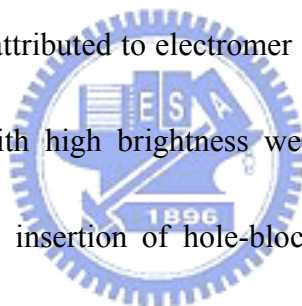
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## Abstract

Several series of light-emitting oligo(*p*-phenylene-vinylene)s (BIII and BV series containing three- and five-conjugated phenylene rings) with various side groups and end groups attached to the cores were characterized. Not only the solubility and thermal properties but also the photoluminescent (PL) and electroluminescent (EL) properties can be effectively adjusted by the attachment of flexible alkoxy groups either on the central rings or on both end rings of the conjugated cores. The application of multilayer polymeric light-emitting-diodes (PLEDs) containing an electron-transporting layer (ETL), i.e. tris(8-quinolinolato) -aluminum(III) (Alq) and 2,2',2''-(1,3,5-phenylene)-tris[1-phenyl-1H-benzimidazole] (TPBI), were fabricated by doping fluorescent oligo(*p*-phenylene-vinylene)s (BIII and BV) and polymer derivatives (PBV) into poly(*N*-vinyl carbazole) (PVK). These PLEDs can be optimized to increase brightness and efficiency by the design of multilayer device configurations. Another series of bis-pyridyl acceptor emitters were also used and the liquid crystalline (LC) and photophysical (PL and EL) properties of their

supramolecular structures, including H-bonded polymer networks and trimers, were explored. Compared with pure bis-pyridyl acceptor emitters, red-shifts of PL emission wavelengths were observed in most of the H-bonded complexes and polymers. A very narrow full width at half maximum (FWHM) value (38 nm) of EL spectra was obtained in the device of H-bonded complexes blended with PVK, and higher brightness of EL was produced at an appropriate annealing temperature. Additionally, highly fluorescent polymeric LEDs (PLEDs) utilizing blue-emitting fluorene derivatives (FBF14 and FBPh4) blended with PVK were demonstrated. The origins of red and white emission were attributed to electromer (or electroplex) formation. Red- or white-emission devices with high brightness were obtained by the addition of Carb9 in the blends, and the insertion of hole-blocking bathocuproine (BCP) and electron-transporting (Alq) layers can adjust the electromer (or electroplex) formation.



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