HKBU R&D LICENSING LTD
浸大科研發展有限公司

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CN 101671256 B

Priority Date
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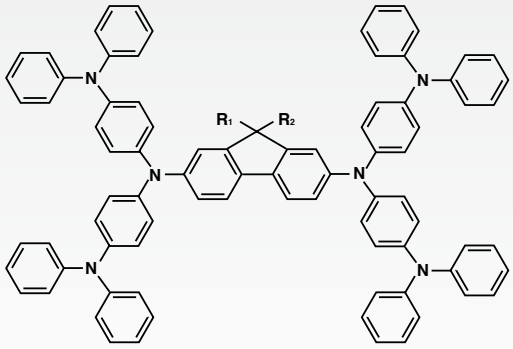
新型空穴注入材料的製備及其用途

❖ Introduction

有機電致發光器件（OLED）具有優良的發光性能，如相應快、亮度高、工作電壓低，因而吸引眾人的注目。現時面積大的OLED，已經被應用於不同的平面顯示器中。OLED的發光機制在於電子和空穴分別從陰陽極注入後，通過在兩電極間的多層有機功能層（空穴注入層HJL，空穴傳輸層HTL，發光層EML，電子傳輸層ETL，電子注入層EJL）在發光分子中結合形成激發子，激子輻射衰變而發光。由於電子和空穴的輸送率一般很難均等，由此造成激發光效率降低。要保持電荷載體的平衡，各功能層的優化是至關重要的。要獲得性能優異的器件，首先要選擇合適的材料。在組成OLED的諸多材料中，有機空穴注入材料的成膜性及其薄膜的熱穩定性和厚度對提高有機電致發光器件的效率和壽命具有重要的作用

本發明涉及N，N'-雙（三苯胺基）二胺衍生物及該化合物用作OLED的空穴注入層材料的用途，和該化合物的製備方法。在OLED注入層採用該化合物，既能保證有機材料與電極的良好歐姆接觸，有利於空穴的注入，還可提高空穴的傳輸效率，降低器件的驅動電壓，使器件的效率得到提高，且空穴注入材料的厚度不影響器件的性能。



❖ Key Features

- 提高器件效率
- 減低接觸不良
- 製程簡單

❖ Application

本化合物可應用在平面全彩顯示器、照明燈、LCD電視背光、透明及可捲曲的顯示器。

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US 6,759,686 B2
US 6,869,814

Priority Date
Mar 15, 2002

Silicon-Based LED

❖ Introduction 簡介

Global awareness of environmental protection and energy conservation has brought about the rise of the LED industry. Traditional LEDs can no longer fulfill the increasing market demand for large LED displays. Currently, large LEDs are typically manufactured on sapphire (Al2O3) and Silicon Carbide (SiC) substrates. Silicon substrate is yet to gain popularity due to its lower brightness as compared to other substrates. This invention introduces a novel porous silicon substrate that yields several advantages. Already widely used in the semiconductor industry, silicon is widely available in the form of large wafer diameters with excellent thermal properties, which makes it an attractive low-cost option for lighting.

According to leading equipment firm Veeco, silicon substrates only cost about 10% of sapphire substrates. Compared to existing silicon substrates, this invention significantly enhances the brightness by at least 10 times even under low-pressure environment. Silicon substrate LED comprises no heavy metal and is much more friendly to the environment. This LED is also tunable and can emit a broad spectrum of visible and invisible light by filling in different gases.

隨著全球氣候日益惡化，低碳經濟時代已經來臨，世界各國對LED（發光二極體）綠色產業給予前所未有的關注。然而，隨著對大規格LED需求的日漸增長，傳統的LED製造技術已不能滿足市場的需求。因此，新基板LED亦應運而生，新技術主要採用藍寶石（Sapphire）和碳化硅（SiC）基板。

本發明中主要包含了硅基底LED的製造工藝和裝置。選擇使用硅基底有多方面優勢：首先，硅作為半導體，在工業生產中已有很長歷史，它不僅在製造大直徑晶片的可行性非常高，還有很好的熱導性和產品穩定性，因此作為低成本LED生產方法具有相當大吸引力。據全球領先生產設備商Veeco計算，該硅基板的成本僅是藍寶石基板的10%。然而,傳統的硅基板光效能比較低，這也是硅基板多年來未能成為主流的原因之一，本發明正改善了其低光效能的弱點。此外，硅基板材料完全不含任何重金屬成分，減少對環境破壞。在硅基板中充入不同氣體，LED便能產生不同顏色的可見和不可見光。

❖ Key Features

- **Low production cost** - Low material cost of silicon and commercial gases, and simplified production process
- **High efficiency** - Operate at low voltage and save on electricity
- **Strong Liability** - Great heat dissipation and simplified structure
- **Environment-friendly** - No heavy metal and a greener environment for all
- **Tunable light** - Broad spectrum of light by simply controlling the composition and pressure
- **生產成本低** - 原材料如硅和各種充入氣體都是常見的工業原料，價格比較便宜，加上生產流程比較單一和高效，生產成本相對較低
- **效能高** - 硅基板在低壓運作，是理想的綠色節能器材
- **環境污染低** - 硅基板不含任何重金屬，降低對環境的影響
- **產品範圍廣** - 用同樣的生產流程，充入不同的氣體，便能產生多種波長和顏色的光

❖ Application

This invention may be used for Display, Spectroscopy portable devices, Anti-counterfeit device, Medical devices, Antiseptic device, R&D and scientific instrumentation etc.

本發明可用於顯示設備、光譜測量和分析設備、防偽設備、醫學設備、消毒設備、其他高端科學儀器（特別是需要紫外光的）等等。

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Priority Date
May 22, 1998

New Approach For High Brightness LED

❖ Introduction

As well-known, porous silicon is a material that can emit visible light. Since its spectrum is broad, it is not suitable for light emitting device (LED) application. Doping the foreign element(s) can not only significantly improve the brightness, but also make the spectrum narrow. Existing doping techniques including co-deposition, ion-implantation, and electro-chemical deposition, however, have problems such as low productivity, long processing time and difficulty in mass production, etc.

The present invention introduces a novel and compatible method for doping rare earth (RE) phosphors into porous silicon, which can significantly enhance brightness by ten times or give infrared (IR) emission.

眾所周知的，多孔矽的材料可以發出可見光。因其頻譜闊，所以不適合應用在發光二極管（LED）上。摻雜的異質元素，不但可以明顯增加其發光亮度，亦可以令光譜收窄。可是，現時的摻雜技術，包括共沉積，離子注入，和電化學沉積技術，都潛在問題，例如生產效率低，製作時間長和生產困難等問題。

本發明提出一種新合適的方法，在多孔矽摻雜稀土（RE）螢光材料，可以顯著把光亮度提高10倍或發出紅外（IR）射線。

❖ Key Features

- Scalable process for mass production
- Easy and controllable
- Emission colors tunable
- 可擴展的大規模生產過程
- 簡單及容易控制
- 可調發出可見光的顏色

❖ Application

This technology can be used for the applications such as street lighting, head lights for vehicles, IR camera and semiconductor devices.

這項科技可應用於例如：街燈，車頭燈，IR攝像機，半導體器件。

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US 7,652,136 B2

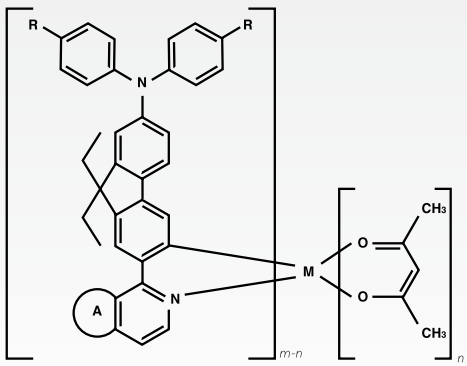
Priority Date
Nov 15, 2005

New Organometallic Phosphors for Optoelectronic Devices

❖ Introduction

Organic light emitting diode (OLED) technology has entered into the flat panel displays and lighting markets to compete with the current-dominant liquid-crystal displays (LCDs) and light emitting diodes (LEDs) due to light-weight and thin, fast-response, low-power consumption attributes. However, thermally stable and solution-processable phosphors that suit for these applications are still under development. For example, fluorine-based compounds are attractive candidates because of their good thermal and chemical stability, high emission quantum yields and the ease of functionalization. However, there is an issue of poor morphology during device fabrication.

The present invention provides methods for obtaining highly amorphous and phosphorescent compounds comprising diarylaminofluorene groups, which offer low ionization potential, induce morphologically stable amorphous thin-film formation and good thermal stability. It also encompasses methods of tuning colors.



❖ Key Features

- Chemically, thermally and morphologically stable
- Strong emission
- Significant improvements in device's efficiency
- Colors tunable

❖ Application

These phosphors can be used in manufacturing OLED for the applications of solid-state lighting, black-light displays, full color displays, transparent and flexible displays.

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