Study of the Properties of Bis{(benzimidazol-2-yl) Pyridenato} Zinc

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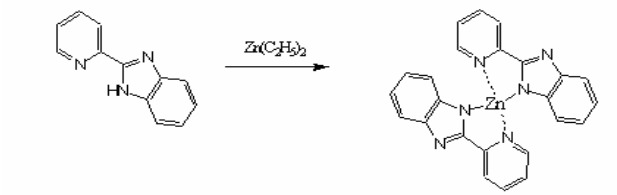
Abstract: A bright blue emission material, bis {(benzimidazol-2-yl) Pyridenato} zinc (**ZnBIP**) used for organic light emitting devices, has been prepared in good yield and characterized by ^{1}H-NMR, elemental analysis, and mass spectrometry. This complex is reasonably stable upon exposure to air and exhibited high thermal stability. [The Journal Of American Science. 2007;3(4):93-94]. (ISSN: 1545-1003).

Keywords: Electroluminescence; white light; OLED

1. Introduction

White organic light emitting diodes have attracted much attention, because their potential applications in the backlights of laptop computers and portable panel light sources. In the literatures, several strategies including multi-layer devices have been developed to realize highly efficient white organic electroluminescence [1-5]. Luminescent chelate complexes have been shown to be particularly useful in electroluminescnt (EL) displays because of their relatively high stability and volatility. The most well-known one of this kind of complexes is $A1q_3$, not only a good emitter but also a highly efficient electron-transporting material, where q is the 8-hydroxyquinolinato ligand [6, 7]. By modifying the structure of ligands of metal complexes, the emission color of which may be tuned, and the other properties, such as thermal stability and carrier mobility, may also be improved. Therefore, in this report, we prepare benzimidazol-2-yl Pyridine (**BIP**) and let it react with diethyl zinc to synthesize a thermally stable complex, bis{benzimidazol-2-yl) Pyridenato} zinc (**ZnBIP**). The thermal stability, an important character for the practical application, of this metal complex was investigated by thermogravimetric analysis (TGA) and differential scanning calorimetry (DSC).



Scheme 1: Synthesis process for the **ZnBIP** compound

2. Experimental

The synthesis of the title compound was accomplished by following processes, as shown in Scheme 1. The diethyl zinc solution (15wt.% in hexane, 11.34ml, 10mmol) was slowly added to 100 ml of THF solution containing benzimidazol-2-yl pyridine (2.95g, 20mmol) at 0^{o}C under N_2. After the resulting mixture was stirred at room temperature for 6 hours, 5 ml isopropyl alcohol was added to quench the reaction. The solvents were removed under vacuum condition at 5×10^{-3} Torr, and the residual solid was sublimed to purify the final product. Light yellow powder of **ZnBIP** was obtained in 80% yield. ^{1}H NMR and elemental analysis have determined the formula of this compound. The EL spectrum and the Commission Internationale de l'Eclairage (CIE) co-ordinates were measured by Pro-650 Spectroscanner (step size is 1.0 nm and bandpass is 4nm), the current-voltage (I-V) characteristic was measured by Keithley 2400 Source meter. Thermogravimetric analysis (TGA) was performed on a Perkin-Elmer thermogravimeter (Pyris 1) under a dry nitrogen gas flow at the heating rate of 20^{o}C/min. Glass transition

temperature (T_g) and melting point (T_m) of materials were determined by differential scanning calorimetry of the Perkin-Elmer differential scanning calorimeter (DSC-7).

3. Results and discussion

The Photoluminescent (PL) spectra of the **ZnBIP** solutions and neat film, excited with 330 nm laser line, were illustrated in Figure 1.

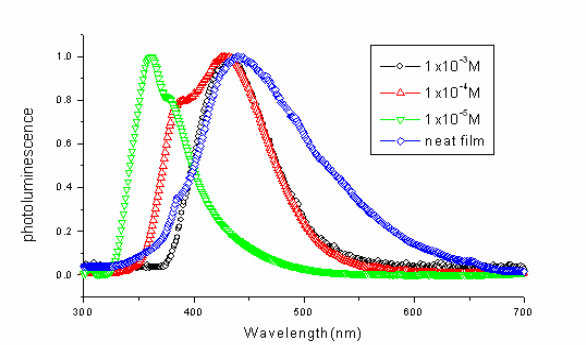


Figure 1: Photoluminescent spectra of the **ZnBIP**.

At low concentration, 1×10^{-5} M in DMF that double emission bands are observed at 357(m) and 385(s) nm, corresponding to the relaxation of **ZnBIP** from the excited state of a single molecule into ground state. Besides the 445 nm band, a new emission band appeared while the concentration of **ZnBIP** increased from 1×10^{-5} to 1×10^{-3} M. This new emission band having a maximum at 450 nm is observed in the spectrum of the **ZnBIP** neat film. A novel metal complex, bis{benzimidazol-2-yl} Pyridenato} zinc (ZnBIP), was successfully prepared by the reaction of benzimidazol-2-yl pyridene and diethylzinc. Because of its high thermal stability and excellent electrical characteristics, ZnBIP suggest a possible application for the use of the organic white light emitting devices.

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