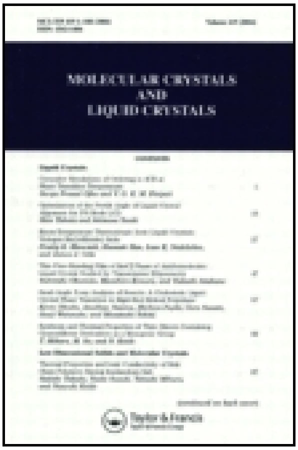

Molecular Crystals and Liquid Crystals Science and Technology. Section A. Molecular Crystals and Liquid Crystals

Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/gmcl19

Synthesis and Application of the Aromatic Spacered Azomethine Metal Complexes for the Organic Electroluminescent Devices

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Version of record first published: 24 Sep 2006

Mol. Cryst. and Liq. Cryst., 2001, Vol. 371, pp. 321-324

Synthesis and Application of the Aromatic Spacered Azomethine Metal Complexes for the Organic Electroluminescent Devices

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The new azomethine metal complexes were synthesized and three complexes among them were applied to the organic electroluminescent devices as a blue or white light-emitting layer. Emission wavelengths were observed at the region of 420-540 nm in luminescence spectra for these complexes. Their HOMO, LUMO and band gaps were investigated with cyclic voltammetry and found to be consistent with their UV-vis absoption spectral data.

Keywords azomethine metal complex; organic electroluminescent device; blue or white light-emitting layer; band gap; cyclic voltammetry

INTRODUCTION

Since the electroluminescence (EL) of a multilayer device using AlQ_3 as an electron transporting and light-emitting material was reported by Tang et al[1], a number of organic EL materials have been prepared for the light emitting devices. Among red, green, and blue (RGB) electroluminescent diodes for full-color display, blue emitting devices have usually been found to have the lowest efficiencies due to the big band gap of the emitting material[2]. Recently, improvement of efficiency and luminance in blue EL has been reported from the device including lithium tetra(hydroxyquinolato)boron derivatives[3], alkyl-bridged azomethine zinc complexes[4], or bis(2-methyl-8-quinolinolato) aluminum hydroxide as an emitting layer[5].

In this study, the new blue or white light-emitting metal complexes containing Be, Mg, or Zn and azomethine derivatives with an aromatic spacer were synthesized (Figure 1) and investigated as emitting materials for organic electroluminescent devices (OELD). Cyclic voltammetry was also used to estimate HOMO, LUMO, and band gaps of the complexes.

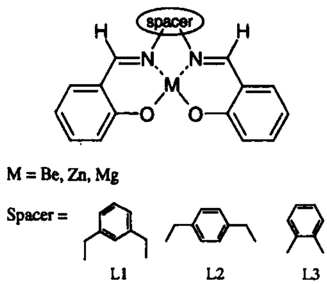


FIGURE 1. The chemical structure of the metal azomethine complexes for OELD

EXPERIMENTAL

Azomethine ligands with a variety of aromatic spacers were synthesized by reactions of salicylaldehyde with aromatic diamine derivatives in methanol. Reaction of $BeSO_4$, $(CH_3CO_2)_2Mg$ or $(CH_3CO_2)_2Zn$ with these ligands resulted in the desired complexes. The ligands prepared in this study were characterized by ^1H NMR, and the complexes by UV-vis, MS, FT-IR, photoluminescence (PL) and EL. Cyclic voltammetry of the complexes was performed with their thin films on glass, respectively.

RESULTS AND DISCUSSION

Several azomethine ligands with aromatic spacers were introduced to the complexes for understanding the effect of the spacers on coordination and luminescence. Among the complexes prepared herein with a metal ion and an azomethine ligand, BeL1, ZnL2, ZnL3 and MgL3 were possible to be sublimed and thus vacuum deposited to the electroluminescent device as an emitting layer.

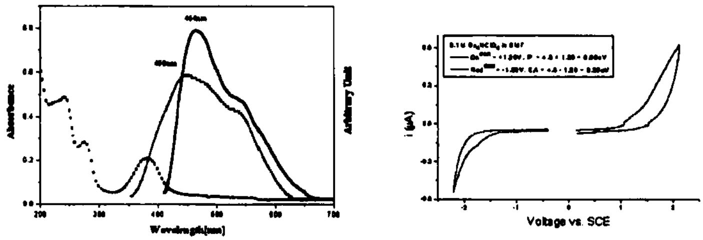
Their luminescence spectra displayed blue or white emission at 420-540 nm. From the results of cyclic voltammetry, the band gaps (E_g) were found to be consistent with the UV-vis spectral absorption edges.

TABLE 1. PL and EL properties of azomethine metal complexes

Complex	PL peaks (nm)	EL peaks (nm)	Absorption Edge (nm/eV)	E_g (eV)	Turn-on Voltage (V)
BeL1	447, 540	482	412 (3.01)	2.98	17
ZnL2	464	450	422 (2.94)	2.70	11
ZnL3	440	533	475 (2.61)	2.63	9
MgL3	423, 536	-	513 (2.42)	2.44	-

The devices were fabricated with the structure of ITO/TPD(400 Å)/an azomethine metal complex(600 Å)/Al. The luminescence, UV-vis absorption spectra, and cyclic voltammogram of ZnL2 were shown in Fig. 2, and the overall data were listed in Table 1. The device including BeL1 as an emitter exhibited the maximum luminance of 292cd/m^2.

With systematic variation of the spacers in the ligand and introduction of various metal centers, it was possible to show the effect of spacers and metals on OELD performance. These investigations lead to the conclusion that ligand conformation has a great influence on complex formation, emission wavelength, and sublimation capability.



(a) (b)

FIGURE 2. ZnL2 : (a) UV-vis(dotted), EL(faint), and PL(solid) spectra, (b) Cyclic voltammogram of ZnL2

ACKNOWLEDGEMENT

This work was supported by Korea Research Foundation Grant (KRF-99-005-E00018).

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