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STUDY OF Mg METAL COMPLEX WITH 8-HYDROXYQUINOLINE IN PMMA MATRIX

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Abstract- $MgCaq_4$, $MgBaq_4$ and $MgCdq_4$ have been synthesized by simple precipitation method at room temperature and blended films with Poly (methyl metha-crylate) (PMMA) at 10, 5 and 1 wt% were prepared for different characterizations like UV-Vis absorption, photoluminescence. In absorption spectum of all 8-hydroxyquinoline derivative metal complexes; at 360 nm and 270 nm two prominent peaks are obtained due to electronic transition between ^1L_a and ^1B_b. The film of polymeric compound with PMMA in chloroform solution shows a bright bluish green emission. The light emitting and optoelectronic property of polymeric compound may find applications in electroluminescence, OLED and sensors.
Keywords- UV-Vis absorption, simple precipitation method, photoluminescence, 8-hydroxyquinoline, PMMA

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Introduction

Among the metal 8-hydroxyquinoline chelates, tris(8-quinolinolate) aluminium (AlQ_3) has widely been used as a light emitting layer in organic light-emitting devices (OLED) [1,2]. Interest in AlQ_3 complexes with extended conjugated chromophores [3] and other metal 8-hydroxyquinoline chelates for improving and understanding the correlation between the electronic structure and photonic properties continues to develop vigorously. Organic electroluminescent (EL) devices based on organic fluorescent materials are one of the most promising ideal thin and flat panel display systems for the coming generation. This is because of their potentiality to produce emissions of all colors ranging from blue to red due to the wide selection of organic emitting material, which is not available when inorganic light-emitting diodes are used. These great progresses attracted extensive studies to OLEDs and contributed greatly to their rapid development. Owing to their thin-film, light-weight, fast-response, wide-viewing-angle, high-contrast, full color and low-power attributes [4], OLEDs showed their unlimited potential to be mainstream of flat-panel-display technologies and they will be able to compete with the now-dominant liquid-crystal displays (LCDs) in the future display market. One of the advantages of OLEDs, compared with other display technologies, is the possibility of making flexible displays [5].

Experimental

$MgCaq_4$, $MgBaq_4$ and $MgCdq_4$ have been synthesized by simple precipitation method at room temperature. While preparing the $MgCaq_4$; $Ca(NO_3)_2.2H_2O$, $Mg(NO_3)$ and 8-hydroxyquinoline are taken in 1:1:4 proportion. $MgCaq_4$ was prepared as follows: firstly take 10 ml double distilled water and 10 ml acetic acid in beaker. Dissolve 0.0478 gm of 8-hydroxyquinoline in a mixture of double distilled water, acetic acid and stirr it still the orange transparent solution was obtained say solution I. Then take 0.02128 gm of Mg (NO_3) and 0.01960 gm of $Ca(NO_3)_2.2H_2O$ dissolve in double distilled water. Stirr it till clear solution was obtained say solution II. Mix the solution I and II and stirr for 10 min and add NH_4OH solution by drop by drop to this mixture of solution with continuous stirring. Filter the yellow green precipitate and wash the precipitate with double distilled water for 8 to 10 times. Place the precipitate for drying 40-50 °C. Other 8-hydroxyquinoline derivative metal

complexes $MgBaq_4$, $MgCdq_4$ are prepared by Simple precipitation procedure which one used for $MgCaq_4$. To prepare the composite blended films, PMMA was selected as the host material because it is hard, rigid and have a glass transition temperature of 105 °C. Blended films of polymeric compound were prepared with PMMA in chloroform solution at 10, 5 weight% and 1 weight%. Blended films were homogeneous and showed excellent optical transparency. No visible phase separation was observed. The good miscibility is due to their structural similarities.

Results and discussion

Absorption spectroscopy is performed across the electromagnetic spectrum. The absorption spectra of 8-hydroxyquinoline derivative metal complexes ($MgCaq_4$, $MgCdq_4$, $MgBaq_4$) are reported in (Fig. 1). In absorption spectum of all 8-hydroxyquinoline derivative metal complexes; at 360 nm and 270 nm two prominent peaks are obtained due to electronic transition between ^1L_a and ^1B_b.

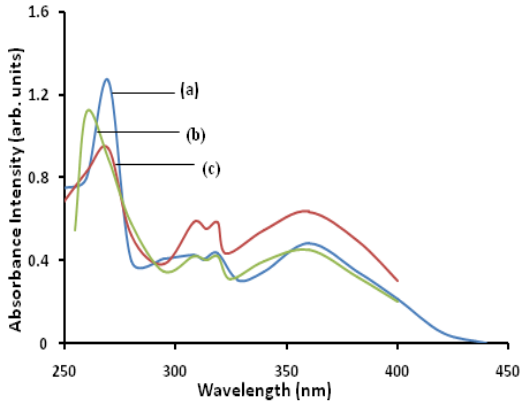

Fig. 1- Absorption spectra of (a) $MgCaq_4$ (b) $MgCdq_4$ (c) $MgBaq_4$

The photoluminescence spectra (excitation and emission) were recorded on a Hitachi F-4000 spectrofluorometer. The Photoluminescence spectrum of metal complex of $MgCaq_4$ is as shown in (Fig. 2). In case of $MgCaq_4$, the excitation spectrum shows a peak at 380 nm, when excited in the range of 250 nm to 450 nm. When $MgCaq_4$ material excited at 380 nm, it emit bluish green light of wavelength 488 nm.

The PL spectra of thin films of the $MgCaq_4$ with PMMA at different concentrations like 10, 5 and 1 weight % are investigated and as shown in (Fig. 3). The films of $MgCaq_4$+PMMA at 10, 5 and 1 weight% excited in the range of 250 to 500 nm, centered at 385nm, it shows emission of bluish green light at 493 nm. The green emission from the Alq3 side-chain is observed, indicating that any excited electrons formed by the MgCa side-chain are transferred to the lower excited energy levels of the Alq_3 side chain.

A very narrow full width at half-maximum (FWHM) value of $MgCaq_4$ powder is at 76 nm and blended films with PMMA having in the range of 70 - 86 nm of PL spectra at different weight % concentrations such as 10, 5, 1 weight %.

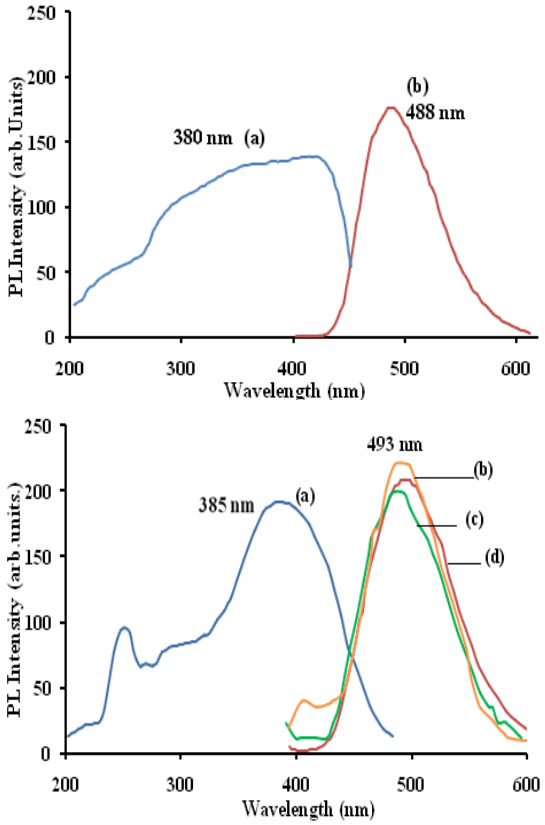

Fig. 2- (a) Excitation spectrum, Emission Spectra (b) $MgCaq_4$+PMMA (10%) (c) $MgCaq_4$+PMMA (1%) (d) $MgCaq_4$+PMMA (5%)

Conclusion

A variety of polyquinolines are acting as the active emitting layer or as the transport layer in LEDs. 8-hydroxyquinoline derivative metal complexes $MgCaq_4$, $MgBaq_4$, $MgCdq_4$ have been synthesized by Simple precipitation method. The organic compounds are blue-green light emitting chromophore in solid crystalline powder as well as in blended thin films. Organic phosphors usually possess strong absorptions in NUV region, which are produced by π-π* transitions and the emission colors can be easily adjusted via molecular design and structural modifications. The PL spectra of thin films of the $MgCaq_4$ with PMMA at different wt% concentrations show the emission of bluish green light at 493 nm with maximum intensity is obtained at 10 weight %. The PL characteristics of organic phosphor are favorable for solid state lighting.

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