Synthesis and Optical Characterization of Green Light Emitting 8-Hydroxyquinoline Magnesium Complex for OLEDs

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ABSTRACT

A exhaustive understanding of the characteristics of organic electroluminescent (EL) material bis-(8-hydroxyquinoline) magnesium (mgq_2) is meaningful for organic light-emitting device (OLED). Mgq_2 sample was synthesized by simple precipitation method. Absorption and photoluminescence (PL) spectra have been investigated on bis-(8-hydroxyquinoline) magnesium (mgq_2) powder. Mgq_2 emission band with peak 486 nm.

Keywords: *photoluminescence, OLED, Mgq2, chalet*

I. INTRODUCTION

Efficient electroluminescence (EL) from an organic light-emitting device (OLED) was reported by Tang and VanSlyke[2,3] using tris-(8-hydroxyquinoline) aluminium(Alq_3). Since those report, the interest in Alq_3 and other metal-chelet systems to produce EL in different spectra regions for display applications has considerably increased[4,6].The first report of organic light-emitting diodes(OLEDs) fabricated using tri-(8-hydroxyquinolinolate) aluminium (Alq3) in 1987[7], organic metal chelateshave attracted much attention due to their high thermal stability, electron transport, and luminescent propertiesmaterial[8-10]. Therefore it is needed to find more stable (8-hydroxyquinolate) - metal compound. Hence we are synthesized mgq_2 which has been presented to be useful for high efficient material in OLED's [11-12].

The chemical structure of mgq_2 molecule is as shown in fig.1. mgq_2 is a metal chalet composed of one metal magnesium ion(mg^{2+}) and two 8-hydroxyquinoline (HQ) molecule. In mgq_2 molecule, the electronic structure of mg^{2+} is $1s^2\ 2s^2\ 2p^6\ 3s^2$.

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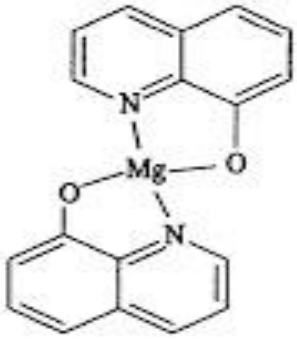

Mgq2 [Bis(8-Quinolinolato) Magnesium]

Fig 1

II. EXPERIMENTAL PROCEDURE

Mgq_2 was synthesized by simple precipitation method at room temperature. Mgq_2 is prepared as follow: firstly take 25 ml of double distilled water and 25 ml acetic acid in same beaker. Dissolve 5 gm of 8-hydroxyquinoline in mixture of double distilled water, acetic acid and stir it still the orange transparent solution was obtained. Then take 4.411 gm Mg $(NO_3)_2.6H_2O$ and dissolve in double distilled water. Stir it till clear solution was obtained. Mix that two solution and stir for 10 min and add NH_4OH solution by drop by drop to this mixture of solution with continuous stirring. Filter the yellow green yellow precipitate. Place the precipitate for drying at 40-50°c for 45 min. The fundamental principle of synthesis of mgq_2 is to combine HQ anion with mg^{2+} in its aqueous solution. Mgq_2 is precipitated under the condition by adjusting pH value of solution. The aqueous solution of magnesium nitrate (Mg $(NO_3)_2.6H_2O$)was chosen as mg^{2+} ion. Ammonia solution was used to adjust the pH value of solution. The pH value of Mgq_2 when it is precipitated out completely ranged 5 to 7.5.

III. RESULT AND DISCUSSION

PL Characteristics of Mgq_2(excitation and emission)

PL spectra of mgq_2 at room temperature is as shown in fig 1.itshows the photo luminescent (PL) excitationand Emission spectrum of Mgq_2powder having excitation wavelength is 389nm, 424nm. The prominent PL emission peak of Mgq_2 is observed at 486 nm in green region of the spectrum.Hence the emission peak reveals that prepared phosphors is not only suitable for organic light emitting diode but also for photoluminescence liquid crystal display (PLLCD) and solid state lighting application as their no significant change in the emission peaks but there is an increase in the intensity.

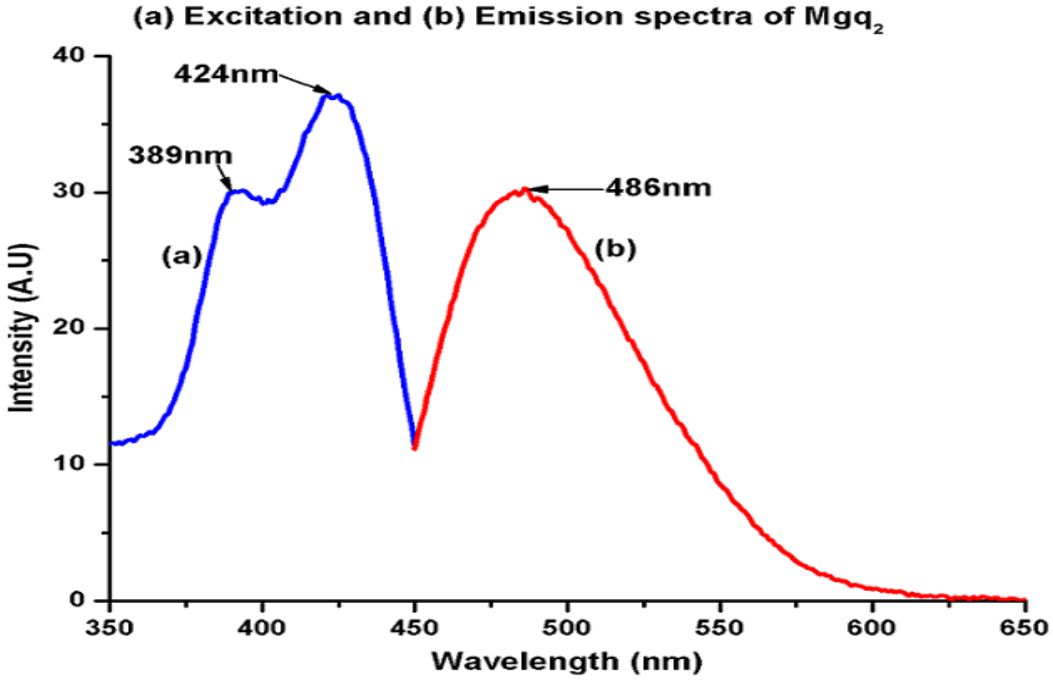

Fig.1.excittion and emission spectra of Mgq_2

FT-IR OF Mgq_2

The absorption bands (1600-1350 cm-1) are generally due to intra molecular phenomena, and are highly specific for each material. They predicts aromatic ring stretching, revealing the presence of C=C group. The aromatic C-H vibration stretch appears at 2800-3000cm-1. The strong and considerable peak at 3146 cm-1 predicts the presence of ammonium ion in the complex . The aromatic C-C bands emerged about 1500 cm-1. The peak 1951 cm-1 owes to the carbonyl group can be observed in the FTIR- spectrum of Mgq2. Strong peaks between 850- 700 cm-1 may be due to the presence of C=Cl group. The peaks between 700 – 1300 cm-1 is indicative of skeletal C- C vibrations..These results confirm the formation of the desired complex and the presence of quinoline structure in the synthesized organic complex.

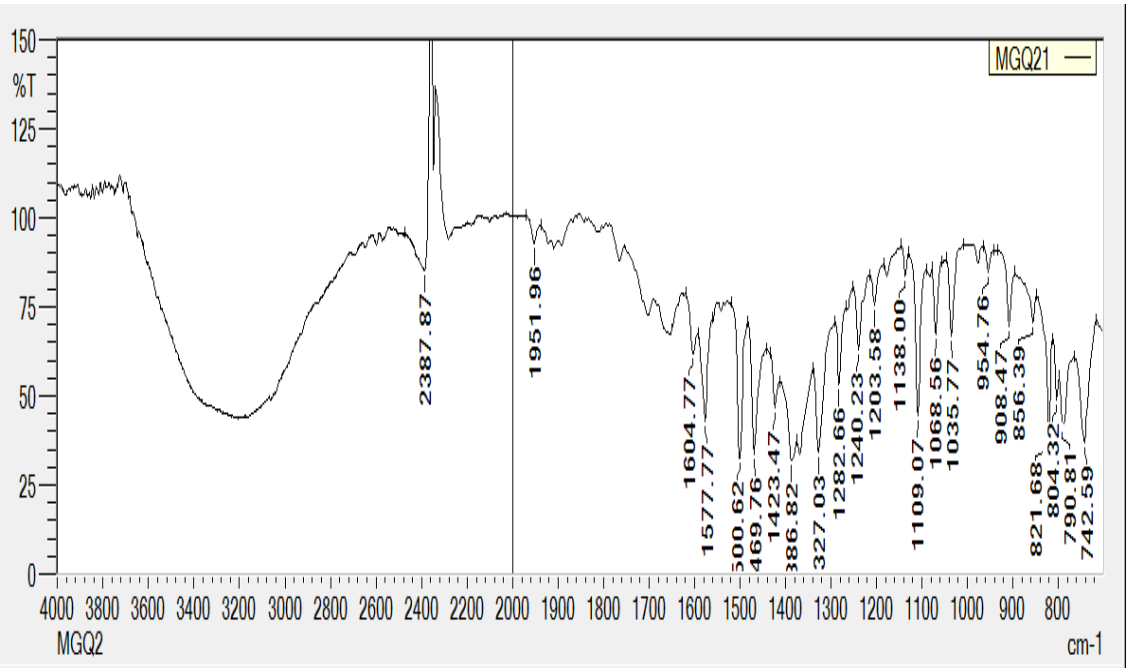

Fig.2. FT-IR of Mgq_2

IV. CONCLUSION

In summary, the organic EL material Mgq_2 with high purity have been synthesized and purified. Mgq_2 have the emission band with peak at 486nm and hence this material is useful as a blue-green emitter for OLED. The absorption bands (1600-1350 cm-1) are generally due to intra molecular phenomena, and are highly specific for each material. They predicts aromatic ring stretching, revealing the presence of C=C group. And hence we confirm that there is the presence of 8-hydroxyquinoline in the synthesized organic complex.

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