NOVATEUR PUBLICATIONS
International Journal of Research Publications in Engineering and Technology [IJRPET]
ISSN: 2454-7875
VOLUME 3, ISSUE 9, Sep. -2017

GREEN LIGHT EMITTING TRICOMPONENT LUMINOPHORS OF 2-NAPHTHOL FOR CONSTRUCTION OF ORGANIC LIGHT EMITTING DEVICES

K. G. MANE
Dept. of Chemistry DoshiVakil Arts and G.C.U.B. Sci. and Comm. College, Goregaon-Raigad402103, Maharashtra,India.
kanchanmane13@gmail.com

P. B. NAGORE
Dept. of Chemistry DoshiVakil Arts and G.C.U.B. Sci. and Comm. College,Goregaon-Raigad-402103, Maharashtra,India.
pravin.nagore@gmail.com

DR.S. R. PUJARI
Dept. of Chemistry D. B. F. Dayanand Science College, Solapur, Maharashtra, India. pujari_aarush@yahoo.co.in

ABSTRACT:

This article presents a previous study and incredible progress in basic theoretical modeling, and working for organic light-emitting devices (OLEDs) including preparation and characteristic studies of Organo-Luminescent Materials by conventional solid state reaction technique.

Keywords: Organic light emitting device, Luminophors, FRET.

I. INTRODUCTION:

Now days the fast development of science and technology, and their wide applications to daily life, the requirement for good interfaces between users and machines is growing, such as information display for instruments, televisions, computers and so on. In order to gain ample, correct, concise and high-speed information from machine, the display elements have been widely studied.

Even though the display market is still dominated by Cathode-Ray-Tubes (CRT) andLiquid-Crystal-Displays (LCD) the impact oforganic light emitting diodes (OLEDs) is becomingstronger [1].

Hence here we have prepared Anthracene and tetracene doped 2-napthol luminophors in crystalline powder form by conventional solid state reaction technique which is used as electroluminescent material in OLED. The structural parameters and morphology of the luminophors were explained by XRD and SEM technique. The powder X-ray diffraction studies show that the 2-napthol forms a homogeneous solid solution with the added guests. From the fluorescence spectra it is seen that anthracene impurity shifts the UV fluorescence of 2-napthol towards blue region at a wavelength of maximum emission at 413 nm. Incorporation of nonfluorescent tetracene into it leads to tricomponent crystal system which emitting at green region. SEM image confirm the crystallites having average size at128.9 nm .This system can efficiently be used in scintillation application [2].

A. THE BASIC WORKING PRINCIPLE OF OLED:

OLED's lightening devices consists of very thin films of organic compounds in the emissive layer. The organic compounds used have as special property of creating light when electricity passed through it.

The schematic of 2-layer OLED is as fig.1.

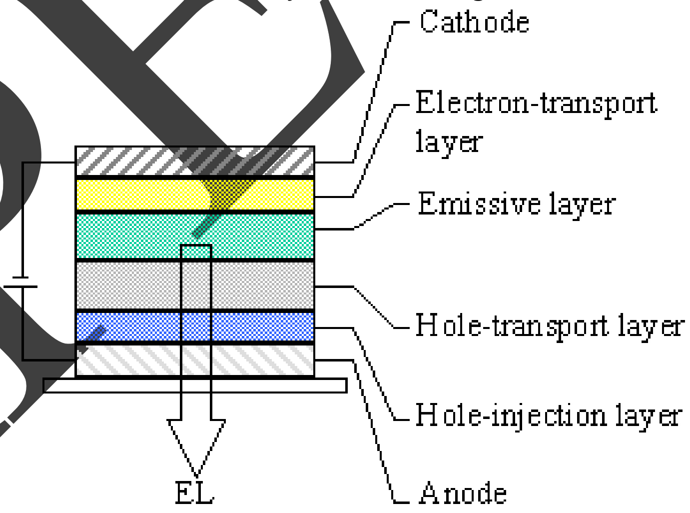

Fig.1: - Schematic of a 2-layer OLED

To light up OLED, electricity needs to flow across anode and cathode with applied voltage. In this process, cathode receives an electron lost by anode .The emissive layer becomes negatively charged due to electrons received(like n-type layer in a junction diode) while conductive layer is becoming positively charged (like p-type material).

Here, positive holes become more mobile than negatively charged electrons, so they jump from conductive layer to emissive layer.

When a hole meets an electron, due to annihilation it release a brief burst of energy in the form light photon. Due to this OLED produces continuous light as long as current keeps flowing[3].Various methods are well known for the deposition of organic kind depending on the type of device such as thermal vacuum evaporation, spin coating, Ink-jet printing and laser induced thermal images, etc.

B. PREPARATION OF NOVEL LUMINOPHORS:

Tuning of the colors of the phosphor materials is an attractive topic in construction of organic light emitting devices [4]. Hence, the authors achieved creation of material emitting with desired colors by mixing homogeneously blue and green light emitting material in the material emitting in ultraviolet region i.e. luminophors of 2-napthol (2-NP) doped by anthracene (AN) and tetracene (TN) were prepared by solid state reaction technique [4].

II. EXPERIMENTAL WORK:

A. SYNTHESIS OF AN AND TN DOPED 2-NAPTHOL:

2-napthol based Tricomponent luminophorsdoped by Anthracene and tetracene were prepared by conventional solid state reaction techniqueby using crystalline powders of anthracene and tetracene .These host and guests were purchased from Aldrich utilized as received. Series of 2-napthol solid solutions with anthracene and tetracene were prepared . All chemicals were of scintillation grade.

B. CHARACTERIZATION OF SAMPLE:

The samples were characterized to determine the morphology of prepared sample by SEM on FEI Quanta FEG 200 images, Fluorescence spectra were measured using JOBIN YVON FLUROLOG-3-11 SPECTROFLURI METER, from IIT Madras. The X-ray diffraction (XRD) patterns were recorded with the help of Ultima-IV, Japan from Solapur University, Solapur.

III. RESULTS AND DISCUSSION:

A. FLUORESCENCE SPECTROSCOPY:

Fig.2 shows fluorescence spectrum of tricomponent luminophors of 2-napthol containing varying concentration of anthracene and tetracene. For comparative study the Fig .2 is also given which shows fluorescence spectra of bi-component luminophors of anthracene doped 2-naphthol which we were prepared. From the result it was observed that the fluorescence spectra of anthracene doped 2-napthol is structured which appear at blue region but completely different than fluorescence spectra of 2-napthol which clearly indicates that the excitation energy of 2-napthol exciton is trapped by anthracene.Whereas From the figure .3 it is seen that the addition of nonfluorescent tetracene in anthracene doped 2-naphthol gives a new band at λ_{max}= ~ 528 nm which gives green light emission with simultaneous quenching of 2-NP fluorescence due to excitation energy transfer (EET) when excited at 334 nm.

Also, it is observed that for $1x10^{-3}$ and $1x10^{-2}$ anthracene and with 1x10-3 tetracene only the intensity of peak is changed and but no any shift in the peak observed.

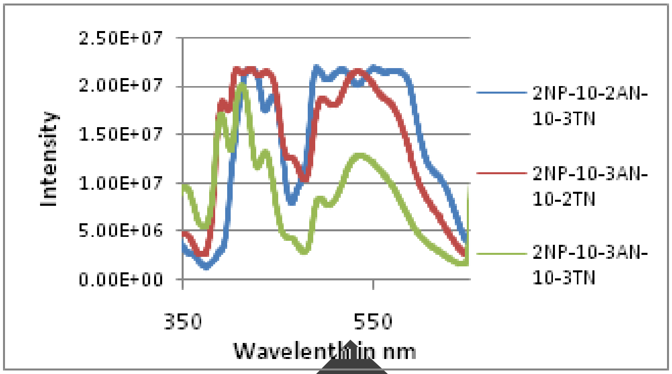

Fig.2 Fluorescence spectra of AN and TN doped 2-NP

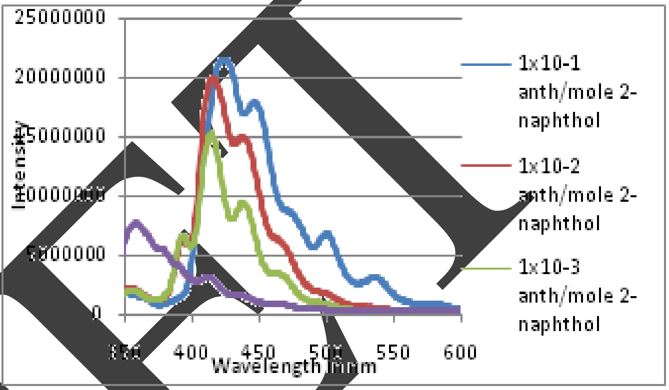

Fig.3 Fluorescence spectra of pure 2-NP and AN doped 2-NP

FLUORESCENCE MECHANISM:

PRESENTATION		PROCESS
2-NP (S_0) + $h\upsilon_{334nm}$	= 2-NP*(S_1)	2-NP excitation
2NP* (S1)	= 2-NP(S_0) + $h\upsilon_F$	2-NP fluorescence
2NP* (S1) + AN(S_0)	= 2-NP(S_0) + AN*(S_1)	Guest excitation by EET process
AN*(S_1)	= 2-AN(S_0) + $h\upsilon_F$	Guest fluorescence
2AN* (S1) + TN(S_0)	= 2-AN(S_0) + TN*(S_1)	TN excitation
TN*(S_1)	= 2-TN(S_0) + $h\upsilon_F$	Guest TN emission

B. X-RAY DIFFRACTION STUDIES:

Fig.3 shows well defined peaks of pure 2-napthol and 2-napthol luminophors. The spectra were recorded as a function of tetracene concentration. The sharp, well defined and no any additional peak in the spectra indicate the crystalline behavior of the luminophors with no any change in the position of the peaks (2θ values) even after doping and formation of homogeneous mixed crystals, respectively. From the observed data we have calculated the structural parameters such as microstrain, dislocation density, grain size and stacking fault as tabulated in (Table -1). The average grain size of doped 2-naphthol luminophors with pure 2-naphthol, anthracene and tetracene were estimated by using classical Sherrer formula [5]. It is observed that, by introduction of tetracene dopant into 2-naphthol luminophors, the grain size of luminophors decreases with dopant concentration. On doping of a pure crystal into host, it deforms by creating defects and imperfection into host lattice. The deformation in crystal slightly changes microstrain and dislocation density as per expectation which were estimated and represented in (Table -1). Stacking fault seen to be constant. Overall result leads to consider close packed structure of both host and guest molecules.

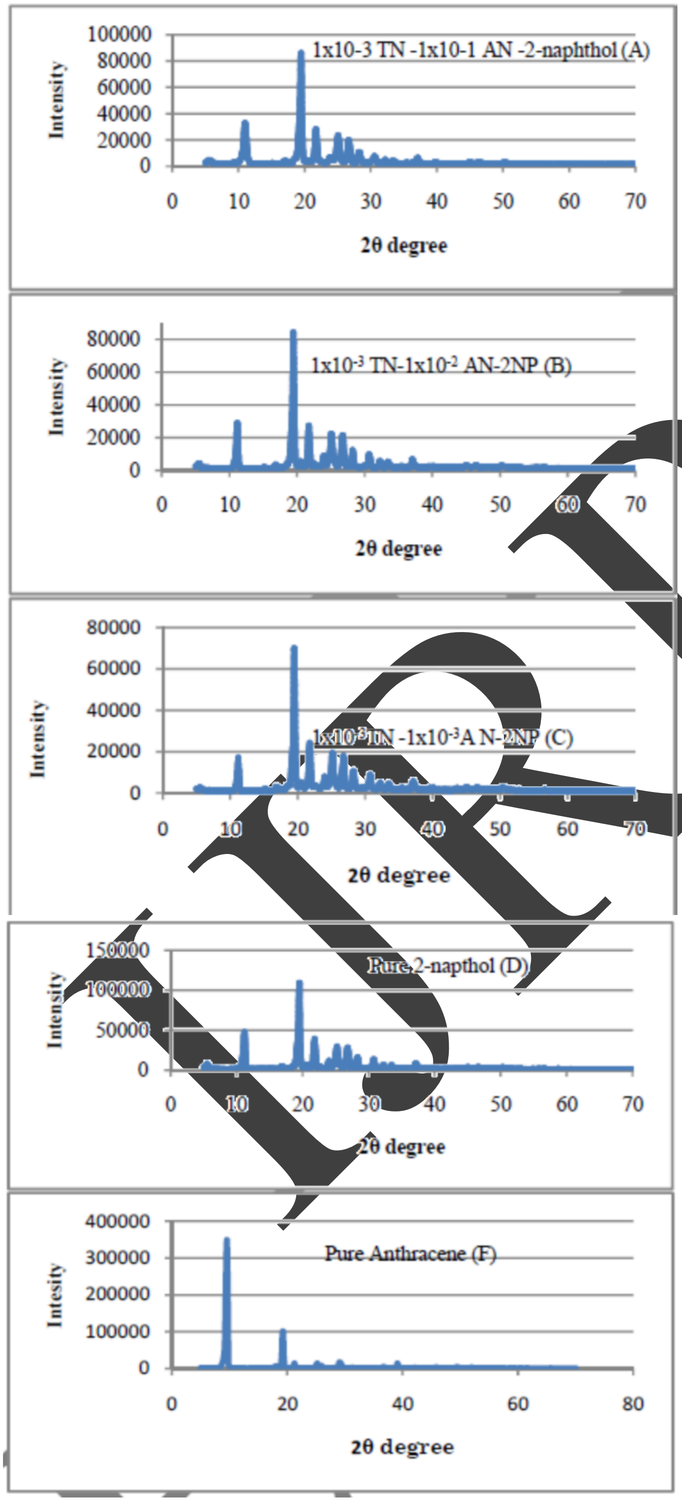

Figure-1. XRD profile of anthracene and tetracene doped 2-naphthol

C. SEM IMAGES:

Fig.4 A and B shows the SEM micrograph of pure and doped 2-NP. Hence the image- A is of pure 2-naphthol shows the compact crystal type picture and image- B shows identical and well separated crystallite of monoclinic form. The observed average crystallite size of doped 2-napthol 128.9 nm is noted from SEM micrographs is of the range required in scintillation tion.

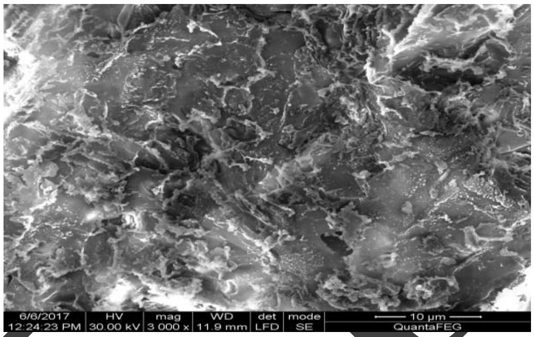

Fig.4 SEM images A) Pure 2-naphthol

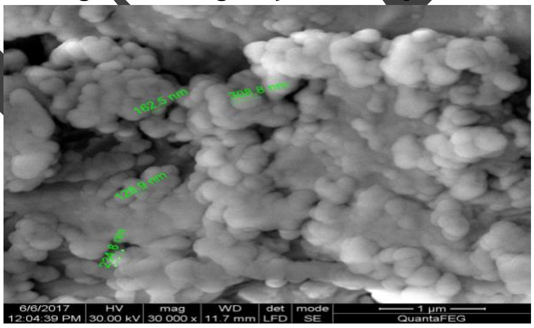

Fig.4 SEM images B) $1x10^{-3}$TN-$1x10^{-1}$AN-2NP

TABLE1:-STRUCTURAL PARAMETERS OF 2-NAPTHOL LUMINOPHORS

Conc. of AN, (M)per mole of 2-NP	Sample (A)	Sample (B)	Sample (C)	Sample (D)	Sample (E)	Sample (F)
Glancing Angle, (2θ) degree	19.460	19.470	19.480	19.445	19.480	9.550
FWHM, ($\beta_{2\theta}$)	0.459	0.459	0.447	0.446	0.447	0.471
Microstain, (ε x 10^{-3} $1^2/m^4$)	1.973	1.973	1.922	1.917	1.922	2.047
Grain Size, (A⁰)	259.8	259.9	267.18	266.9	266.89	428.9
Dislocation Density (ρ x $10^{15}cm^{-2}$)	4.997	4.99	4.734	4.725	4.738	3.129
Stacking Fault,(α)	0.610	0.610	0.610	0.2725	0.6106	0.4122

IV. CONCLUSION:

1) The observed green light emission of doped material results therefore in smart materials

with finely-tuned optical and electronic properties.

2) The advantages of these Organo-luminophors material compared with other “classic” materials is economic and can be used more effectively in photoresist, optical storage industry, in scintillation process and obviously for construction of OLED. The addition ofadditives opens furthermore the option of fine tuning of properties.

ACKNOWLEDGMENT:

a. The authors are thankful to Hon. Prin. Dr. G. D. Giri and Management of DoshiVakil Art’s And G.C.U.B. Sci. and Comm. College, Goregaon-Raigad and also express sincere thanks to IIT Madras, SAIF and Solapur Univerity, Solapur.

REFERENCES:

1) P. Petrova , R. Tomova “*Materials used for organic light-emitting diodes – organic electro active compounds*” Bulgarian Chemical Communications, Vol. 41, 2009 pp. 211–225
2) T.P.Nguyen, P.Molinie, P. Destruel, “*Organic and Polymer Based Light Emitting Diodes Handbook of Advanced Electronic and Photonic Materials and Devices*”, H. Sing Nalwa(e),vol.10,AcademicPress, San Diego, 2001, pp.3.
3) Mr. Bhrijesh N. Patel, Mr. Mrugesh M. Prajapati ,*“OLED: A Modern Display Technology”,* International Journal of Scientific and Research Publications, Vol. 4, Issue 6, 2014 pp.1-5
4) LEROY ALEXANDER AND HAROLD P. KLUG, *“Determination of Crystallite Size with the X-Ray Spectrometer*, Journal of Applied Physics 21, 1950, 137; pp.137-142
5) Dattta A.K., Talpatra G. and Mishra T.N. “*Exciton transport mechanim in 1,4-dibromonaphthalene-1-bromo4 chlorona phthalene mixed crystal at 77K”,* Bull. Chem .Soc. . Vol.68, pp. 3331.