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SHORT COMMUNICATION

A REVIEW -THE DEVELOPMENT IN ORGANIC LIGHT EMITTING DIODES (OLEDS) THE FUTURE OF DISPLAYS

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The last three decade were marked by tremendous advances in the area of electronics and telecommunication .This includes the semiconductors ,solar cells ,high density batteries and materials of optoelectronics interest like electroluminescent and nonlinear optical materials.(1)The light emitting diode (LED)could be new generation of alternative flat panel display to the CRT(cathode ray tube)and LCD(Liquid crystal display)The story of LED goes back to 1907 (2).the studies were limited to the use of inorganic semiconductor such as GaN,ZnS and ZnSe . The large area fabrication technologies by LEDs have not been practicable due to problems in fabrication. The attention was given to the conjugated organic molecules which showed electroluminescence properties. A single crystal anthracene was first discovered in 1963 to exhibit electroluminescence (3). This important milestone was due to Tang and Van Slykes discovery of the double layer green thin film organic luminescent device.(4)This kind of multilayer set up is is now common in organic LED devices. The fabrication of such devices constitutes the three layers 1) transparent ITO electrode which serves as anode 2) an electro active material -a flurophore may be dissolved in a polymeric binder and coated from solvent or vacuum evaporated directly on to the anode such as calcium3) Low work function metal cathode such as calcium , magnesium or aluminum.

The different material technologies are 1) small molecules2) PLEDs (polymer light emitting diode or LEP light emitting polymers),PHOLED Phosphorescent OLEDs ,POLED Patternable OLED . The different OLED structures 1.Bottom emission, 2.Top emission ,3.Transperent OLED 4.Stacked OLED 5.IOLED Inverted

There is a lot of interest developed in the recent years among the researchers towards organic electroluminescence (EL) due its applications in the full and flat color display system. Organic light emitting devices (OLED) have received considerable attention in the recent years due to its potential applications in the light emitting devices and flat panel displays. The technology behind the OLED displays is pure chemistry but the applications are much more in day to day life from mobile phone, laptop, television screen etc. This OLED technology based on the principle of light emitting, fast switching diodes could be made from polymers as well as from semiconductors .The LCD glass covered with structured ITO (Indium -tin oxide) then polymer material is applied by precision ink jet printing thus pixels of red ,green, and blue material are applied by metal evaporation and then cell is sealed. The other approach is based on t a white le from which the three primary colors can be obtained by micro patterned filters.

The full color red, green, blue (RGB) displays based on the organic materials have very attractive prospects. Several methods have been developed for obtaining RGB pixels (5-7).The highest driving efficiency can be achieved by using self emitting RGB pixels , ti is very much necessary to develop such light emitting materials for each of these colors .The materials for the green and blue organic light emitting diodes (OLEDs) with high efficiency ,saturated emission ,high luminescence and substantial life time have been reported (8-11)The dot matrix OLED panels with blue and green colors become commercial y available and full graphics array (320x240 dots)panel was demonstrated(12).

There are various types of OLEDs based on 8-hydroxyquinoline, carbazole ,LiBqm$_4$ are based on two electrode system containing anode and cathode and the organic material is sand witched between them.

In typical OLED a hole transporter ,a electron transporter and a light emitter must be present .The carbazole derivatives are well known as hole transporting and electroluminescent structure because of their high charge mobility and photochemical stability and their blue electroluminescence as a result of the large band gap (improved planar biphenyl unit by bridging nitrogen atom)(13-14).The carbazole derivatives can readily functionalized at 3-,6-,9-position and covalently linked to other molecular unit resulting in a versatile synthesis of many types of derivatives ,substituting the hydrogen atom on nitrogen atom with alkyl chains such as 2-ethylalkyl bromide and octylbromide can increase the solubility of carbazole derivatives.[15-19]The carbazole group has been used as a functional building block in the fabrication of the organic photoconductors, nonlinear optical devices and OLEDs. The 8-hydroxyquinoline metals are presently considered as one of the most reliable electro transporting and emitting material applied in molecular based OLEDs for their thermal stability ,high fluorescence and excellent electron transporting mobility.

The synthesis and characterization of LiBqm4 boron complex and its suitability for OLEDs application .It has been recognized as the charge transfer mechanism is an important phenomenon in the organic light emitting diode .OLEDs have been fabricated in a triphenyl diamine derivative TPD /LiBqm4 bilayer configuration .The complex emits a quite bright greenish -blue light with peak wavelength at 503nm.

The interest in the Alq3 and other metal- chelate systems to produce EL in the different spectra region for display applications has increased .Thin film of the Alq3 are among the most widely used EL material in OLEDs and have led to the point that products are entering in the market place. Alq3 is the metal chelate composed of one metal aluminum ion (AL+3) and three 8-Hydroxyquinoline (HQ) molecule. The Al+3 is structure of inert gas atom, so Alq_3 has good stability in the inert atmosphere .The Alq3 is received electron carrier transporting /photoemitter material .The metals which have the low work function have been chosen as cathode in order to enhance the injection efficiency of electron in the investigation and fabrication of EL devices .The analysis of possible chemical reactions between the Alq3 and alkali and alkaline earth metals. Choong etal have studied the luminescence. Photoluminescence quenching phenomenon of Alq3 by using metal deposition [20].

The high efficiency OLEDs have been fabricated using electro phosphorescent molecules such as PtOEP, IrPPy. This has improved the quantum efficiency and luminous efficiency in OLED.As in fluorscene based LED , the quantum efficiency of phosphorescence based LEDs arew not limited and can reach to 100% using the singlet and triplet excitation. The most phosphorescent guest materials investigated are complexes of heavy metals ,as strong spin-orbit coupling leads to singlet -triplet mixingand resulting in to high efficiency lecrophosphorescence in LEDs. It is of interest to use polymers instead of organic small molecule as a host material as PLEDs have the potential to be used for large area display which can be made using simpler process and at lower cost.[21] The OLEDs are have self laminating material that eliminates the need of backlight. In LCD the backlight is crucial to improve the brightness which adds significant cost and extra power .The polymer LEDs have many inherent properties that eliminates the need of backlight such as a) all colors are of the visible spectrum b)high brightness at low voltage a/current density c)no angle dependence e)operating life time 10000hrse)high response speed.

In this technology there is much scope for the improvement and cost reduction The printing OLEDs on to flexible substrate opens the door to new application such as roll up display and displays embedded in fabrics or clothing .The biggest problem in OLEDs is limited lifetime .The intrusion of water into display can damage or destroy the organic molecule, improved sealing is required and may limit the longevity of the flexible display.

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