Luminescent polymers-based light emitting diodes: A review

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Abstract. Diodes with light emitting materials fetch the attention with different emerging trends such as Optoelectronic devices, Solar cells, etc. are very crucial, revolutionary and fascinating from the research point of view. The main focus of this review is to explore conducting polymer such as Polyacetylene, which plays vital role in electroluminescent devices. In this case, an optical and electrical characteristics of light emitting diode with Al is used for the contacts of electron injection which upgrade the performance of light emitting diode in terms of quantum efficiency.

Keywords: conducting polymers, LED, quantum efficiency.

1. Introduction

The organic light emitting diodes are the most valuable and fascinating area of research in many fields which are equally important in our life [1-7]. Since the initial works was completed Tang et.al. on small molecules [8] and much of organic and polymeric compounds were prepared and applied to the Optoelectronic appliances for the different applications. A brand new generation of technology is emerging within the lighting market. It's being propelled by the dramatic improvements providing benchmark performance of solid state light sources. Solid state lighting could also be a desirable research field which mentioned the revolutionary breakthrough technology of inorganic LEDs during the last decade.

P-type conjugated polymers are developed and resulting in the recent achievement in mobility of holes with high field-effect.

In Polymers positive polarons and negative polarons are the radical cations and anions. The main focus of this review is to explore different conducting polymers- Polythiophene, Poly (p-phenylenevinylene), Polyacetylene, which plays vital role in electroluminescent devices.

Poly-acetylene is one of the example of the conjugated organic polymers. The foremost necessary preparation was projected by many researchers. Once chemical action takes place, the films square measure with chemical doping by reaction with grouping different chemical structures severally.

R Sun et al. observed, phenyl or phenyl and alkyl distributed polyacetylene indicates a greater luminescence performance in the green or blue region [10]. Hence polyacetylene derivatives are vital in emission of light in the whole visible region. The used derivatives are as shown in figure 1.
2. Experimental

T. Masuda et.al., were described the preparation of the above-mentioned poly-acetylene derivatives [11]. A series of polyacetylene spread as poly[2-(o-iso-propylphenyl) acetylene] (PPA-iPr), poly [1-(p-n-butylphenyl)-2-phenylacetylene] (PDPA-nBu), poly(1-hexyl-2-phenylacetylene) (PHPA) are developed and analyzed with electroluminesence. For the optical absorption spectra and electroluminescence, the polymer thin films are made using spin coating from tetrahydrofuran or chloroform solution at 5 to 10 mg/ml concentration.

For devising of Electroluminescent appliance (figure 2), with the help of chloroform films was prepared on Indium Tin Oxide coated plate. Then on the top of the film Mg-In alloy was deposited with the help of vacuum evaporation technique. Using spin-coating method, again there was deposition of second and third layer with deposition of aluminum layer on that by using evaporation. Properties of Electroluminescent device had been studied under vacuum or in liquid nitrogen.
3. Result and Discussion
In figure 3, absorption spectra of different derivative of polyacetylene were ranging in between 265 to 420. More likely associated with the Π-Π* transition of the main chain of the derivatives. PHPA shows highly intense absorption in ultra violet region and very weak absorption in visible region [10]. The amount of absorption depends on the wavelength of the radiation as well as the structure of the compound. The second peak is existed due to the phenyl side chains of the main derivative.

A robust interaction between the metal and therefore the polyene chain was found, which ends up within the formation of valency aluminium-carbon bonds and a discount of the Π-electron conjugation on the chain. However, an outsized degree of delocalization in Π-levels is maintained. Extraordinarily sensible electrical properties of compound devices are reportable by Burroughs et al., with poly-acetylene [12].
Figure 4. EL spectra of PHPA, PDPA-nBu, PPA-iPr [10]

Red EL from PPA-iPr has a less efficiency while with green or blue from PDPA-nBu or PHPA has a relatively greater efficiency, which are between an indium-tin oxide (ITO)-coated glass substrate and a Mg/Al cathode as shown in figure 2, have been observed. The EL efficiency [10] of the above derivatives was studied 0.001%, 0.01% and 0.01% respectively as shown in figure 4. The optical and electrical characteristics with Aluminum as the electron-injecting probes which is responsible for an enhanced quantum efficiency for light emission [13].

Figure 5. EL spectra of PDPA-tBu, PDPA-SiMe₃, PDPA-mSiMe₃ [14]

From figure 5, it was confirmed that the Poly(diphenylacetylene) derivatives showed green electroluminescence [14]. Substituents in derivatives of poly-acetylene were responsible for the extent of composure of the utmost chain configuration after excitation of photon. In this Electroluminescent
appliances, Electroluminescence changing due to voltage and that is changing because of central E-layer [15].

4. Conclusion
A most vital reason for preparation and exploration of novel polymeric compound is to inspect molecular engineering perspective on the basis of derivatives to enhance the characteristics of solid-state materials. Rapidly increasing use of such solid state lighting has been showing emergent concern on global energy consumption. In optoelectronic devices, conjugated polymers are required with high optical range within the blue and bluish-green region.

5. References
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