OLED Technology

Yash Agrawal
B.Tech. IV Year,
Department of Electronics and Communication Engineering
Vivekananda Institute of Technology, Jaipur

Abstract: **Organic LED is a solid state semiconductor device containing two electrodes and a conducting and an emissive layer are situated between them to create electroluminescence in form of electricity. The hole or electron limited electroluminescence mechanism in OLED devices has made it eminent in display technology. Being light in weight, small thickness and more flexible than LEDs and LCDs. OLED has maximum efficiency due tom low power consumption. In addition, the cost is main advantage of OLED which make it lead to future applications.**

INTRODUCTION

OLED is advance technology based on electroluminescence. It is thin film solid state device. Its fabrication process is very Simple and less distortion according to the geometric form of displays. So it is easy to make its display flexible. Organic Light Emitting Diode (OLED) has two layers one is conductive layer and another is emissive layer between two electrodes. These layer are made by using organic material. Light which produced by the OLED due to recombination in organic layer majority charge concentration is organic light responding to an electric current. OLED is LED but in it we use electrode in place of PN junction diode. One of the main advantage is no used of backlight as compare to LED. Hence OLED has thin and compact display.

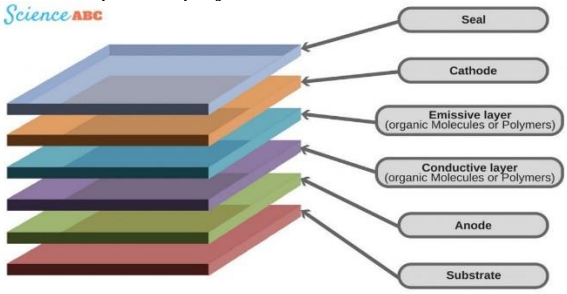

Fig.1. Structure of OLED

HISTORY

The first observation of electroluminescence is done by Andre Bernanose at the Nancy University in France in organic material in the 1950s. They applied high alternating voltage in the air on material which is dissolved on thin films according to this mechanism electrons are exited. In 1960, the martin pope developed a dark injecting electrode made by contacts of organic crystal. Due to these contacts charge injected in all the modern OLED. Pope observed first time DC current on single organic crystal in a vacuum. In 1965, pope observed that on a organic crystal in absence of electric field the electroluminescence occur due to the recombination of hole and electron. American physical chemist Ching W. Tang and Steven Van Slyke make first time practical OLED in 1987. In this device two layer such as hole transporting and electron transporting layer is used due to this a large no. of recombination occur at the middle of the organic layer. The result is light emission, low supply voltage, high efficiency.

WORKING PRINCIPLE

OLED mainly working on a electroluminescence. In LED, OLED, LCD only Direct band gap Semiconductor is used because in it energy dissipated in the form of light. For large no. of recombination forward bias is applied on the electrode, result in light emission. OLED is contain a layer of organic material which is situated between two electrodes called anode and cathode and all this structure is placed on a substrate. Due to the delocalization of pi electrons organic molecules are electrically conductive. These materials shows its conductivity between conductor and insulator so these material consider as a organic semiconductor. Generally, the basic polymer OLEDs consisted a single layer of organic material. The first light emitting device contained a single layer of organic material. To improve the device efficiency multilayer OLEDs can be fabricated using two or more layers of polymers. When we applied the voltage from 2.5 to 20V then due to very thin emissive layer electric field is very high in it about 107V/cm. due to the high electric field charge carrier of electrons are injected from the cathode and holes are injected from the anode. There electron and cathode are recombined at the junction. In this process of recombination energy is released in the form of light and electroluminescence occur.

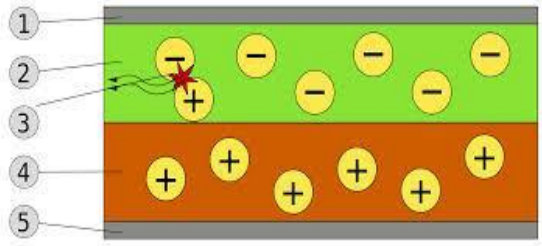

FIG.2: BILAYER OLED: 1. CATHODE (-), 2. EMISSIVE LAYER, 3.EMISSION OF RADIATION, 4.CONDUCTIVE LAYER, 5. ANODE (+)

ADVANTAGES

Weight and Substrate: OLED has light weight because it can be fabricated on any flexible plastic substrate which is

leading to the possible fabrication of flexible OLED for other application, such as roll-up displays embedded in fabrics or clothing. The substrate which is used can be flexible such as polyethylene terephthalate(PET), and the display which produced may be inexpensive.

Viewing angle and Brightness: OLEDs has greater artificial contrast ratio and viewing angle is wider as compare to the LCD because pixels of OLED emit light directly. OLED pixel colors are unshifted and correct, even as the viewing angle approaches to 90°from the normal.

Power efficiency and thickness:LCDs are filters the light which is emitted from a backlight, and allow a small fraction of light through it. So LCD cannot show true black. But OLED element does not produce light or consume power, so OLED allow true black. So here backlight is not use in OLED this makes OLEDs lighter because for this substrate is not needed. In OLED thickness is also plays important role due to index match layers (IMLs). So emission intensity is enhanced when thickness of IMLs is 1.3-2.5nm.

Response Time: As compare to LCD the response time is much faster in OLEDs. This OLED response time is 1000 times faster than LCD. Due to faster response time, OLED displays can also be easily designed and creating an effect similar to CRT flicker and avoid the sample and hold behaviour.

REFERENCES:

[1] OLED over conventional LED by Prof.Atul Shire, Prof.UmeshLawarker, AkshayArbat, EXTC Amaravati University, India.
[2] Study of OLED by GeetaDhyani and NiveditaBishtz,Assistant Professor, S.I.T, Pithoragarh, Uttarakhand, India
[3] https://en.wikipedia.org/wiki/OLEd