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Organic Led

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Abstract: *In this paper we propose the information about the organic light emitting diode . our main objective in this work is to study the structure, functioning,advantages and disadvantages of the organic lED. The information consists of how the organic LEDs will replace the ordinary LEDs in near future.Self-emissive organic light-emitting diodes (OLEDs) are a new promising technology with high expected profitability on the display market, which is currently dominated by liquid crystals.Despite intense research efforts during the last decade there are still improvements to be made in OLED-lifetime and OLED-outcoupling.By this thesis we will structurewell performing organic led polymers with direct lithography and investigate their applications in electro optic devices as diffraction elements. we will first intensely study the structuring techniques. organic LEDs show low driving voltages in combination withunrestricted viewing angles ,light weight , low production costs , small film thicknesses,highcolour brilliance. They can be deposited on flexible subtrates because of the plasticity of the materials. Some OLED display like PDAs , mp3 players ,mobile phones ,navigation system .*

Keywords *- OLED,features,structure,working,types, applica tions,advantages,disadvantages.*

I. INTRODUCTION

Organic light emitting diode are originated from the class of LEDs. They serve as the major display technologies that differs with low power and combination of great colours.OLED works on the principle of electroluminescence .As electric current passes through certain materials it will start emitting light ,this is stated by optical and electrical phenomenon.The applications of OLEDs are such as to create digital displays in devices such as TV screens , computer monitors and portable systems like mobile phones , mp3 player and digital camera etc. Thickness of OLED is about 100 to 500 nanometers and 200 times smaller than human hair.LCD displays are cheaper than OLED as OLED uses inject printing technology and sprays conductive polymer substances instead of ink. Advantages of OLED are bright, clear, thin, light in weight, and possess an efficient viewing angle.Apart from this, they can be taken on various surfaces and can be printed on various surfaces.Disposal and pollution problem is eliminated as OLED lighting contains no mercury.OLED (Organic Light Emitting Diodes) is a flat light emitting technology, made by placing a series of organic thin films between two conductors. Another best advantage of OLED is provision of best quality image ever and they can also be made transparent,flexible,rollable,foldable and stretchable.

Figure 1. OLED display

II. FEATURES

- Flexibility
- Emissive technology
- Light weight and thin
- Low power consumption

- Perfect contrast, brighter and best display from all angles

III. STRUCTURE

Composition of OLED consist of Amorphous and crystalline molecules which is arranged in irregular pattern. Structure consist of multiple thin layer of organic molecules.When current passes through these thin layers, light gets emitted from their surface by a process of electro phosphorescence. OLEDs follows the principle of electro-luminescence, and this can be achieved by using multi-layered devices. In between these multi-layered devices, there are several thin and functional layers that are sandwiched between the electrodes.When direct current is applied, charge carriers from the anode and cathode move towards organic layers,this is due to electroluminescence and visible light gets emitted.The architecture of OLED display comprises several layers: two or three organic layers like conducting layer, emissive layer and other layers such as substrate, anode and cathode layers that are explained below in detail.

Substrate Layer:-This layer is a thin sheet of glass with a transparent conductive layer, which can also be made by a clear plastic layer or foil. This substrate supports the OLED structure.

Anode Layer:-This layer is an active layer and removes electrons. When current flows through this device, electrons are replaced by electron holes.Anode surface is deposited on thin layer, hence, it is also known as transparent layer. Indium tin oxide is the best example of this layer that serves as the bottom of the electrode or anode.

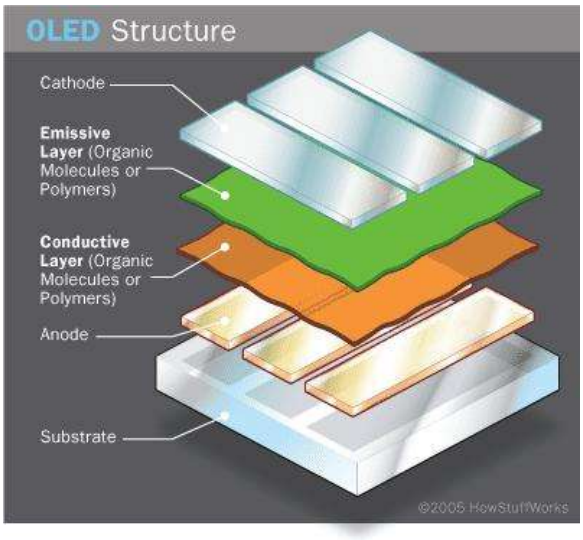

Figure 2. Structure of OLED.

Conductive Layer:- This layer plays an important role, that is transporting the holes from the anode layer. This layer is made up of organic plastic,and the polymers used include light emitting polymers.The conductive polymer used in OLED are polyaniline, polyethylenedioxythiophene. This layer is an electroluminescent layer and uses the derivatives of p-phenylenevinylene and polystyrene.

Emissive layer:- This layer transports electrons from anode layers, and it is made of organic plastic molecules that are different from the conducting layers. For getting wide range of wavelength during emission there are multiple choices of material and processing variable. In this layer, two polymers are used for emitting such as polyfluorene, poly paraphenylene which normally emits green and blue lights.Special Organic molecules that conduct electricity are used to make this layer.

Cathode Layer**:-** Electrons are forced inside as current flows through the device this is done by cathode layer. Calcium, barium, aluminum and magnesium are used for making this layer. It may be either transparent or opaque depending on the type of OLED.

LED fabrication process is as follows:-

- Substrate Preparation
- Device deposition (Deposit and pattern anode,Pattern Organic layer,Vaccum deposit and pattern cathode)
- Encapsulation
- Making of Backplane

Three ways to manufacture OLED by applying the organic layers to substrate:

- Vaccum depositon or vaccum thermal evaporation : In a vaccum chamber the organic molecules are gently heated and allowed to condense as thin films onto cooled substrates. This process is expensive and inefficient.
- Organic Vapor Phase Deposition (OVPD) – In cooled substrates evaporated organic molecules are transported by carrier gas, where they condense into thin films.This is done in low pressure hot walled reactor chamber .By using a carrier gas we can increases the efficiency and thus reducing the cost of making OLEDs.
- Inkjet Printing –Oleds are spread onto substrate in Inkjet printing ,this reduces the cost of Oled manufacturing and thus allowing Oled to print onto very large displays like 80 inch TV screens or electronic billboards .

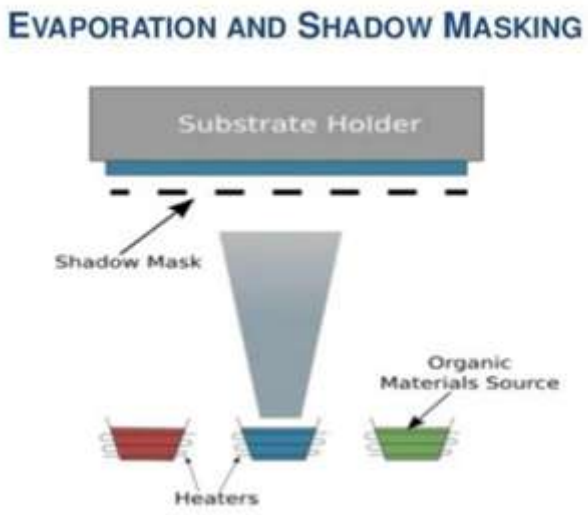

Figure 3. Evaporation and shadow masking

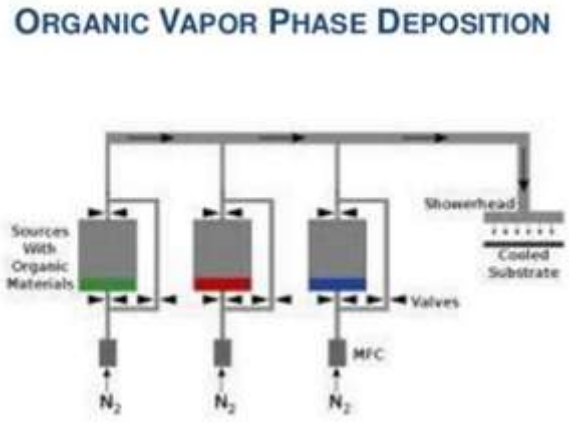

Figure 4. Deposition process of OLED

IV.WORKING PRINCIPLE

Principle:

- Across the anode and cathode voltage is applied.
- Through the organic layers electrons flow from cathode to anode.
- Electrons flow to emissive layer from the cathode.
- Electrons are removed from conductive layer leaving holes.
- Holes jump into emissive layer.
- Electron and hole combine and light emitted.

The conductive layer and emissive layers are made of special organic molecules that are helpful in conducting electricity. Anode and cathode are used for connecting OLEDs to the source of electricity.

On application of power to OLED, the emissive layer becomes negatively charged and the conductive layer becomes positively charged. Due to electrostatic forces applied, the electrons move from the positive conductive layer to a negative emissive layer. This may lead to a change in electrical levels and creates radiation that varies in frequency range of visible light.
Light emission through led

- The battery or power supply of the device containing the OLED applies a voltage across the OLED.
- Through the organic layers there is flow of electrons from cathode to anode.
- Electrons find electron holes at boundary between the emissive and conductive layer.
- The OLED emits light.

Colour Generation

- Different approaches for fabricating red , green and blue pixels
- Red ,green and blue individual pixels.
- White emitter and colour filters.
- Blue emitter and colour converters.
- Stacked OLED.

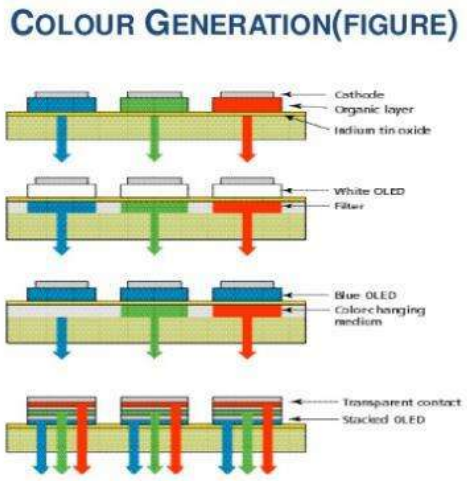

Figure 5. Colour Generation through

V.TYPES OF OLED

Based on the structure of OLEDs, they are classified into different types:
1. Passive OLED: The details about the pixels and the external circuitry are understood by these types of OLEDs. The layers which run between the anode and cathode strips are known as Passive OLEDs. These OLEDs are easy to make which is an advantage and use more power and best options for small screens.

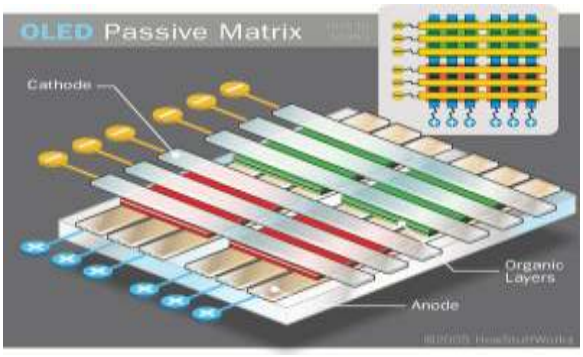

Figure 6. Passive matrix of OLED

2. Active matrix OLED**:** This OLED requires a thin-film transistor to place on the top of the anode layer. These OLEDs require less power and are suitable for large screen displays. Anode is used to control pixels. All the other layers such as cathode and organic molecules are similar to a typical OLED

OLEDs also work as diodes if current flows through them in correct direction. Above the emissive layer is the anode layer. This anode layer is at higher potential while the cathode which is connected to the conductive layer is at relatively lower potential

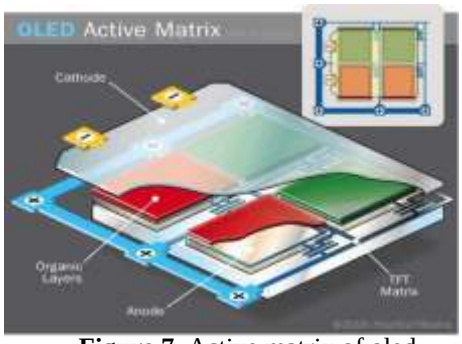

Figure 7. Active matrix of oled

3 .White OLED**:** They emit white lights. They also replaced the fluorescent lights and also the cost of energy used for lighting purpose is reduced. Efficient lighting systems are made.

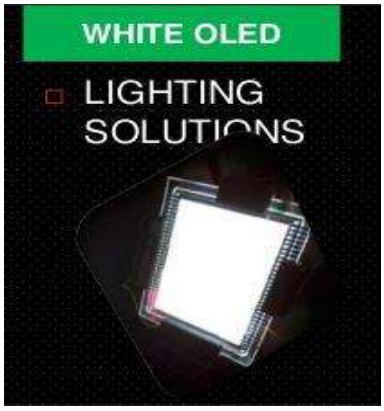

Figure 8. White OLED

4. Transparent OLED: This OLED consists of transparent substrate, anode and cathode. Lights get emitted bi-directionally, and it can also be referred to as an active matrix OLED or a passive OLED. These types of OLEDs are self emitting and here the need for backlight is eliminated. It is a see through LED which gives an illusion of frameless glass design.
5.Top emitting OLED: A reflective or non reflective substrate layer is used and transparent cathode layer is also incorporated. They make use of active matrix devices. Useful in making colorful displays.

6.Foldable OLED: These types of OLEDs can be bendable and flexible. The material used is flexible glass, plastic or metal. These OLEDs will be durable as well as lighter .

7.Phosphorescent OLED: The principle of electroluminescence isused to convert the electrical energy into light(almost 100%). The advantage of these OLEDs are that they reduce heat generation; operate at very low voltage and is durable.

VI. APPLICATIONS

- TVs
- Cellphone screens
- Computer screens
- Keyboards
- Lights
- Portable device displays

Sony Applications- In the year 2009 February Xel-1 was released by sony ,this was the first Oled TV which was sold in all stores which had high resolution .specifications of this tv is 11" screen and 3mm thin ,the appropriate weight of this TV was 1.9 kg along with a 178 degrees wide range of viewing angle.

LG Applications-LG made new OLED TV in the year 2010 with specifications like 15 inch screen, 15EL9500. LG also produced OLED3Dtelevision with specifications of 31" screen and 78cm in the year March, 2011. Mitsubishi Applications-OLED lighting panels with Immense brightness and and long lifeline was developed by first company in the world named Lumiotec in January 2011

Lighting: OLEDs are used for flexible and bendable lighting, wallpaper and also for transparent lighting.

Figure 9. Applications of oled

VII. ADVANTAGES

1.Thinner, lighter and more flexible.
2.Brighter.
3.Consume much less power.
4.Easier to produce and make into larger sizes.
5.Large field of view, about 170°.
6.Do not require back lighting like LCDs.
7.High resolution, <5µm pixel size.

VIII. DISADVANTAGES

1.Lifetime
2.Manufacturing
3.Water damage.
4.Expensive.
5.Colour balance issues.

IX. CONCLUSION

Organic Light Emitting Diodes is evolved as the widely used displays.
As OLED display technology matures ,it will be better able to improve upon certain existing limitations of LCD including high power consumption,limited viewing angles,poor contrast ratios.

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