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LATEST TRANSPARENT DISPLAY TECHNOLOGY WITH LEAST POWER CONSUMPTION

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***Abstract*— With passage of time technology has been improving and importance is increasing for display system as it used for various applications. LED, Light Emitting Diode, were first to emerge consuming less energy and with long life for different display applications in solid semiconductor technology after vacuum tube technology, CRT, Cathode Ray Technology, which were in use before LED. It used to consume large power and life was also less. LED are further improved and Organic LED (OLED) has imaged now providing display system which consume least power and is transparent when not in use. OLED can provide viewing angle much more than other display systems, even up to 160 degrees.**

***Index Terms*—** CRT, LED, Organic LED, Light Emitting Diode, Display System.

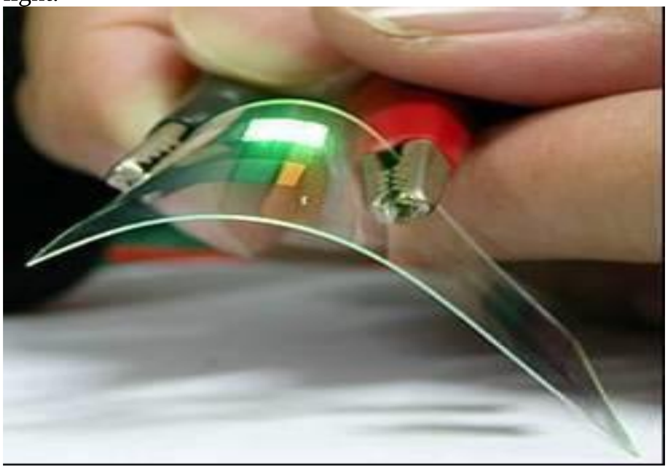
I. Introduction

OLED, Organic Light Emitting Diodes, have received a lot of attention over the through out the world as a new display System. OLED has many advantages over conventional display technologies. OLEDs are energy conversion devices (electricity-to-light) based on Electroluminescence. Fabrication of OLED is easy and lighter than CRT and has advantages over LCD also.

Viewing angle of display system is much more than other display system and as such provide more coverage to view the display, it does not require backlight and power consumption is also less. First OLED was displayed in 1977 in the form of Car Stereo. Some other applications are in use, such as mobile phones, digit cameras, GPS, radios etc. Another advantage of OLEDs is that they are current-driven devices, where brightness can be varied over a very wide dynamic range and they operate uniformly, without flicker.
Both Active matrixes TFT's and Passive matrix Technologies are used for display and addressing purposes for high speed display of moving pictures and faster response. Already some of the companies released Cell Phones and PDA's with bright OLED technology for color full displays.

II. WHAT IS OLED?

Organic LED is a electronics device that is solid and is typically consists of organic thin films sandwiched between two thin film conductive electrodes. On applying Electrical current, a bright light is emitted. OLED use a carbon-based designer molecule that emits light when an electric current passes through it. This is called electro phosphorescence. Even with the layered system, these systems are thin. Usually less than 500 nm or about 200 times smaller than a human hair. When used to produce displays. OLED technology produces self-luminous displays that do not require backlighting and hence more energy efficient. These properties result in thin, very compact displays. The displays require very little power, i.e., only 2-10 volts. OLED technology uses substances that emit red, green, blue or white light. Without any other source of illumination, OLED materials present bright, clear video and images that are easy to see at almost any angle. Enhancing organic material helps to control the brightness and color of light.

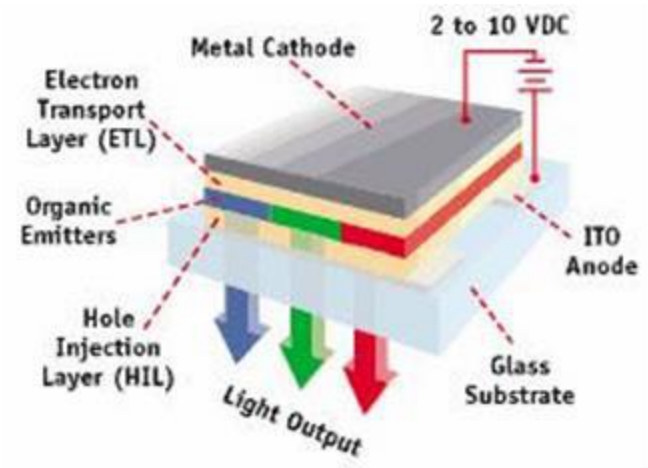


III. WORKING PRINCIPLE & STRUCTURAL ASPECTS

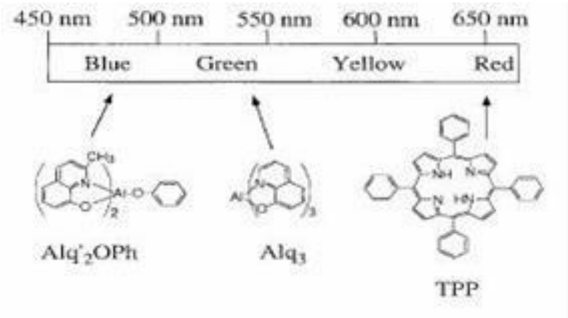
Organic Light Emitting Diodes (OLEDs) are thin-film multi-layer devices consisting of a substrate foil, film or plate (rigid or flexible), an electrode layer, layers of active materials, a counter electrode layer, and a protective barrier layer At least one of the electrodes must be transparent to light.

The OLEDs operate in the following manner: Voltage bias is applied on the electrodes, the voltages are low, from 2.5 to ~ 20 V, but the active layers are so thin (~10Å to 100nm) that the electric fields in the active layers are very high, of the order of

105 – 107 V/cm. These high, near-breakdown electric fields support injection of charges across the electrode / active layers interfaces. Holes are injected from the anode, which is typically transparent, and electrons are injected from the cathode. The injected charges migrate against each other in the opposite directions, and eventually meet and recombine. Recombination energy is released and the molecule or a polymer segment in which the recombination occurs, reaches an exited state. Exactions may migrate from molecule to molecule. Eventually, some molecules or a polymer segments release the energy as photons or heat. It is desirable that all the excess excitation energy is released as photons (light).



The materials that are used to bring the charges to the recombination sites are usually (but not always) poor photon emitters (most of the excitation energy is released as heat). Therefore, suitable doping are added, which transfer the energy from the original exaction, and then release energy more efficiently as photons. In OLEDs, approximately 25% of the excisions are in the singlet states and 75% in the triplet states. Emission of photons from the singlet states (fluorescence), in most cases facilitated by fluorescent doping, was believed to be the only applicable form of energy release, thus limiting the Internal Quantum Efficiency (IQE) of OLEDs to the maximum of 25%. Work in this field will further increase the efficiency of OLED



IV. BASICS OF LIGHTEMISSION

Light is one type of energy. So in order to emit light, the molecules must absorb energy from other sources. Once a molecule has absorbed enough energy, it can go to the excited electronic state. When the molecule relaxes to the ground singlet state, it can use different processes, one of which is to emit light. Fluorescence occurs when it returns from an excited singlet state to the ground singlet states. Because the two states have same multiplicity, it is spin-allowed and is very fast (10-5 to 10-8 seconds). Phosphorescence occurs when it returns from an excited triplet state: this is spin-forbidden and is often slow (10-4 seconds tominutes).

Colors	Red	Green	Blue
Efficiency (cd/A)	5.5	19	5.9
Lifetime (h)	80,000	40,000	7,000

Table.1: Present OLEDs efficiency and lifetime

V. FABRICATION METHODS FOROLEDS

OLED can be fabricated by two methods.
1. Thermal evaporation of the organic small molecules
2. Spin-coating polymer layers methods.

Thermal evaporation is normally performed in a vacuum. The vacuum pressure is usually about 10-6 tore or better. In addition to depositing molecules, it can also be used to deposit cathode materials. There are some advantages to using thermal evaporation. During the fabrication the thickness of each layer can be monitored easily, compared to spin-coating. The vacuum equipment is already in the semiconductor industry, and it is easy to achieve the multi-color displays by using shadow masks for depositing organic materials.

Spin-coating is widely used in the polymer-based LEDs. The polymer layers can be deposited from solution directly, but the thickness can't be monitored during the deposition.

VI. OLEDS AS WHITE LIGHT SOURCE

In contrary to display applications where all colors are equally important, "good quality" white is of prime importance for general illumination. Individual colors are not as important. OLEDs have typically very broad band emissions, which makes them uniquely suitable for applications where white with high CRI and the desired position on the chromaticity diagram is desirable. Both small-molecular and polymeric systems with singlet (fluorescence) emitters have achieved full color with good positions on the CIE .

VII. PRODUCING WHITE LIGHT can be done by four different methods.

1. Deposition of three emission layers, each with different (R, G, B) emitters: One of the approaches to generate white light was to segregate three dopants into three separate emissive layers. The concept is enabled by the long diffusion lengths of triplet excitations, which may cross several layers before transferring the energy to an emitter. Triplets may migrate up to 1000Å. The thickness and the composition of each layer must be precisely controlled to achieve the color balance.

2. Mixing two, or more different dyes (emitters), or polymers which emit different colors, in one layer: Copolymers whose segments emit different colors are also used as single layers. Good quality white light was generated in OLEDs with three fluorescence emitters in a single layer with R, G, and B.

3. Using monomer-exciter complexes: The basic idea is to employ a lumophore, which forms a broadly emitting state, and a lumophore (or lumophores) which form exciters or exciter plexus (excited states whose wave function extend over two molecules, either identical - exciters or dissimilar - exciter plexus). Some phosphorescent doping molecules indeed form exciters. These molecules are bound together only in the excited state but not in the ground state. The energy of the exciter is always lower than the energy of an excited single molecule and its emission is typically very broad. Thus, if an OLED is made with two blue dopants, one of which does not form excimers and the other does, the device will emit blue light from the former dopant, and lower-energy light (typically yellow) from the excimer of the latter dopant. The light from the blue dopant will mix with the light from the yellow excimer to make white light. None of the blue light will be lost because the excimer has no ground state to absorb it, and the blue emitter does not absorb yellow. The ratio of blue to yellow emission can be readily tuned by varying the ratio of the two dopants without the complication of energy transfer from blue to yellow.

4.Using "horizontally stacked" narrow bands or pixels emitting in basic colors:
(an analog of LCD displays): An extension of the tri-junction concept leads to another approach, basically similar to that used in LC flat panel displays, where the colors are separated and addressed independently as an array of individual pixels, dots, etc. The individual color-emitting segments / devices may be deposited as dots, miniature squares, circles, thin lines, very thin stripes etc. If that approach turns out to be feasible, and good white can be obtained, the system would have a number of advantages.

VIII. COMPARISON

A. OLED and LCD

From calculator screens, LCDs are used in mobile phones, computers, and a lot more applications. OLEDs produce their own light unlike LCDs which require a backlight. Another advantage of OLED is the lower power consumption compared to the LCD which has a great amount of the power consumption. The lack of a backlight also means that an OLED display can be significantly slimmer than an LCD display. Manufacturing OLEDs could also be a lot cheaper than manufacturing LCDs.

B. OLED and LED

OLED display can be thinner and lighter than LED display. They provide very wide and consistent color no matter where you are seated in the room. LED display tends to get significantly dimmer as one move away from center and many exhibit color shift. OLEDs are quite energy efficient. The greatest attribute of OLED is the ability to have the deepest blacks of any flat panel technology. OLEDs can make more colors than LED display

IX. MERITS

The different manufacturing process of OLEDs lends itself to several advantages over flat-panel displays made with LCD technology.
Lower cost in the future: OLEDs can be printed onto any suitable substrate by an inkjet printer or even by screen printing, theoretically making them cheaper to produce than LCD or plasma display. However, fabrication of the OLED substrate is more costly than that of a TFT LCD, until mass production methods lower cost through scalability

A. Light weight & flexible plastic substrates*:*

1. Displays can be fabricated on flexible plastic substrates leading to the possibility of flexible organic light-emitting diodes being fabricated or other new applications such as roll-up displays embedded in fabrics or clothing.

2. Better power efficiency: LCDs filter the light emitted from a back light
3. Response time: OLEDs can also have a faster response time than standard LCD screens.

B. DEMERITS

1. Power consumption: While an OLED will consume around 40% of the power of an LCD displaying an image.

2. Outdoor performance: As an emissive display technology, OLEDs rely completely upon converting electricity to light, unlike most LCDs which are to some extent reflective

3. UV sensitivity: OLED displays can be damaged by prolonged exposure to UV light. The most pronounced example of this can be seen with a near UV laser (such as a Bluray pointer) and can damage the display almost instantly with more than 20mW leading to dim or dead spots where the beam is focused.

4. Screen burn-in: Unlike displays with a common light source, the brightness of each OLED pixel fades depending on the content displayed. The varied lifespan of the organic dyes can cause a discrepancy between red, green, and blue intensity. This leads to image persistence, also known as burn in.

5.Water - Water can easily damage OLEDs

6.Lifetime - While red and green OLED films have longer lifetimes (46,000 to 230,000 hours), blue organics currently have much shorter lifetimes (up to around 14,000 hours.

CONCLUSION

By the analysis done on the various de-blurring techniques, it can be concluded that the adaptive weighted median filtering is an improved technique as compared to the traditional median filter due to the fact that in this, filtering is applied only to the corrupted pixels in the image whereas the uncorrupted pixels are left unchanged. The Adaptive weighted median filtering technique provides a higher PSNR value and reduces the MSE as compared to the median filter, thereby improving the quality of the image. This adaptive weighted median filtering approach is used to considerably reduce the number of noisy pixels present during filtering. Advantage of the adaptive weighted filter include retaining the information of the edges even in case of high density noises. AWMF retains the finer details in the images and the noisy images are restored with an improved quality. The ability of detail preservation also makes it best suited for medical image de-noising purposes. The results justify the performance of this method, which could also be used for the filtering of synthetic aperture radar ice noisy images.