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APPLICATION OF TRANSPARENT ELECTRONICS IN MILITARY FOR NAVIGATION DISPLAY

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Abstract: This paper introduces a new trend called as "Transparent Electronics", which is an emerging science and technology field focused on producing 'invisible' electronic circuitry and opto-electronic devices. The paper enlightens the improved techniques of navigation display in military using transparent electronics. This proposed system uses flexible AMOLEDs which gives high information content full color display.

Keywords: navigation display, OLED, AMOLED, TFT

I.INTRODUCTION:

Modern life requires the equipments having low power consumption, high speed , light weight and wearable.
One of the technologies such as Transparent Electronics fulfills all these requirements.

Transparent electronics has various applications such as

- Consumer electronics
- Transportation
- Military
- Civilian
- New energy sources

We represent one of the progressing application of transparent electronics regarding to the security of nation i.e. military. In military, we use transparent electronics for navigation display

For this application, a prototype is designed in such a way that it fits over the user's wrist, as shown in figure 1.

During war, it is very difficult for soldiers:

1. To keep walky talky with them to know the positions of other soldiers.

2. To monitor the position of enemies.

A prototype shown in figure1 helps the soldiers to overcome these difficulties. The soldiers can see real-time video and graphics information.

Here, a full-color flexible PHOLED **(Phosphorescent organic light-emitting diodes** are a type of organic light-emitting diode (OLED) that use the principle of phosphorescence to obtain higher internal efficiencies than fluorescent OLEDs. [2]) display is used. The displays use a-Si backplanes fabricated on stainless steel substrates, with a total thickness of less than 0.3mm. The power consumption in video mode is only 0.3W. Full specifications of the display are shown in Table 1.[4]

Figure 1. Demonstration of a soldier wearing the wrist unit with a navigation display on.

Table 1: The specification of the finished 4.3″half-size video graphics array (HVGA) flexible foil displays. H: Horizontal. V: Vertical. RGB: Red, green, blue.

Display type	**Emissive (top-emission OLED)**
Active area	87.7mm (H) × 65.6mm (V), 4.3" diagonal
Resolution	HVGA 480 × RGB × 320
Pixel density	134dpi
Colors	16.7million
Color method	Phosphorescent OLED (PHOLED)
Luminance	$200cd/m^2$ at full white
Contrast ratio	1000:1
Bending radius	2.5″
Panel thickness	0.3mm

In military, the navigation display must be full-colored and of high information content. This can be provided using organic light-emitting devices (OLEDs).

For fabricating an OLED display, the individual pixels need to be addressable. The most commonly used addressing scheme for video applications is 'active matrix' and it is realized using a thin-film transistor (TFT) 'backplane'.

An OLED display built using an active matrix backplane is referred to as an AMOLED display. The OLED 'frontplane' forms the top of this backplane. But, OLEDs degrade in the presence of oxygen or moisture, and hence to ensure long operational lifetimes, the device needs to be encapsulated.

II.WORKING:

Figure 3 shows the standard process of AMOLED display fabrication using flexible substrates.

These flexible substrates should support the process of fabrication. For example, stainless steel foil, which provides not only reasonable flexibility but also excellent thermal stability and is an excellent barrier to moisture and oxygen.[3]

Amorphous silicon (a-Si) TFTs are used for the backplane technology. A **thin-film transistor** (**TFT**) is a special kind of field-effect transistor made by depositing thin films of a semiconductor active layer as well as the dielectric layer and metallic contacts over a supporting substrate These TFTs provide following advantages as.[1,5]

- Uniform electrical characteristics over large areas
- Reasonable field-effect mobility ($\sim 0.5 cm^2/V \cdot s$)
- Low-temperature process ($< 300^{\circ}C$)
- Low-cost fabrication

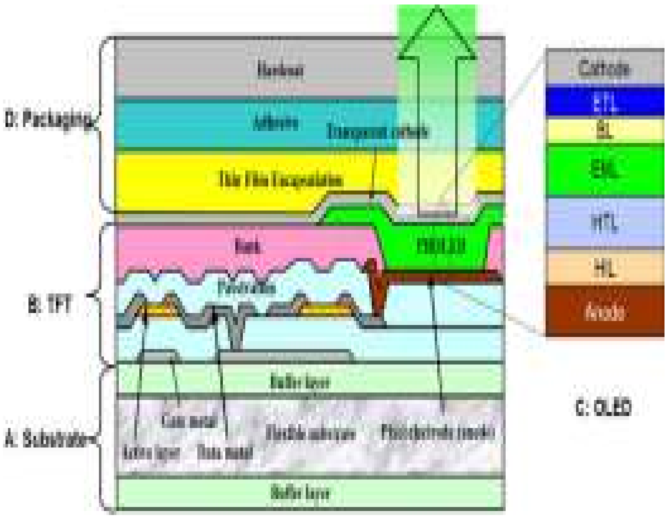

Figure 2. The cross-section of a flexible active matrix OLED (AMOLED) display structure. BL: Blocking layer. TFT: Thin-film transistor.

VARIOUS CHALLENGES OVERCOME BY AMOLED DISPLAYS

To reduce threshold voltage shifts:

It is provided using high efficient PHOLEDs which provide low drive voltage. Otherwise, simple circuitry can also be added.

To reduce power consumption to a minimum:

Phosphorescent emitters are used for low power consumption. During operation, charge is injected into the OLED device and converted into photons through the formation and subsequent recombination of excitons, the bound molecular excited state. Excitons come in two different forms: singlet and triplet, depending on the spins of the electrons and holes that came together to form the exciton. Phosphorescent emitters contain a heavy metal atom that facilitates the mixing of singlet and triplet states, which enables the triplet states to radiate and therefore to potentially achieve 100% internal quantum efficiency.[6,7] This is up to four times higher than that of fluorescent OLEDs where only singlet states emit light. This level of efficiency enables low power consumption, and significantly extends battery life.

III.CONSTRUCTION:

An OLED device structure is a series of thin organic films deposited between two electrodes (see Figure 3). By applying a voltage across the device, charges are injected and converted into photons to generate light. OLEDs provide exceptional image quality, offering very high contrast and excellent color reproduction, as well as fast video response rates. In particular, the simple device structure and thin-film nature of OLEDs make them the perfect candidate for flexible displays. In addition, phosphorescent OLED (PHOLED^{TM}) technology enables OLED displays to have low power consumption, making them well-suited for portable electronics, where long battery life is a critical concern.

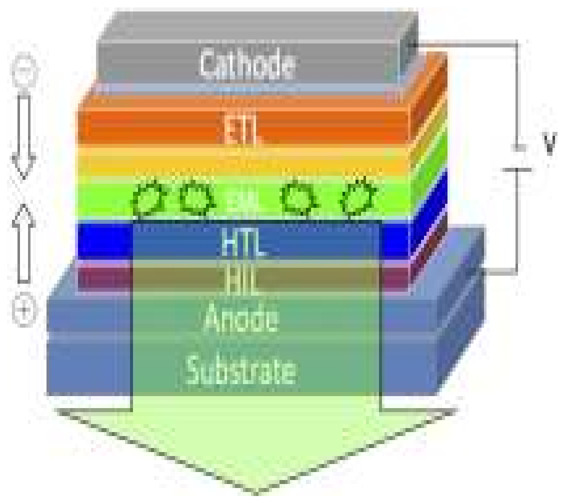

Figure 3. Illustration of an organic LED (OLED) device structure. ETL: Electron transport layer. EML: Emissive layer. HTL: Hole transport layer. HIL: Hole injection layer.

IV.ADVANTAGES:

- Low power
- Thin and light

- Bendable
- Light and slim
- Wearable
- High luminance
- Good uniformity

V.DISADVANTAGES:

Stainless steel foil, which is used as the substrate can present challenges in mass production, and an additional planarization step is usually required

Thin-film encapsulation is required for flexible displays.

VI.CONCLUSION:

The combination of two rapidly evolving areas of research, OLEDs and transparent electronics, enables the realization of novel transparent OLED displays. This appealing class of seethrough devices will have great impact on the human–machine interaction in the near future.

As the world is suffering from climate change which is the outcome of pollution, the transparent electronics gives best solution as OLEDs degrade in the presence of oxygen, it does not harm the environment.

V.FUTURE SCOPE:

Flexible AMOLEDs will keep improving in optical performance, lifetime, and flexibility and hence in near future, they will be adopted in specialized applications where rugged displays are needed.

Automobile windshields could transmit visual information to the driver.

Police and firefighters use HMDs to display tactical information such as maps.

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