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LED and OLED technology. Essence and prospects.

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One of the most topical and prospective technologies used in electronics is LED, or light-emitting diode technology. The light-emitting diode (LED) is one of today's most energy-efficient and rapidly-developing lighting technologies. LED has changed the way the world sees the light. Inefficient, old-style incandescent and compact fluorescent lamps are being phased out by a lighting technology that can deliver warm, traditional light or a cooler, more contemporary white light, all while using a fraction of the energy and with virtually zero environmental damage [1].

To get a clearer idea of the differences between LED OLED technologies we will look into its essence, operating principles, merits and demerits.

We will start with defining the concepts.

LED (Light emitting diode) is a semiconductor device, that converts electric current into light emission. It consists of semiconductor crystal at base-plate, body with stud contacts (anode and cathode) and the optical system. Whereas OLED (Organic light emitting diode) is a semiconductor device, that consists of a set of membranes organic origin and effectually emits light when electrical current flows [2].

Speaking about the operating principles of LEDs and OLEDs, LEDs function when a semiconductor device is inserted into the circuit and electrical current starts to flow from anode to cathode. When current flows through the semiconducting crystal, it starts to emit light. Light emission

takes place because electrons and electron holes recombine in p-n junction area, thus releasing energy in the form of photons. A p-n junction is a combination of two different semiconducting materials with different levels of conductivity. The color of the emitted light depends on which material is used in this junction.

As for operating principles of OLEDs they are semiconductor devices that have a p-n junction. When electrical current flows through the device, cathode gives into emissive layer electrons and anode gives into conduct layer holes. Holes and electrons are attracted and when they meet, they recombine and as a result the light emits.

Comparing the two different technologies, it is worth mentioning, their advantages and disadvantages. Basically, LEDs correspond to the most significant technical parameters such as clear light, durability, reliability, safety, low power consumption, a low price and, definitely, a long lifespan, which add to their value [3].

As well as LEDs, OLEDs are mostly associated with a number of advantages, to which we refer compactness, portability, flexibility, light weight, relatively low energy consumption, wide aspect angle, wide range of brightness and high efficiency. As we see the technical specifications and benefits are quite similar. The only disadvantage we can think of is the high price of technology at present.

The fields of application of the two technologies being discussed are different in the way that in some areas it is better and more rational to apply LEDs than OLEDs or vice versa. For example, LEDs are used in manufacturing motorcycle and bicycle lights, traffic lights and signals, message displaying boards, light bulbs and many others. Whereas the main sphere of OLEDs application is creating displays for different devices such as: TV, computers, smartphones, car radios, different portable devices and wallpapers [4].

There are quite a few perspectives of development LED and OLED technologies such as PHOLED (Phosphorescent OLED) technology which functions as OLEDs, but uses the principle of electro phosphorescence to convert up to 100 % electric energy into light and used in making large TV displays; PMOLED (Passive-matrix OLED) that have organic layers and strips of anode and cathode perpendicular to one another, and used in MP3 players, mobile phones sub displays; AMOLED (Active-matrix OLED) that uses technology allowing to switch each pixel into on or off state as desired, thus forming an image, and best used for making computer monitors, large billboards and different handheld devices; TOLED (Transparent OLED) that have only transparent components applicable in head-up displays, laptops, mobile phones and smart windows.

References:

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