



LIGHT Education

LED:Light Emitting Diodes

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A light emitting diode is a device that emits visible light when an electric current passes through it.

The materials used to manufacture this kind of diode are a combination of chemical elements such as Gallium Arsenide, Indium, Gallium, Antomonium Phosphide. They are frequently used as "pilot" lights, to indicate whether the circuit is closed or not, in electronic appliances, alphanumeric displays, traffic lights, car lights, screens, street lighting. LEDs are made of a wafer-like semiconductor material: one layer is dominated by negative electric charges, the other by positive electric charges (called "holes"). A LED is enclosed into a transparent case so as to let the light shine through. When the system is connected to an electric circuit, electrons and "holes" start moving, they recombine and produce a differently coloured light according to the material used. White light for illumination is created by combining different colours or by directing the light of a blue LED towards a layer of phosphorus that produces white light. LEDs are 10 times as efficient as an incandescent lamp and 2 times as efficient as a fluorescent lamp. The inverted pyramid LED consists of semiconductors manipulated on a nanoscopic scale. It is, by now, the most efficient source. LED luminous performance (lumen per watt) is shown in the table below:

LED Red	= 45 Lumen
LED Yellow	= 40 Lumen
LED Green	= 36 Lumen
LED Blue	= 32 Lumen
LED White	= 28 Lumen (the same value as an halogen lamp)
Inverted pyramid LED	= 100 Lumen (the same value as a low pressure sodium lamp)

A LED light lasts 100 thousand hours, which correspond to a ten-year use, compared to the 1,000 hours of an incandescent lamp. It has a reduced power requirement, (a red LED for a traffic light requires 15 watts, by contrast a traditional lamp requires 150 watts). The Laboratory of nanotechnology of the National Institute of Physics of the Matter of Lecce, discovered a liquid that can emit white light. It exploits the formation of special molecular complexes called exciplexes, which can emit white light when they pass from an excited state (i.e. the state in which an electron has moved to a superior energy level) to the ground state. When a current passes through the liquid emits lights, 10 square cm can emit as much light as a 40-watt lamp, but with a lower power requirement. This liquid can be spread out on various surfaces thus creating organic LEDs. A LED usually consists of 2 regions: an "n-type" layer (i.e. charged with atoms that release electrons) and a "p-type" layer (charged with atoms that capture electrons leaving positively charged "holes" in their place). These two layers, which form a diode, are separated by a neutral "active layer". When sufficient

voltage is applied to the n- and p- regions, the electrons and the holes move into the active layer. Each time they re-combine light is emitted.

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