TECHNICAL NEWS

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New generations of LEDs for application in potentially explosive atmospheres

We have already spoken about LED lighting and the advantages that this lighting support can provide for lighting fixtures suitable for use in areas with potentially explosive atmospheres.

However, the technology in this field is moving so fast that we think is appropriate to analyze the developments. The only term LED is no longer sufficient to identify the wide range of products which has been developed with particular characteristics according to the use.

In electronics, the LED (light emitting diode) is an optoelectronic device that exploits the characteristics of semiconductor materials to convert the electric current that passes through it into light. Although the first LEDs were developed in 1962, only in recent years the technological progress has made it possible to fully exploit the LED to replace the traditional light sources with a long series of advantages.

A. The advantages of LED lighting

Many are the advantages of LEDs compared to traditional light sources.

We list here below the most important for lighting in areas with potentially explosive atmospheres.

1. Energy Saving

The LED lighting is more efficient than traditional incandescent bulbs. On average, the LEDs last from three to five times more than fluorescent lamps and they have lighting up to ten times higher than incandescent.

2. Reduced Costs

LED lamps have low maintenance costs due to their greater reliability and so, even if the initial investment may seem higher than a normal light bulb, the longer life reduces the overall expenses. The duration of operation, over 50,000 hours, amply justifies the initial purchase cost.

3. High mechanical strength

An important feature is the resistance to shock, vibration and impact thanks to the solid state manufacturing.

4. Thermal Resistance

In addition to mechanical strength, LEDs are virtually impermeable and resistant to extreme temperatures.

LEDs allow an instant ignition, no need to wait for the high brightness. It's possible the immediate ignition even at very low temperatures such as -40°.

5. Clean Light

The LEDs do not emit UV rays, so they are safer.

6. Increased security

The power of the LEDs is low voltage direct current and thus maintenance operations are absolutely safe.

7. Respect for the environment

Last, but not least, an illuminating device that consumes less and lasts longer, allows a greater protection of the environment.

B. Types of LED

As we said at the beginning of this article, we can no longer speak generically of LED.

Technology has made great strides in this area since, in 1962, appeared the first light-emitting diode.

Mainly, we can divide the current LED in three categories:

1. Low wattage LED;

2. High Power LED;

3. LED COB.

1. Low wattage LED

The low wattage LEDs are mainly used in electronics, in displays, signs and signal lights. The wattage of each LED is about 0.07W.

This type of LED is also used with the infrared light (850nm) in remote controls and signal receivers.

Applications in Ex areas are mainly in the design of indicator lights for switchboards.

2. High Power LED

The high-power LEDs are generally from 1 to 3W. Usually, they are used individually in a chip of 3W or in a 3x1W configuration.

In the early days of the history of the LEDs, their luminous efficiency (lm/W) was calculated at a minimum ratio of 3 to 1. Following, improved tremendously. The limit of the first devices suitable to be used in this type of application was the insufficient amount of light emitted. This problem has been overcome with the models of the last generation, combining the improving of efficiencies to the technique of having arrays of diodes in the same package connected to each other in series and parallel or realizing the array directly in the substrate of the device. The efficiency of current devices, for professional and civil use, is over 120 lem/W.

As a comparison, just think that an incandescent lamp has a luminous efficiency of about 10-19 lem/W, a halogen lamp of about 12-20 lem/W and a linear fluorescent of about 50-110 lem/W.

3. LED COB

COB technology (chip on board) exceeded previous generations of LED lighting in terms of quality, energy saving, heat dissipation and efficiency.

In this technology, the chip is glued directly on the plate and put in contact through so-called bond wires with gold contacts.

Subsequently, an epoxy lens is applied, said bubble, which defines the light distribution. Depending on how you built this lens, a COB LED can have a distribution to very narrow or extremely wide beam.

The LED COB technology, compared to the old technology, presents a better yield, allowing, for the same wattage, to develop about 30% more lumens.

This type of LED has, with respect to those of the previous generation, some further advantages. With a ratio of 110 to 140 lumens/watt, this generation of LEDs produces the right amount of light while consuming even less. A LED COB of 9 watt produces the same light as a 23 watt CFL lamp or a 100 watt an incandescent lamp.

The positioning of the silicon chip directly on the layer of aluminium, also allows to obtain a dispersion of heat up to 97%, allowing the lamp to operate in a cooler environment saving, consequently, more energy, and, in the field of explosion protection, allows to build lighting fixtures with a better class of temperature.

C. Lumen and Lux

To conclude this quick overview on the latest technological innovations of LED applications, we would go back for a moment on a topic that is often the subject of debate.

In choosing a lighting product, we often hear of two major units of measurement to be taken into account: the lumens and lux.

Often these two parameters are confused with each other. You have to know, however, that there is an important difference between the two. While the lumen is a measure of the "amount of light" on a unit sphere (centered on the source), the lux is a measure relative to the illuminated plane tangent to the spherical portion.

1 lumen over an area of 1 m^2 is 1 lux, while the same lumen concentrate in a 1 cm^2 corresponds to 10.000 lux.

Two lighting fixtures with the same lumen, therefore, can return data in terms of lux very different. This is due to a number of factors including:

- Beam angle
- Decay bright
- Real lumen.

For lighting calculations must be used lux data.