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LIGHT-EMITTING DIODES IN OUR LIFE: ADVANTAGES AND DISADVANTAGES

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Анотація

У даній роботі розглядається роль світлодіодів (LEDs) у нашому житті, описано коротку історію їх винайдення та розвитку. Також окреслено основні переваги світлодіодів та наведено деякі недоліки порівняно з іншими традиційними джерелами світла.

Ключові слова: технічний прогрес, світлодіод, пристрій, застосування, електроенергія, джерело світла, лампа розжарювання, енергозберігаючий пристрій, люмінесцентна лампа, тепловіддача.

Abstract

This paper examines the role of the light-emitting diodes (LEDs) in our life, briefly described the history of their invention and development. Also identified the main advantages of LEDs and are some disadvantages compared with other traditional light sources.

Keywords: technical progress, light-emitting diode, device, application, electricity, light source, incandescent bulb, energy-saving device, fluorescent lamp, heat dissipation.

Introduction

During the last four decades, technical progress in the field of light-emitting diodes (LEDs) has been breathtaking. State-of-the art LEDs are small, rugged, reliable, bright, and efficient. At this time, the success story of LEDs still is in full progress. Great technological advances are continuously being made and, as a result, LEDs play an increasingly important role in a myriad of applications in our life. In contrast to many other light sources, LEDs have the potential of converting electricity to light with near-unit efficiency [1].

LEDs were discovered by accident in 1907 and the first paper on LEDs was published in the same year. LEDs became forgotten only to be re-discovered in the 1920s and again in the 1950s. In the 1960s, three research groups, one working at General Electric Corporation, one at MIT Lincoln Laboratories, and one at IBM Corporation, pursued the demonstration of the semiconductor laser. The first viable LEDs were by-products in this pursuit. LEDs have become devices in their own right and today possibly are the most versatile light sources available to humankind [2].

Advantages of using LEDs

● LEDs produce more light per watt than incandescent bulbs; this is useful in battery powered or energy-saving devices.
● LEDs can emit light of an intended color without the use of color filters that traditional lighting methods require. This is more efficient and can lower initial costs.
● The solid package of the LED can be designed to focus its light. Incandescent and fluorescent sources often require an external reflector to collect light and direct it in a usable manner.
● When used in applications where dimming is required, LEDs do not change their color tint as the current passing through them is lowered, unlike incandescent lamps, which turn yellow.
● LEDs are ideal for use in applications that are subject to frequent on-off cycling, unlike fluorescent lamps that burn out more quickly when cycled frequently, or Higher Intensity Discharge (HID) lamps that require a long time before restarting.
● LEDs, being solid state components, are difficult to damage with external shock. Fluorescent and incandescent bulbs are easily broken if dropped on the ground.
● LEDs can have a relatively long useful life. A Philips LUXEON k2 LED has a life time of about 50,000 hours, whereas Fluorescent tubes typically are rated at about 30,000 hours, and incandescent light bulbs at 1,000–2,000 hours.

● LEDs mostly fail by dimming over time, rather than the abrupt burn-out of incandescent bulbs.
● LEDs light up very quickly. A typical red indicator LED will achieve full brightness in microseconds.
● LEDs used in communications devices can have even faster response times.
● LEDs can be very small and are easily populated onto printed circuit boards.
● LEDs do not contain mercury, unlike compact fluorescent lamps [3].

Disadvantages of LEDs

● LEDs are currently more expensive, price per lumen, on an initial capital cost basis, than more conventional lighting technologies. The additional expense partially stems from the relatively low lumen output and the drive circuitry and power supplies needed. However, when considering the total cost of ownership (including energy and maintenance costs), LEDs far surpass incandescent or halogen sources and begin to threaten the future existence of compact fluorescent lamps.
● LED performance largely depends on the ambient temperature of the operating environment. Over-driving the LED in high ambient temperatures may result in overheating of the LED package, eventually leading to device failure. Adequate heat-sinking is required to maintain long life.
● LEDs must be supplied with the correct current. This can involve series resistors or current-regulated power supplies.
● LEDs do not approximate a "point source" of light, so they cannot be used in applications needing a highly collimated beam. LEDs are not capable of providing divergence below a few degrees. This is contrasted with commercial ruby lasers with divergences of 0.2 degrees or less. However this can be corrected by using lenses and other optical devices.
● There is increasing concern that blue LEDs and white LEDs are now capable of exceeding safe limits of the so-called blue-light hazard as defined in the eye safety specifications [4].

Conclusion

LEDs in the future: LEDs have come a long way and currently they are widely used in many different applications. In future, I believe research will continue for high intensity LEDs, even though heat dissipation is an issue. Systems of lighting on the basis of light-emitting diodes can reduce the size of the consumed electric power necessary for obtaining the required values of light characteristics. Progress in the production technology of light-emitting diodes, and also the growing energy crisis demonstrate that light-emitting diodes will play a key role in creation of lighting fixtures already in the near future around the world.

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