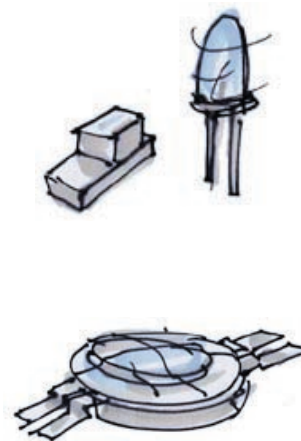


LEDs – Light Emitting Diodes

LED is the most rapidly developing light source in the world. It already beats conventional incandescent bulbs in luminous efficacy and it is expected that it will in the same way challenge gas discharge lamps by the end of this decade. Ledil mostly uses LED as the light source for its applications.

Construction of a LED

The heart of a LED is its semiconductor chip. The chip is manufactured in a long chemical process. The chip itself contains many of the optical elements described in the previous chapter "Geometrical Optics". Electricity is brought to the chip through a thin wire of gold and most often through conductive glue that connects the bottom of the LED to its reflector. These connections are further connected to the "legs" of the LED, i.e. anode and cathode. The chip often has a reflector around it to collect all the light directed away from the opening surface. The system is often encapsulated with epoxy resin that also at the same time forms a lens surface above the chip.



Semiconductor technologies

During the 40 years of LEDs, there have emerged many different semiconductor technologies. Today, there are two main branches, on which chip manufacturers invest their R&D money: InGaN and AlInGaP technologies. InGaN technology is at the moment the most important one, due to it staying behind green and blue light, which in most cases is converted into white light using several phosphor technologies. AlInGaP technology gives us light in a spectrum of yellowish green to red. In luminous efficiency AlInGaP has been superior, but due to greatest development being carried out on InGaN, it will most probably pass AlInGaP in the near future.



Benefits of LEDs

LED is the most stable of the light sources available today. It has a superior life span of up to 100,000 hours of use. It is vibration resistant, because it does not have any moving parts or include any brittle materials. LED emits cold light, which turns on rapidly, when electricity is applied. LED is an easily tunable light source. Its electrical efficacy is better than most of the other light sources'. As the most important feature resulting from all these benefits we at Ledil see the possibilities for total integration of the light source into the mechanical structure of a product. When using LEDs we do not have to take care of replacing broken ones, which often makes many constructions complex and expensive.



Challenges when designing LED lighting

The semiconductor chip itself is a very stable component, both when it comes to life-time and to resistance against environmental stresses. But, poor thermal and mechanical design can easily destroy all the advantages of the chip. E.g., inadequate cooling of the LED package raises the chip temperature above the specifications and easily shortens the life-time of the component. The same applies to vibrations resistance: a weak mechanical construction of the LED package or of the total lighting product can quickly destroy the reputation of LED products being robust and resist vibrations.

