

What you need to know about LEDs

Light-emitting diodes, or LEDs, have gradually penetrated into many aspects of our lives. A LED is essentially a p-n junction diode comprising of two layers of differently-doped semiconductors, whose structure is no different from the diodes used in our electronic circuits. The key difference lies with the material, or the bandgap of the material to be more precise, that the diode is made of. Using a suitable material with a bandgap energy, there will be light emission when forward biased due to carrier recombination.

At least in theory, LEDs of all visible colours can be grown with p-dope Gallium Nitride-material. In reality, GaN LEDs are typically available with emission colours of green and blue-but that's more than enough, because we can fabricate white light LEDs using blue LEDs.

Why blue? Firstly, blue light has the highest energy amongst the three primary colours. Light is type of electromagnetic wave. Waves of shorter wavelength (or high frequency) possess higher energy and can potentially be down-converted to waves of longer wavelengths whilst preserving energy conservation. Secondly, blue is a primary colour. Blue light can be used as an excitation source to induce fluorescence in various materials so that they emit light of longer wavelengths (such as green and red). With the three primary colours, we can obtain all the other colours by mixing.

Currently the most common commercial application of white light LEDs is probably backlighting in the displays of mobile phones, and LCD displays. The ultimate longer-term goal is to adopt LEDs for lighting. LEDs run on dc voltage sources, while the conventional incandescent lamps and fluorescent lamps run on ac. Presently the need for a converter makes it less compatible with existing lamp fixtures, but also increases conversion loss. No doubt LEDs are more efficient than other light sources, capable of converting electricity to light at a higher percentage. So in the future

The Electrical Blog is contributed by the Electrical Division. If you would like to know more about this topic, please contact the Division Hon Secretary, Ir K.M. LEUNG at 'kmleung@emsd.gov.hk'