Let There Be Light

Gallium nitride (the white LED)

Gallium nitride (GaN) is probably the most important new semiconductor material since silicon. It owes this status to the development of bright blue, green and white GaN-based light emitting diodes (LEDs), and these in turn owe their invention to a young Japanese researcher named Shuji Nakamura. This revolutionary technology may eventually replace all the light bulbs and fluorescent tubes in the world, thus saving huge amounts of energy.

Lighting is one of the biggest underlying causes of greenhouse-gas emissions, causing some 1900 megatonnes of carbon dioxide (CO_2) to be emitted by power stations each year. This is three times the total CO_2 emissions from aircraft, and is comparable to the total amount of CO_2 emitted by cars. It is almost certainly easier to reduce CO_2 emissions by having more efficient lighting than by making cars and planes more efficient.

Gallium-nitride white LEDs provide an obvious route to this goal. They should eventually be 10 times more efficient than filament light bulbs, and more than twice as efficient as long fluorescent tubes and compact fluorescent lamps (CFLs). White LEDs also have considerably longer lifetimes than these other technologies, and — unlike fluorescent tubes and lamps — they do not contain toxic mercury.

Perhaps this explains why galliumnitride LEDs made it to market so rapidly. The first prototype bright blue LED was demonstrated by Nakamura in his small laboratory in November 1993. Last year galliumnitride LEDs worth over $4bn were sold worldwide. This is more than the total sales of gallium-arsenide (GaAs) devices in 2006, even though The seven-storey-high Nasdaq full-colour display in New York's Times Square, for example, consists of 19 million LEDs and covers almost a quarter of an acre.

Flashlights and lanterns that utilise white LEDs are becoming increasingly popular due to their durability and longer battery life.

Advantages of using LEDs

- LEDs produce more light per watt than do incandescent bulbs; this is useful in battery powered or energy-saving devices.
- 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.
- 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 have an extremely long life span.
- 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, while compact fluorescent lamps do.

Some applications for white LEDs

- Light bulbs e.g. domestic or street lighting
- Status indicators on all sorts of equipment
- Traffic lights and signals
- Motorcycle and Bicycle lights
- Toys and recreational sporting goods
- Elevator Push Button Lighting
- Remote controls, such as for TVs and VCRs, often use infrared LEDs.
- The NintendoWii's sensor bar uses infrared LEDs.
- Movement sensors, for example in optical computer mice
- LED-based Christmas lights have been available since 2002, but are only now beginning to gain in popularity and acceptance due to their higher initial purchase cost when compared to similar incandescent-based Christmas lights.

For more information visit
http://en.wikipedia.org/wiki/Light-emitting_diode