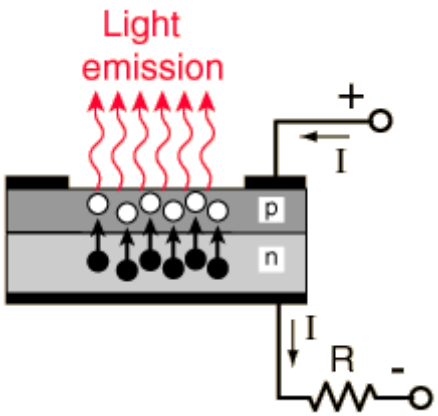
Light Emitting Diode Structure



LEDs are p-n junction devices constructed of gallium arsenide (GaAs), gallium arsenide phosphide (GaAsP), or gallium phosphide (GaP). Silicon and germanium are not suitable because those junctions produce heat and no appreciable IR or visible light. The junction in a LED is forward biased and when electrons cross the junction from the n- to the p-type material, the electron-hole recombination process produces some photons in the IR or visible in a process called electroluminescence. An exposed semiconductor surface can then emit light.

Circuit symbol | Packaging | Characteristics

More detailed structure of device

Index

LED concepts

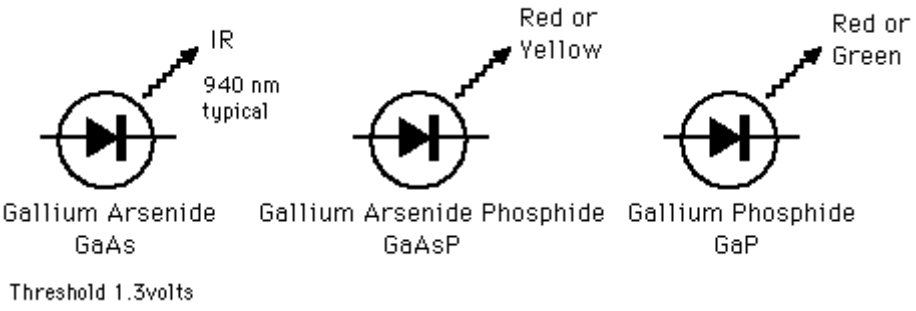
Reference Floyd Electronic Devices, Sec. 3-4

HyperPhysics*****Electricity and magnetism***** Quantum Physics ***** Optics

R Nave

Go Back

Electroluminescence in LEDs



When the applied forward voltage on the diode of the LED drives the electrons and holes into the active region between the n-type and p-type material, the energy can be converted into infrared or visible photons. This implies that the electron-hole pair drops into a more stable bound state, releasing energy on the order of electron volts by emission of a photon. The red extreme of the visible spectrum, 700 nm, requires an energy release of 1.77 eV to provide the quantum energy of the photon. At the other extreme, 400 nm in the violet, 3.1 eV is required.

The search for a blue LED

Index

LED concepts

Reference Floyd Electronic Devices, Sec. 3-4

Go Back

HyperPhysics*****Electricity and magnetism***** Quantum Physics ***** Optics *R Nave*

Search for a Blue LED

After a decade of intense research, a bright blue LED was successfully produced by Nichia Chemical of Japan in 1994. The material used for the diode was gallium nitride GaN. Nichia has also produced an InGaN laser diode which lases in the blue-violet region of the spectrum.

Blue LEDs are important for the development of high-information-density storage on optical disks, as well as a host of other applications such as high-resolution television and computer displays, image scanners and color printers, biomedical diagnostic instruments, and remote sensing.

Other ways of producing blue light from solid state sources involve doubling the frequency of red or infrared laser diodes. Hitachi and Matsushita have taken this approach to producing blue light for optical disks and digital versatile disks (DVD).

Reference: The Elusive Blue Laser, The Industrial Physicist, 3, September 1997, p16

LED electroluminescence

Index

LED concepts

HyperPhysics*****Electricity and magnetism***** Quantum Physics ***** Optics *R Nave*

Go Back