# A Review study on Light Emitting Diodes & its Application

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***Abstract-*** In the first Nineties, the biological significance of light-emitting diodes was accomplished. Since this discovery, numerous lightweight sources are investigated for his or her cochineal effects. A MEDLINE search was performed on junction rectifier lights and their therapeutic effects between 1996 and 2010. to boot, AN open-label, investigator-blinded study was performed employing a yellow junction rectifier device to treat skin disorder, rosaceous, photo aging, alopecia, and androgynous baldness. The authors known many case-based reports, tiny case series, and a number of randomized controlled trials evaluating the employment of 4 completely different wavelengths of light-emitting diodes. These devices were classified as red, blue, yellow, or infrared, and lined a good vary of clinical applications. The twenty one patients the authors treated had mixed results concerning patient satisfaction and pre- and post-treatment analysis of improvement in clinical look. The authors clinical expertise with a particular yellow junction rectifier device was mixed, betting on the condition being treated, and was possible influenced by the device parameters. The following is a brief idea of LED, an electronic component discovered from another electronic component that is used in our day to day life and has a major impact on the electronics industry.

## I. INTRODUCTION

Light emitting diode is a, semiconductor energy source that produces it energy in the form of light. Led is a type of diode that releases energy in the form of photon's when current is flowing through it. The color of the led light is determined by the energy band gap of the semiconductor.

A PN junction diode is one that has 2 sides, one positively changed and the other negatively charged. it is doped in such a way that when current flows through it the current flows only in one direction. The negative side of PN junction diode is called N-type semiconductor and infused with a P-type semiconductor creating a PN junction at the center when voltage is provided. Electrons are attracted towards the side with majority carrier holes and when this process continues further they create a junction wall. The junction is in the state of equilibrium when no voltage is applied. When it is connected to a voltage source in a circuit, the free electrons and holes in P-type and N-type semiconductors if a suitable voltage is provided as they cross the junction. When the voltage is sufficient enough to cross this barrier (barrier voltage) the current flows through diode in one direction.

## II. ELECTRONICALLY MAJOR APPLICATIONS OF DIODES AS COMPONENTS

- Rectifier circuits
- Amplifiers
- Logic circuits and transistors

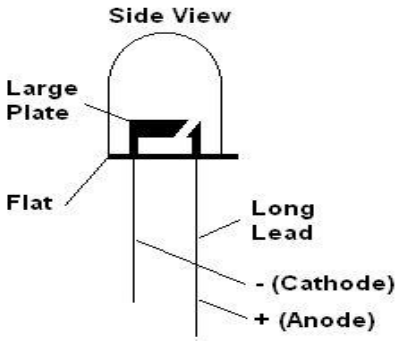
**Rectifier circuits**: As we know that diodes are unidirectional components and conduct only in one direction, diodes are very useful to make ac to dc rectifiers. These rectifiers pass current in one direction so a half cycle is completed the other half cycle is rectified.

**Amplifiers:** diodes show another property called amplification and are used as basics to create amplifiers of different and hybrid classes.

**Logic circuits and transistors**: transistors are three terminal components that work like switches 2 terminals are positive and ground and the third is the switch to make the connection between the 2 other terminals. Transistors are used to create digital IC's and transistors are in used in millions to create Boolean logic circuits on which today's computer's work. and diodes are used in trillions in a single octa core processor chip.

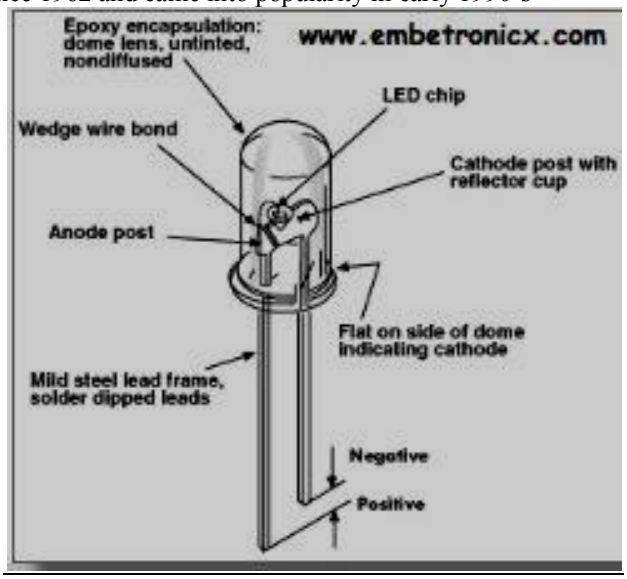
## III. WORKING

The material used in led is aluminum-gallium-arsenide (AlGaAs) and is a type a material that when sufficient amount of current flows through it at specific voltage it emits light. The material itself shows the property but the intensity and color of the light it determined by adding impurities to the material. This process is called doping. By adding impurities, we add extra electrons on the n-type and extra protons to the p-type semiconductor material of the diode. A diode is a unidirectional component and it conduct's flow of electricity in one direction only.

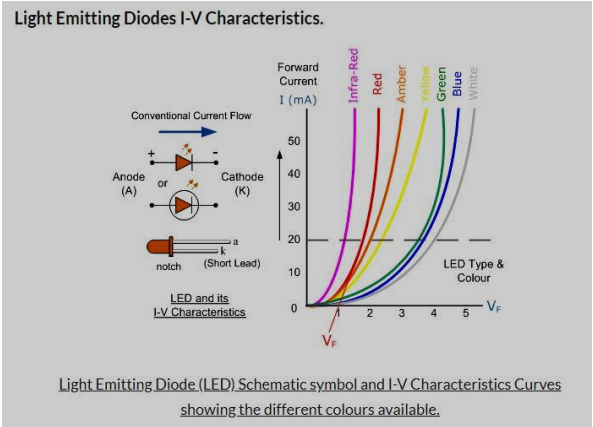



Scientifically to emit light from led the process by which lasers work is reversed. we make the electron fall from higher to lower energy level. This phenomenon is exploited in led. Red or yellow light is produced by using Gallium-Arsenide-Phosphorus (GaAsP) as a semiconductor. Red or green light is produced by using Gallium-Phosphorus (GaP) as a

semiconductor. Led's have been introduced and modified since 1962 and came into popularity in early 1990's




## IV. CHARACTERISTICS




Light Emitting Diode (LED) Schematic symbol and I-V Characteristics Curves showing the different colours available.

| Typical LED Characteristics | | | |
|---|---|---|---|
| Semiconductor Material | Wavelength | Colour | $V_F$ @ 20mA |
| GaAs | 850-940nm | Infra-Red | 1.2v |
| GaAsP | 630-660nm | Red | 1.8v |
| GaAsP | 605-620nm | Amber | 2.0v |
| GaAsP:N | 585-595nm | Yellow | 2.2v |
| AlGaP | 550-570nm | Green | 3.5v |
| SiC | 430-505nm | Blue | 3.6v |
| GaInN | 450nm | White | 4.0v |

## V. BI-COLOR LIGHT EMITTING DIODES

A bi-color light emitting diode has two LEDs chips connected together in "inverse parallel" (one forwards, one backwards) combined in one single package. Bi-color LEDs can produce any one of three colors for example, a red color is emitted when the device is connected with current flowing in one direction and a green color is emitted when it is biased in the other direction. This type of bi-directional arrangement is useful for giving polarity indication, for example, the correct connection of batteries or power supplies etc. Also, a bi-directional current produces both colors mixed together as the two LEDs would take it in turn to illuminate if the device was connected (via a suitable resistor) to a low voltage, low frequency AC supply.

## VI. TRICOLORED LIGHT EMITTING DIODE

The most popular type of tricolor light emitting diode comprises of a single Red and a Green LED combined in one package with their cathode terminals connected together producing a three terminal device. They are called tricolor LEDs because they can give out a single red or a green color by turning "ON" only one LED at a time. These tricolored LED's can also generate additional shades of their primary colors (the third color) such as Orange or Yellow by turning "ON" the two LEDs in different ratios of forward current as shown in the table thereby generating four different colors from just two diode junctions.

## VII. LED DISPLAYS

As well as individual color or multi-color LEDs, several light emitting diodes can be combined together within a single package to produce displays such as bar graphs, strips, arrays and seven segment displays. A 7-segment LED display provides a very convenient way when decoded properly of displaying information or digital data in the form of numbers, letters or even alpha-numerical characters and as their name suggests, they consist of seven individual LEDs (the segments), within one single display package. In order to produce the required numbers or characters from 0 to 9 and A to F respectively, on the display the correct combination of LED segments need to be illuminated. A standard seven segment LED display generally has eight input connections, one for each LED segment and one that acts as a common terminal or connection for all the internal segments. The Common Cathode Display (CCD) – In the common cathode display, all the cathode connections of the LEDs are joined together and the individual segments are illuminated by application of a HIGH, logic "1" signal. The Common Anode Display (CAD) – In the common anode display, all the anode connections of the LEDs are joined together and the individual segments are illuminated by connecting the terminals to a LOW, logic "0" signal.

## VIII. APPLICATIONS

- Led's have mainly these applications
- As light sources for common use
- Backlighting in display devices
- Dimming the intensity of light
- Optical fiber communication
- micro tech displays
- Li-Fi applications
- Opto – couplers

- OLED

## IX. LED AS A LIGHT SOURCE

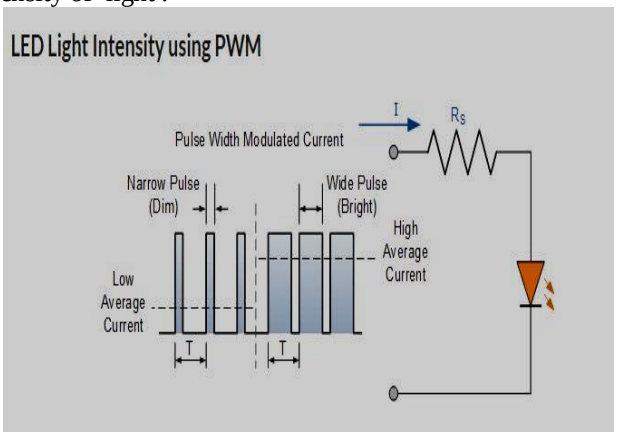
Led's have replaced bulbs and tube lights for good as we know that led 's consume less energy compared to any other light source which leads led to become eco-friendly and more popular as a light source. Led's have been proven as the most efficient source of light as it is not only power efficient but it has made it possible to get a thinner display screen with high definition graphics making contributions in employment and growth in graphics and gaming industries, all at a cheap rate.

## X. BACKLIGHT IN DISPLAY DEVICES

Led screens have been around for a long time now have you wondered how it work. The layers of the screen

- Cover glass
- Color filter front
- Pixel divided screen
- Color filter back
- Led backlighting panel

**Cover glass:** It is just a glass sheet to protect the inner display mechanism and keep the structure intact.
**Color filter front:** It is a di-electric layer of electrodes in horizontal plane to apply the polarization effect. This is one of the most important layers of an LED display monitor because it is responsible to control the intensity of light of horizontal plane when these are given pulse at specific sections those areas let the led back light pass through it and we get the color that is also pulsed with it . It filters the color and produces clear pixels which in return cause great graphics.
**Pixel divided screen:** This screen is a panel in which the screen is divided into many pixels and when a given voltage which determines the color of a pixel is given to it combines with the backlight and produces the graphics on the screen . a pixel is a combination of three colors red, green, blue (RGB)
**Color filter back :** This is another polarizer that uses horizontal electrodes to display pixel when a voltage is passed it lets the light pass through it .
**Led backlighting panel :** Multiple LED's are connected together to a panel and used as backlighting agent in television, and it makes the device compact and thin in shape which looks very elegant and consumes less space .
**LED monitor without backlighting :** These are display devices that use led as the monitor and there is no backlighting agent, which makes the display ultra thin and because there are hundreds of LEDs that can be controlled precisely to produce light exactly where needed which marked the graphics ultra high definite. The LED displays are 4k in definition.
**Controlling the intensity of light:** Controlling the intensity of light has been a tough task that has been made easier with Led's. This is a major application of led's. if can control intensity of light we control how dark or light a color can be produced in a display screen, by controlling that we can apply it to a pixel and create better graphics at high frames with cheaper, thinner and durable hardware. Led's have made it possible to be in a world full of HD graphics. replacing plasma screens and LCD's as display screens. When higher light outputs are required, a pulse width modulated current with a fairly short duty cycle ("ON-OFF" Ratio) allows the diode current and therefore the output light intensity to be increased significantly during the actual pulses, while still keeping the LEDs "average current level" and power dissipation within safe limits. This "ON-OFF" flashing condition does not affect what is seen by the human eye as it "fills" in the gaps between the "ON" and "OFF" light pulses, providing the pulse frequency is high enough, making it appear as a continuous light output. So pulses at a frequency of 100Hz or more actually appear brighter to the eye than a continuous light of the same average intensity.
LED's are controlled by using PWM pulses. these pulses are distinguished by their width and are used to control the intensity of light .




## XI. OPTICAL FIBER COMMUNICATION

All though lasers are more precise led are also used as a cheaper alternative to communicate using optical fibers. optical fiber communication is one that uses a light source to provide information from one place to the other connected through an optical cable. Optical fiber communication is the fastest way to communicate in digital form. In optical fiber communication, a light source provides light to a fiber glass with a denser and rarer part infused together and doped to have higher efficiency with index modulation's so that there is as little as possible loss. If the receiver detects light above a certain level it determines the light as 1 and if there is no light or the intensity of light is detected less, then a given certain level then it is detected as 0. The light source produces the given information at a high frequency much greater than an electrical signal in a conducting wire that is why optical fiber communication is the fastest communication method. Led's help us in optical fiber communication by giving us a cheap alternative for a light source. LEDs have made it possible for the optical fiber to be installed directly to homes instead of connecting it a station a distributing it to homes this increases the data speeds up to a significant level instead of 20 mbps now with direct links to homes we get 100 mbps speeds.

## XII. MICRO TECH DISPLAYS

LiFi is just like Wi-Fi (wireless fidelity) we have Li-Fi (light fidelity). just like optical fiber communication we use led's as a light source at high frequency to provide information wirelessly to optic sensor's resulting in the fastest speeds in communication greater than 5g speeds. right now only china is set to have 5g by 2020 with speeds up to 20 gbps which is going to be costly to consumers. Li-Fi provides with speed up to 224 gbps, 20 times more than 5g at prices cheaper than 4g which is a revolution in the broadband industry.

## XIII. DISADVANTAGES OF LI-FI

Even though Li-Fi provides us with fast speeds they are not the most reliable as they can be interrupted by any solid object that comes between the light source and receiver making it a great accomplishment with great failure, which is why these have not been in use exclusively.

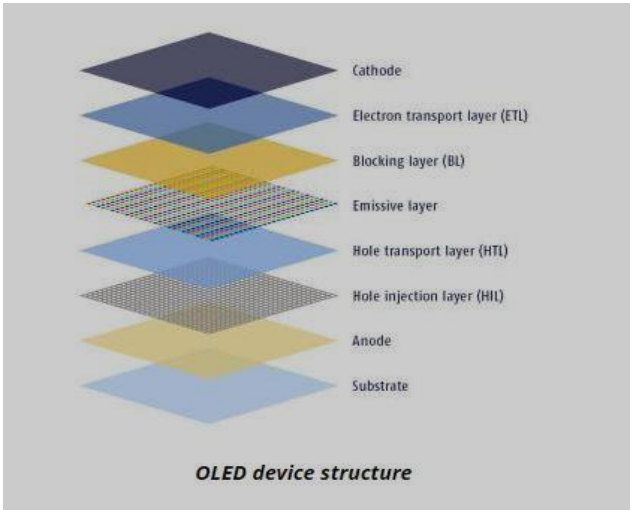
## XIV. OPTO-COUPLER

Finally, another useful application of light emitting diodes is in Opto-coupling. An opto-coupler or opto-isolator as it is also called is a single electronic device that consists of a light emitting diode combined with either a photo-diode, photo-transistor or photo-triac to provide an optical signal path between an input connection and an output connection while maintaining electrical isolation between two circuits.

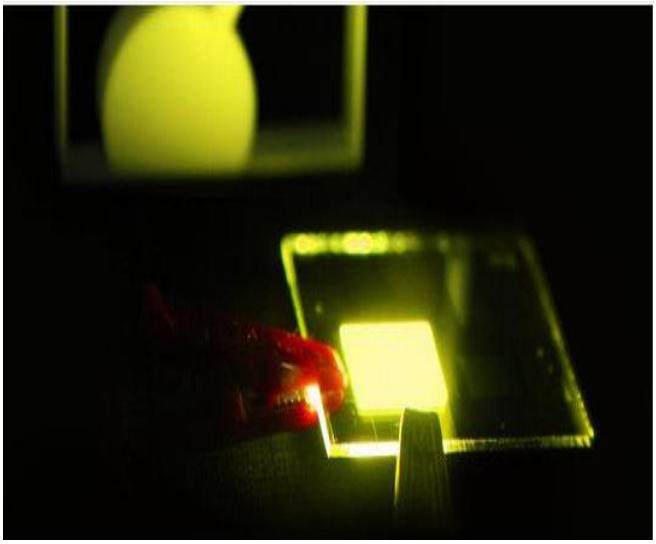
An opto-isolator consists of a light proof plastic body that has typical breakdown voltages between the input (photo-diode) and the output (photo-transistor) circuit of up to 5000 volts. This electrical isolation is especially useful where the signal from a low voltage circuit such as a battery powered circuit, computer or microcontroller, is required to operate or control another external circuit operating at a potentially dangerous mains voltage.

## XV. OLED

Organic light emitting diode is the present and the future of led's. OLED's panels are made from organic materials that emit light when electricity is applied through them. Since OLEDs do not require a backlight and filters (like LCD displays do), they are more efficient, simpler to make, and much thinner - and in fact can be made flexible and even roll-able. OLEDs have a great picture quality - brilliant colors, infinite contrast, fast response rate and wide viewing angles. OLEDs can also be used to make OLED lighting - thin, efficient and without any bad metals. The picture quality is very precise and high def because of it only produces color light where the light is needed and elsewhere the color is black. Because there is no backlighting agent the black color displayed is very deep producing beautiful color schemes and stunning graphics



*OLED device structure*



OLED's have made it possible to get electronic technology in thinner and more compact manner complimenting nano technology and make a grand contribution in the electronics industry .

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