- Can you turn an LED into a laser?
- Wire the LED circuit, connecting the LED with the resistor and battery through the switch. Place the assembled circuit in the holder, bonding, crimping or soldering the LED in place. Put the lens in the barrel and adjust the position to create the smallest spot at the desired distance. Bond the lens with epoxy or RTV.25 Apr

How to Make a LED Into a Laser Pointer

RELATED

How to Use a 9-Volt Battery to Power LEDs

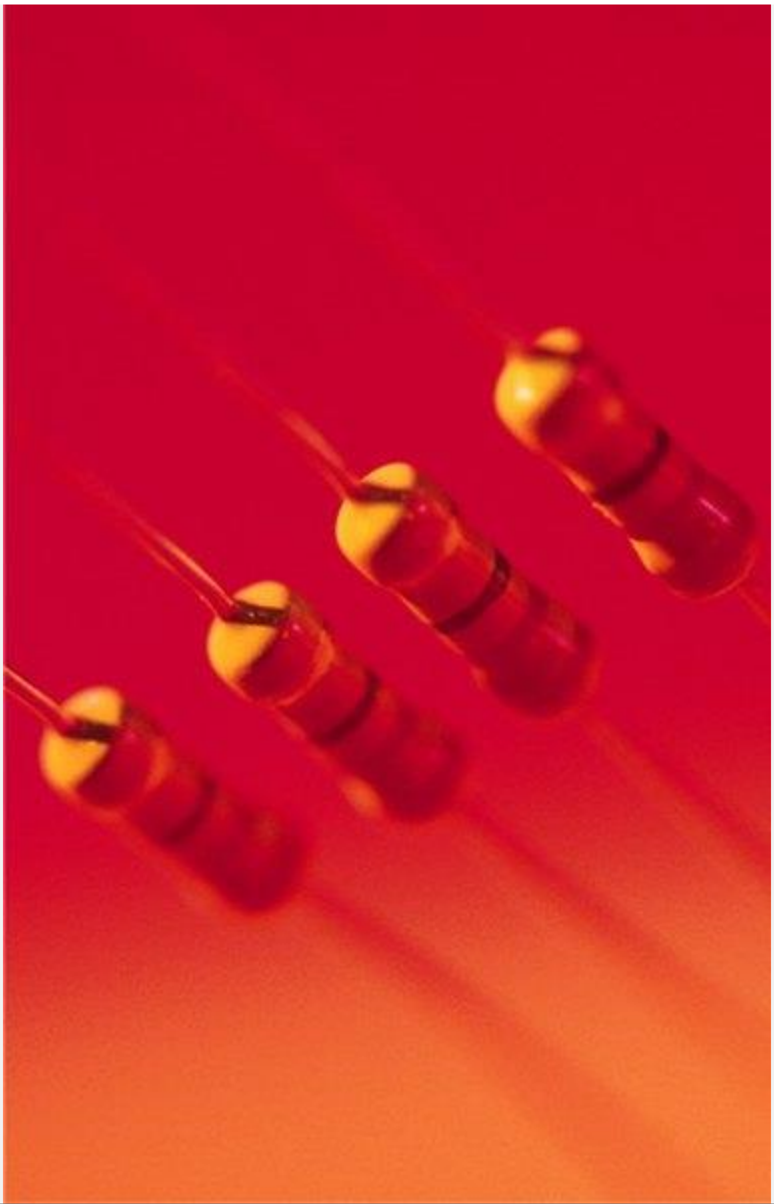
Updated April 25, 2017
By Richard Gaughan

A light-emitting diode (LED) and a semiconductor laser both generate light in the interface region between two different types of semiconductor materials. The energy of the light for both LEDs and lasers is determined by the composition of the semiconductor. The LED and laser emit light in a relatively narrow range of wavelengths. However, lasers put all their energy in a single wavelength, which emits from a tiny spot. LEDs spread the energy over more wavelengths and send that light from a larger spot into wide cone.

Select a LED wavelength near the peak of the visual response of the eye. The human eye is not equally sensitive to all wavelengths, as the eye peaks at a yellowish-green wavelength of about 560 nm (billionths of a meter). A LED near that wavelength region will create a brighter spot.

Find an LED in the desired wavelength with at least a few milliwatts of output power, say three or more. Read the specification sheet and find the electrical requirements, in particular the forward voltage, and the operating current. For example, a typical LED might have an operating current of 20 mA and a forward voltage of 2 V.

Select a watch battery or batteries to supply the needed voltage. For example, use a lithium cell with a voltage of 3 volts.



Calculate the size of a current limiting resistor. The right resistor is given by the equation: R = (supply voltage - LED forward voltage) / (operating current).

In the example, R = (3 - 2) / .020 = 50 ohms.

Calculate the diameter of the lens—something that fits within the diameter of the holder. Select a focal length equal to the diameter of the lens. Because the LED spreads light in a wide angle, to capture as much light as possible the lens should have the shortest realistic focal length—which is equal to the diameter of the lens.

A reasonable diameter for a pointer would be one half inch, so the lens could be a 10 mm diameter/10 mm focal length lens.

Wire the LED circuit, connecting the LED with the resistor and battery through the switch.

Place the assembled circuit in the holder, bonding, crimping or soldering the LED in place.

Put the lens in the barrel and adjust the position to create the smallest spot at the desired distance. Bond the lens with epoxy or RTV.

Can you turn an LED into a laser?

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What's the difference between LED and Laser Red Light Therapy?

by Marc Poirier April 29, 2021

Red light therapy devices are becoming more and more advanced, popular and accessible, thanks primarily to developments in light-emitting diode (LED) technology over the past few decades. However, red light therapy, otherwise known as photobiomodulation or low-level laser therapy, is not new. Therapeutic photobiomodulation using LEDs can be traced back to the 1990s, where it was first employed by NASA. But even before LEDs, photobiomodulation existed in laser form.

Despite the increasing popularity of LED devices for both in-home and clinical use, red light therapy treatment using lasers is still available in many spas and clinics. This may raise a few questions, namely, is one better than the other?

This article explores the difference between the two types of red light therapy treatments, as well as which might be more suitable for you.

THE ORIGINS OF RED LIGHT THERAPY: A RATHER HAPPY DISCOVERY

Photobiomodulation was discovered quite accidentally by Hungarian physician Endre Mester in 1967. Mester was attempting to recreate a study conducted by American scientist Paul McGuff, who'd successfully used something called a ruby laser to cure malignant tumors in rats. The ruby laser used by Mester happened to emit power at a much lower level than the one in the original study, and thus the results could not be replicated. However, Mester noticed faster wound healing and hair growth among the rats that were exposed to his lower-powered laser. He surmised that there might be therapeutic benefits to this weaker type of laser. This was the first instance of what would become known as low-level laser therapy.

Meanwhile, the first LED was constructed by Russian inventor Oleg Lossev in 1927. However, it took another 35 years or so for the technology to reveal any practical applications. In 1962, the first infrared LED was invented, but given that infrared light is invisible to humans, it had little perceived practical use at the time. Later that same year, however, the first visible LED was developed, and the rest is history (which you can read about here). This visible light was - you guessed it - red.

This breakthrough made it possible to discover that the same benefits produced by Mester's laser could also be produced by LEDs. Cheaper to construct and easier to use, they were adopted by NASA in 1993 as a way to speed up plant growth. While plant growth was indeed boosted, it also led to an even more interesting discovery: the scientists' skin lesions were healing faster as well. NASA subsequently began studying the treatment as a means to reduce the loss of bone and muscle mass in astronauts. NASA's adoption of the treatment also helped propel the study of the potential applications of red light therapy for the general public.

(Want to know more about how photobiomodulation works? This article on red light therapy for pain is a great primer.)

So, if LEDs are an effective and less costly medium for delivering therapeutic treatment, why do laser devices still exist? Is there a practical application that LEDs simply don't possess? Let's take a look.

ARE THERE BENEFITS TO LASERS OVER LEDS?

Until the 21st century, the vast majority of clinical studies involving photobiomodulation used lasers. This led to a persistent belief within the scientific community that lasers were the superior medium for delivering red light therapy treatment, and in fact, the laser vs LED debate still exists today.

The perceived advantage of lasers has to do with the way they emit light compared to LEDs. Lasers have a pin-point focus, while LEDs emit light at an angle (called a beam angle), which causes the light to spread out and become weaker as it travels away from the source. Laser red light therapy thus allows you to get the full concentration of light right on the area of the body you're treating. This means it works more effectively on the cells to produce an effect. Sounds like a pretty big advantage right? Well, the downside is pretty major.

A laser-focused treatment means that you can only treat a tiny area of the body at one time. This may be fine for treating smaller wounds and cosmetic issues, or pains that affect one small area (think arthritis in one finger). For anything larger, you'll be spending a lot more time on the treatment table - and a lot more money, especially since laser devices are not commercially available for home use. LED devices, on the other hand, allow you to treat a much larger surface area at one time.

Another important factor in the laser vs LED debate (we've already touched upon it but it certainly bears repeating) is that lasers are a much more expensive technology (costing about 100x more per milliwatt!) and are thus much less accessible to the end user. Some spas and clinics may offer laser treatments simply because they already have a device in their possession. After all, it's only very recently that LED red light therapy devices have become commercially available. Still, many professionals are making the switch from laser to LED, and it's not hard to see why: besides being more cost-effective to purchase and run, LED devices don't require a skilled technician to administer treatment (freeing up time and staff for other clients and procedures). Plus, their greater coverage allows for the treatment of a wider range of issues, in much less time.

WHAT DOES ALL THIS MEAN FOR YOU?

When seeking red light therapy treatment, clinics and spas may try to tempt you with laser photobiomodulation by marketing it as a more exclusive, upmarket treatment. Don't fall for the hype. First, the jury is still out on whether lasers are truly more effective, and more research needs to be done to settle the debate. Second, any advantage lasers may have over LED treatment is tempered by the major disadvantages mentioned above.

The great news is that you can get the same benefits of professional red light therapy treatments right in your own home, for a tiny fraction of the cost of clinic or spa sessions. And Rouge Red Light Therapy offers the best, most powerful in-home devices on the market today. How do we know? Science, of course! We had our Rouge Pro independently tested and compared the results to the leading competition. You can take a look at the results here.

The LEDs on the Rouge device, for instance, have a much narrower beam angle than those of the competition (30 degrees compared to 60 or even 90 degrees). This means that you're getting a much more concentrated amount of light from each individual LED. Rouge devices also have a greater number of LEDs than the competition, so you're not losing anything in terms of surface area of treatment - you're simply gaining power.

Ready to incorporate this NASA-approved therapeutic treatment into your daily routine? Shop the Rouge collection of red light therapy devices today. And for more tips, tricks and helpful info on red light therapy, keep reading our blog!

Difference between LED and LASER

The significant difference between LED and LASER lies in the working principle. **LED** emits light as the consequence of charge carriers recombination across P-N Junction, while **LASER** emits light as a result of photons striking the atom and compels them to release the similar photon. A laser works on the principle of **stimulated emission** and LED works on the principle of **Electro-luminance.**

Thus, in LASER every released photon strike another atom to release similar photon and therefore, the beam of light thus produced is coherent in nature. On the contrary, the light produced by LED is incoherent. Thus, light emitted by LED consists of many colours while light beam generated by the LASER is monochromatic i.e. single colour light.

LED is the acronym of **Light Emitting Diode** while the LASER is the abbreviated term used for **Light Amplification by Stimulated Emission of Radiation.**

Content: LED and LASER

Comparison Chart

PARAMETERS	LED	LASER
Working Principle	Electro-luminance	Stimulated Emission
Full Form	Light Emitting Diode	Light Amplification by Stimulated Emission of Radiation
Response	Slow Response	Fast response in comparison to LED
Driving Current	It ranges from 50 to 100 mA.	It ranges from 5 to 40 mA.
Nature of Emitted Light	Incoherent and consists of various colours.	Coherent and Monochromatic.
Junction Area during Manufacturing	Wide Junction Area	Narrow and small Junction
Bandwidth Range	It lies in the range of 10 to 50 THz.	It lies in the narrow range i.e. from 1 MHz to 2 MHZ.
Power to light Conversion Efficiency	Approx 20 %	Approx 70 %
Numerical Aperture of the obtained Light Beam	Higher in LEDs	Extremely low as compared to LEDs.
Cost	Low cost and thus	High cost and thus used in the

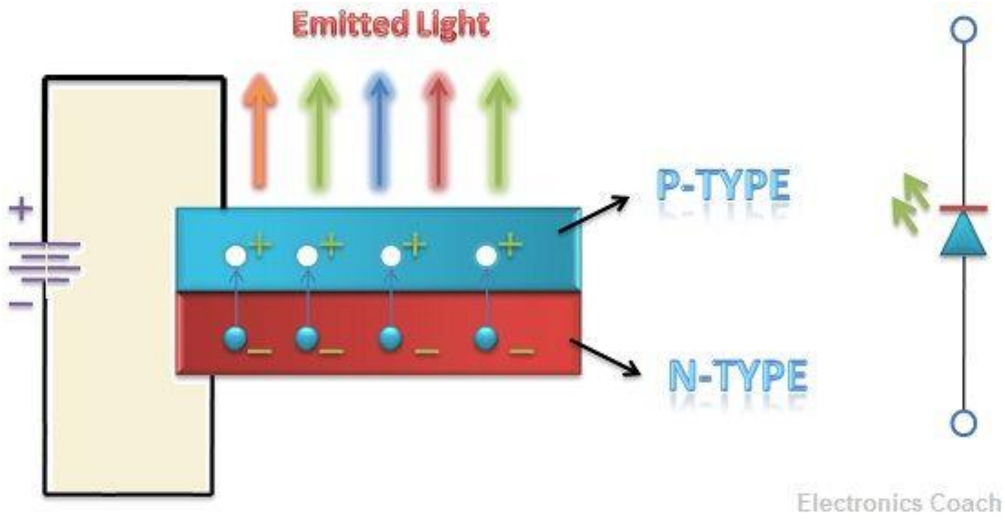
PARAMETERS	LED	LASER
	economical.	specific application.

Definition of LED

The LED is considered as the optical source for various crucial applications. The main principle behind its working is electro-luminance. In this phenomenon, the forward biased P-N junction emits light when electrons and holes recombine at the junction.

The electrons in the conduction band are at a higher energy level and the holes are in valence band which is at the lower energy level. When these electrons from conduction band jump into valence band they release some amount of energy. This energy can be in the form of heat or light.

The recombination of charge carries will be either an exothermic reaction or endothermic reaction. If electrons are on higher energy level and it tends to combine with the hole, it needs to emit energy. As recombination occurs only when the energy of both the recombining charge carriers should be comparable.



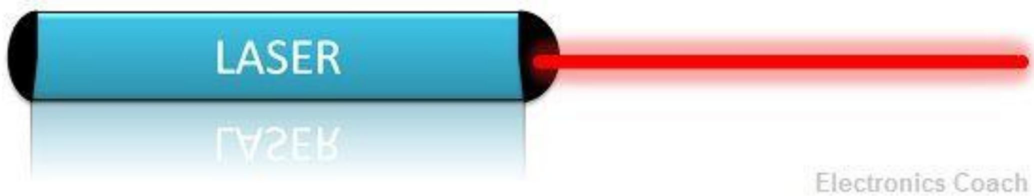
The semiconductor such as Germanium and Silicon emit energy in the form of heat while semiconductor such as GaAsP (Gallium Arsenide Phosphide) and GaP (Gallium Phosphide) emit energy in the form of light. Thus, this type of semiconductor is used in the manufacturing of LED.

LED are significant over various optoelectronic devices because it possesses fast response time in order of 0.1 microseconds. The light emitted by LED consists of various radiations of narrow wavelength. It comprises of visible radiations.

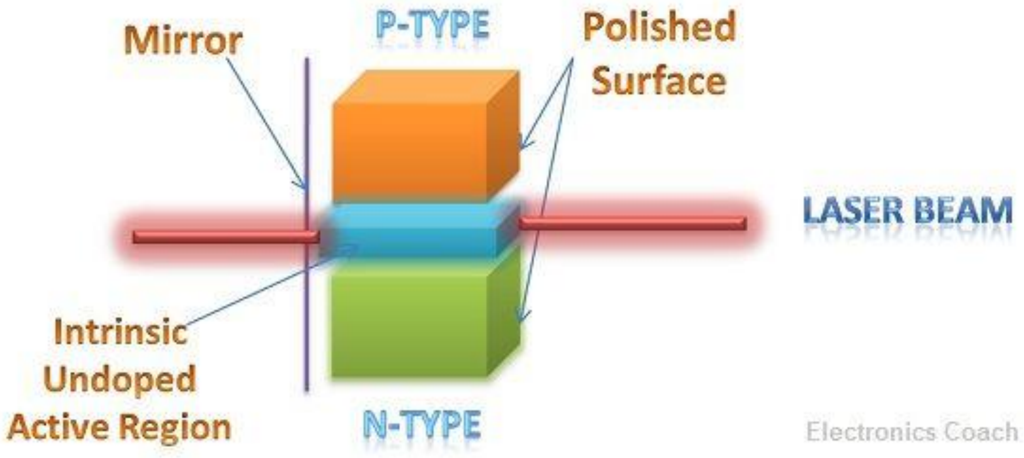
If the power to light conversion efficiency of LED is compared with that of a tungsten lamp, it will be 10 to 50 times higher than that of it which clearly makes it an appropriate optoelectronic device.

Definition of LASER

The LASER works on the principle of stimulated emission of radiation. Thus, it is called Light Amplification by Stimulated Emission of Radiation. The stimulated emission is the emission of the photon by striking the atom with the similar photon.



If electrical energy is supplied to the electron at the lower energy level, it will jump from valence band to conduction band absorbing the additional energy supplied to it. This process is called Absorption.



When the electron is at higher energy level it is unstable, in order to become stable it releases some part of its energy. This energy can be in the form of heat or light. If the energy released is in the form of light then it will emit a photon. This is process is called spontaneous emission.

When the photon strikes the atom it will strike the electrons at higher energy state then as result of collision these electrons will become unstable due to high energy and energy imparted by the striking photon. Thus, this electron will move to lower energy state and release a photon in addition with the incident photon. This is called stimulated emission.

Stimulated emission occurs in the LASER diode. The light beam is formed by emission of a photon which is similar to the incident photon. And these emitted photons will emit more photons similar to the incident one. In this way, the beam produced is coherent and monochromatic.

Key Differences Between LED and LASER

1. The light beam produced by LED and LASER also creates a key difference between LED and LASER. The light emitted by **LED** consists of various colours while the light beam produced by **LASER** consists of a **single colour**.
2. The working principle of LED and LASER also created major differences. LED works entirely on the principle of electro-luminance which means lumination by means of electrons. On the other hand, LASER works on the principle of **stimulated emission.**
3. The another key difference between LED and LASER is the **junction area.** The area of the junction in case of the LASER is extremely narrow as light is allowed to pass from the extremely small area in case of the LASER. On the other hand the in LED, the junction area is wider. Thus, light is allowed to pass through over a wide area.
4. The **concentration of charge carriers** such as electron and holes are also different in LED and Laser. In case of the laser, the concentration is very high while in Led it is very low. Thus, Laser is used in the surgical instrument in the medical field as it possesses sufficient energy that it can even cut the object in contact with it.

Conclusion

LED and LASER, both are the optoelectronic device, both the device generated light. But the working principle of light generation and construction architecture creates the difference. The output power generation capacity of laser diode lies in the range of 20 to 100 mW.

The protection of Eyes should be taken care when dealing with these optoelectronic devices especially in case of the LASER. It generates high energy beam.

Related Terms:

1. **Laser Diode**
2. **Difference between LED and Photodiode**
3. **Photoelectric Emission**
4. **Thermionic Emission**
5. **LED**

Reader Interactions

Comments

LEDs and SLD lose the majority of their energy. The final answer is that **both LEDs and LASERs can be used in cold lasers**. LEDs are primairly used for superficial treatment, due to the basic properties of the LED.

An LED can be converted to a laser by adding optical feedback elements to the LED (mirrors) and then pumping the LED hard enough (higher input current).

Lasers need light to bounce back and forth in an optical cavity, so adding **mirrors** to the LED will **reduce the cavity loss**.

LEDs have **more gain at higher input current** (more pump current), and hence laser diodes typically operate at 30–50 times higher input current than an LED for devices with the same area. In other words, laser diodes operate at >30x higher current densities than LEDs.

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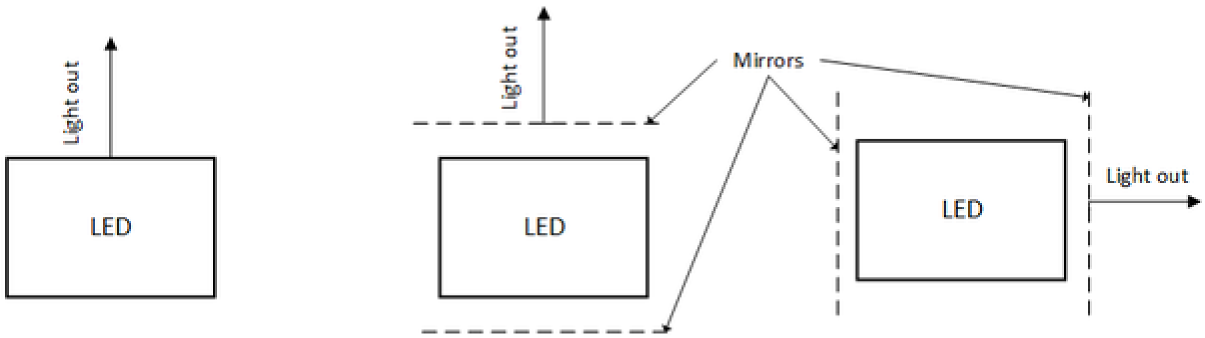
Lasing begins when the gain equals loss. Thus, the mirrors can be designed to reduce the loss, and the input current can be increased to increase the gain, until $\text{gain}=\text{loss}$gain=loss.
In LEDs, light is emitted in the vertical direction, while in lasers the light is emitted perpendicular to the mirrors, as shown in the figure below. If the mirrors are stacked vertically, we call it a surface-emitting laser, while if the mirrors are in the horizontal direction, then we have an edge-emitting laser.



(a) LED (b) Surface-emitting laser (c) Edge-emitting laser

Conceptually speaking, it is fairly easy to convert LED to laser, but making a *good* laser is a whole different story, and there are several subtle design differences between state-of-the-art LEDs and laser diodes.