SOLAR POWERED LASERS

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Abstract: this article reveals the information about solar-powered lasers that is possible to create laser light with sunlight and the difference between sunlight and laser light. It is clear that laser light can have a continuous constant amplitude or pulse, as well as extremely high power. Many devices use a laser as an amplifier to emit radiation from another source. The amplified signal corresponds to the initial signal in terms of wavelength, phase, and polarization.

Key words: *solar energy, lasers, laser radiation, polarity, radiation, directions, solid, crystal, chromium, lenses*

The invention of the laser is one of the great achievements of human scientific and technological progress. Shortly after the invention of laser physics and technology, various lasers based on solid, gaseous, and semiconductor materials based on optical, electronic, injection, and other types of injections were developed and used in many fields of engineering and manufacturing. The main features of lasers in practice are their coherence of radiation, the ability to control the direction and high power.

Laser radiation is monochromatic and coherent, with a constant wavelength and a clear phase, as well as a certain polarity. On the other hand, some types of lasers, such as colored composite lasers or semi-chromatic solid-state lasers, can control several sets of frequencies over a wide spectral range. Sunlight, on the other hand, is produced by an expanded source, resulting in a variety of rays. Sunlight has different frequencies from ultraviolet to infrared. This can cause problems in optical systems, as light at different frequencies tends to refract and refract. Natural sources of light scatter light in a wide range in different directions. In addition, radiation from non-laser sources usually does not have a fixed polarity.

So how do you use solar energy to create laser light? The essence of laser operation is related to the movement of electrons because of the excitation of the working part. The working part is mounted on an optical resonator, and its energy increases exponentially as a result of the rotation of the waves by means of a forced irradiation mechanism. The laser usually consists of three main parts:

- *energy source;*
- *working part;*
- *glass system (optical resonator)*

The power source is the energy supplied to the system, which can be an electric discharge, a pulsed lamp, a submerged lamp, another laser, a chemical reaction, or even an explosive, and natural solar energy. If we think about solar energy from the above energy sources. A solar-powered laser is a laser that has the same optical properties as conventional lasers, such as emitting light consisting of consistent electromagnetic radiation that can have high power, but uses sunlight to create an active environment. This type of laser is unique from other types because it does not require any artificial energy source. This is because energy is absorbed by the wide assimilation ranges of the Cr3 + dopant and then converted to Nd3 + in a dipole-dipole interaction. This material has been proposed for use in solar-powered lasers, which form part of a solar-powered satellite system. Landis et al have also proposed solar furnace semiconductor lasers.

A solar-powered laser was used to create a magnesium combustion engine. The two Fresnel lenses direct sunlight onto the ceramic crystal to produce laser light. There is hope to use such powerful lasers to produce heat and hydrogen from magnesium and water

Magnesium has great potential as an energy source because it has an energy storage density about 10 times higher than that of hydrogen. It is also highly abundant, with about 1.3 grams found in every liter of seawater, or about 1,800 trillion metric tons in our oceans. Moreover, the magnesium oxide resulting from the reaction can be converted back into magnesium. The catch? Recycling the magnesium oxide back into magnesium requires temperatures of 4,000 kelvins 3,726 ºC–hence the need for a laser to generate such temperatures on a small spot. But for a magnesium combustion engine to function as a practical source of energy, the lasers need to be powered by a renewable energy source, such as solar power. Solar- powered lasers already exist: they work by concentrating sunlight onto crystalline materials such as neodymium-doped yttrium aluminum garnet, causing them to emit laser light. Until now, however, most solar-pumped lasers have relied on extremely large mirrors to focus the sunlight on the crystal. A compact laser offers a threefold improvement in efficiency over previous designs, in terms of how much power it can deliver compared with the available sunlight.

The use of Nd:YAG crystals that are additionally doped with chromium, enabling them to absorb a broader range of light. Adding the chromium makes a greater proportion of the spectrum available, thus the efficiency from sunlight to laser is greatly enhanced. The other innovation of laser is the use of a small Fresnel lens instead of large mirror lenses. Fresnel lenses reduce the size and amount of material needed to build a lens by breaking it into concentric rings of lenses. Typically, 10 percent of incident light is focused on the crystal, whereas with the Fresnel, it is around 80 percent. In our case, we used only 1.3 meter squared and achieved 25 watts. Although this is only a threefold increase, the laser output exponentially increases with the increasing area.

The addition of chromium makes up a large part of the available spectrum. Thus, the efficiency of laser light from sunlight is significantly increased. Another novelty of this laser is the use of a small Fresnel lens instead of a large mirror lens. This divides the lenses into concentric rings, reducing the size and amount of materials needed to create the lenses. Typically, 10% of the incident light falls on the crystal, while with a Fresnel lens it falls on 80%.

Solar-based lasers are not used commercially, as the low cost of electricity in most places means that other more efficient types of electric lasers are used more efficiently. Solar pumped lasers can be useful in off-grid locations. Interestingly, such a solar furnace in Uzbekistan was built in 1981 and is located 45 kilometers from Tashkent. The oven is the largest oven in Asia. It uses quartz glass or a series of glasses that act as a parabolic reflector, which can reach temperatures up to 30,000 C. It is currently operated by the largest solar-powered laser research center. This is a solar-powered NdYAG-type laser with a capacity of 1 MW, cooled by distilled water.

It is proposed to use a solar oven in Uzbekistan to power the Nd: YAG laser. Because this furnace is the largest system in the world, it has the capacity to input solar energy up to 1 MW. However, current research is focused on combining the production of several small concentrators.

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