High intensity of Energy in Nano Laser industrial Nano Lasers

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- **Abstract:**

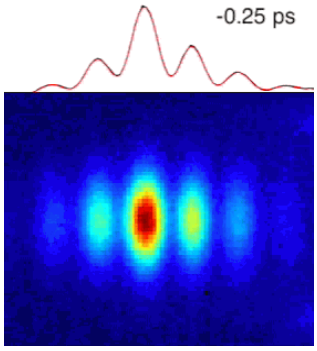
- Another characteristic of industrial nano lasers is the high intensity of energy at its focus point. Due to the fact that the nano laser waves are moving at the same frequency, in a straight line and without phase difference to each other, it can be expected that the amount of energy at the focus point is high. In the report, the energy intensity at this point is more than 10-15 watts per square nanometer.

- **Keywords:** Nano Laser , energy intensity , industrial nano lasers , nanoelectronic

Introduction •

Industrial nano laser has differences with ordinary light, and these features cause its special abilities and applications. Laser light is brighter and more intense than natural light . Laser light can break the hardest metals and easily pass through a hard object like diamond and create a hole in it. The low-power and ultra-fine beams of other types of lasers can be used to perform very delicate operations such as surgery on the human eye. Laser light can be controlled with high precision and used as a continuous beam called continuous laser or fast bursts called pulsed laser . Unlike normal light, laser light has completely coordinated energy, which creates a lot of power to do different things in it. The word laser is derived from the first letters of the words that describe its characteristics, which means light amplification by the induced emission of radiation . The difference between laser beam and normal light is in the important properties that exist in this beam. These characteristics are: coherence, monotony, directness of high intensity. The mentioned properties cannot be seen in normal light and these properties are used for various tasks.Industrial nanolaser is limited to devices emitting electromagnetic radiation using light amplification by stimulated emission of radiation in wavelengths from 180 nm to 1 mm. The electromagnetic spectrum of nano laser includes energy from gamma rays to electricity. Nano laser radiation for current military and commercial applications includes

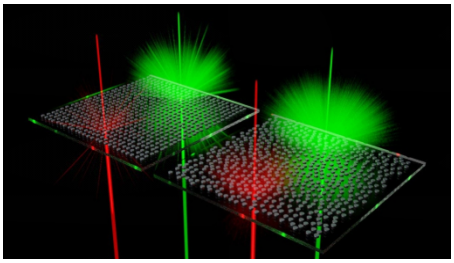
ultraviolet, visible and infrared spectrum. Ultraviolet radiation for nanolasers consists of wavelengths of 180 to 400 nm. The visible region consists of radiation with wavelengths between 400 and 700 nm. This is the part we call visible light. The infrared region of the spectrum consists of radiation with a wavelength between 700 nm and 1 mm. The nano laser beam absorbed by the skin penetrates only a few layers. In the eye, visible and near-infrared radiation passes through the cornea and is focused and absorbed by the retina. It is the wavelength of light that determines the visible sense of color: violet at 400 nm, red at 700 nm, and other colors of the visible spectrum in between. When radiation is absorbed, the effect on the absorbing biological tissue is photochemical, thermal or mechanical: in the ultraviolet region, the action is mainly photochemical. In the infrared region, this action is in temperature.



- **Investigating and understanding the interaction of the electromagnetic beam in "industrial nanolasers"**

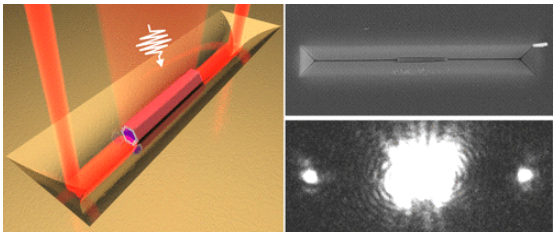
The interaction of the electromagnetic beam occurs in the form of reflection and refraction, absorption and scattering. Reflection and refraction are related by Fresnel's laws. Therefore, these two are expressed in one section. Of course, in nanolaser applications, refraction plays an important role only when a transparent material is irradiated. Which of the events (reflection, absorption, scattering) is more depends on the conditions of the irradiated location and the wavelength of the incoming beam.In relation to the interaction of the electromagnetic beam of the nano laser, the wavelength is a very important factor because the coefficients of refraction, absorption and scattering depend on the wavelength. Therefore, the absorption and scattering properties of the nano laser beam are essential in the operation of the nano laser. Reflection and refraction of the reflection is the return of the electromagnetic beam by the surface on which the beam is irradiated. There are two types of reflection: (regular reflection and irregular reflection) when the incoming beam is reflected from a smooth and polished surface with a height that is smaller compared to the wavelength of the incident beam, it is called regular reflection. Irregular reflection is a phenomenon that generally occurs for all disordered and opaque surfaces. Because none of them have a smooth and polished surface, but in certain cases, regular reflection may prevail over irregular.Lasers are a beam of electromagnetic radiation. Laser beams can be made from visible light, X-rays, ultraviolet rays, or infrared light. Laser is a type of excited and energetic light that cannot be seen in nature under normal conditions, but it can be created with special technology and equipment. Laser has differences with ordinary light, and these characteristics cause its special abilities and applications. Laser light is brighter and more intense than natural light . Laser light can break the hardest metals and easily pass through a hard object like diamond and create a hole in it. Low power and extremely fine beams of other types of lasers can be used to perform very delicate operations

such as surgery on the human eye. Laser light can be controlled with high precision and used as a continuous beam called continuous laser or fast bursts called pulsed laser . Unlike normal light, laser light has completely coordinated energy, which creates a lot of power to do different things in it. The word laser is derived from the first letters of the words that describe its characteristics, which means light amplification by the induced emission of radiation . The difference between laser beam and normal light is in the important properties that exist in this beam. These characteristics are: coherence, monotony, directness of high intensity. The mentioned properties cannot be seen in normal light and these properties are used for different tasks.



Investigation of coherence in the light of industrial nano lasers (coherence radiation) •

The characteristic of the light emitted from a nano laser is its "coherence", due to which the energy loss of the beam caused by the nano laser is less than the beam caused by the lamp. Coherence means that the nano laser waves are in the same frequency and phase. move equally and as a result there is no phase difference between its waves. In this way, its beam will be very powerful. Coherence is one of the physical properties of waves. In physics, two wave sources are perfectly coherent if they both have the same phase difference. This is an ideal characteristic of waves that causes standing interference (a standing wave is produced). In this characteristic, the power of waves to interfere with each other is measured. If the light coming out of a source is Let's divide it into two parts and create a new spring with each of them, so-called two secondary springs are made from one primary spring. Any type of (random) change in the phase that occurs in one of them is repeated exactly in the other, so the phase of the secondary springs remains constant. Two springs which are derived from a primary spring in this way and have a constant phase relationship are called coherent and the resulting light waves are called coherent waves.



For the optical wave of nano laser to be coherent, two conditions must be met. The resulting wave should be very close to single frequency. That is, the frequency splash with a small linear width. And the wave front must have a specific shape, so that it does not change with time. A wave front is a surface consisting of points with the same phase. A point light source produces a wave whose phase is constant at equal distances from the source. According to the concordance conditions, two types of concordance can be imagined.

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