QUESTIONS OF THE APPLICATION OF LASER WELDING

Grigoriev Iliya Vasilevich; Savin Igor Alekseevitch

Kazan National Research Technical University named after Tupolev

Naberezhnye Chelny savin.ia@kaichelny.ru

Abstract: The article deals with the application of modern methods of joining machine parts. The analysis of existing methods of welding parts is carried out. Features of laser welding are considered. Recommendations are given on the areas of application of laser technologies for welding parts.

Keywords: laser welding, laser technology, machine parts.

Laser welding is the process of obtaining an indissoluble welded joint using a laser as an energy source. [1]

For laser welding, solid-state, gas, and gas-dynamic lasers are usually used. The power of solid-state lasers is small and, as a rule, does not exceed 1-6 kW. The maximum power of gas laser installations reaches 20 kW, which allows to weld metals with a thickness of 20 mm. The most powerful are gas-dynamic lasers. The power of such lasers reaches hundreds of kilowatts. [1]

Laser radiation is electromagnetic radiation generated from a wavelength range of 0.1 to 1000 μm. For example, a CO2 laser generates radiation in the infrared range, with a wavelength of 9.4 to 10.6 microns. [2]

Unlike ordinary light, laser radiation has a high degree of monochromaticity, i.e. Consists mainly of waves of one wavelength and frequency, and coherence, i.e. Wave processes occurring in the beam, are consistent in time and space, as well as directivity. Therefore, the energy of the laser beam can be concentrated in a relatively small area, which makes it possible to perfectly focus the laser with optical lenses, since the angle of refraction of the beam in the lens is constant. Coherent oscillations cause resonance, which leads to an increase in the power of the generated radiation. [3]

Due to these properties, the laser beam can be focused into a spot with a diameter comparable to the wavelength of light and create on it an energy density sufficient for the melting of the metal and, therefore, for welding. [4] The formation of a beam with a given power density and configuration occurs in the optical system, which consists in a general form of focusing, refracting and reflecting optical elements. [6]

Interest in laser welding is due to a number of advantages over other types of welding:

- The zone of thermal influence in laser welding is very small, which allows to preserve the properties of the material and ensures minimum deformation of the products;

- high rates of heating and cooling of the metal, as a result of which there are no cold and hot cracks on the treated surface;

- Lack of sensitivity of the laser beam to magnetic fields, which ensures stable formation of the joint;

Laser welding can be divided into two groups:

1) Welding of small thicknesses (less than 1 mm);

2) Welding with deep penetration (more than 1mm).

Welding of small thicknesses is carried out in modes that ensure only the melting of the material without its intensive evaporation. For this, both continuous and pulsed radiation are used. In continuous radiation, gas and solid-state lasers with a power of up to 1 kW are used, and pulsed lasers are mainly solid-state lasers. [5]

The process of welding with deep penetration is carried out in a continuous and pulsed-periodic mode. Continuous radiation uses powerful continuous-wave gas lasers or powerful neodymium-garnet lasers. In this case, you can get narrow deep seams at a welding speed of 1 ... 9 m / min. Compared with the continuous regime, the pulse-periodic differs by a higher energy efficiency of penetration, but the speed is an order of magnitude smaller. Laser welding with deep penetration is used in the manufacture of machine parts and mechanisms. [1]

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