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THE PROSPECTS OF USING PLASMA WELDING IN THE MACHINE-BUILDING INDUSTRY

Plasma welding is an advanced method of joining metal parts, with high efficiency and a wide range of applications. This article discusses the main aspects of plasma welding, including its principle of operation, advantages and limitations. The prospects for the development of this method and its impact on modern industry will also be outlined.

Plasma welding is an arc welding process that uses a plasma torch to join metals. The main feature of plasma welding is the ability to achieve higher temperatures than standard arc welding. This provides better conditions for metal penetration during operation.

Plasma welding is one of the most modern and innovative methods of welding materials. Wide application possibilities are provided due to several advantages:

− the ability to conduct the process using high temperatures;

− reducing the sensitivity of the process to arc length; arc burning even at low currents;

− increased speed of the process;

− increased efficiency;

− ability to work with materials up to 1cm thick;

− precise control of penetration depth;

− practically complete absence of slag and waste during work;

− ease of installation and use of the equipment [3].

The main disadvantage of plasma welding is the high cost of equipment and labour. Despite the ease of installation and use of the plasma torch, the equipment requires careful care and regular cleaning. The torch and electrode of the plasma torch must be changed promptly to avoid problems in the operation of the equipment. Process and equipment temperatures must also be carefully monitored to avoid overheating. Specialists working with a plasma torch must undergo special training. The plasma torch operator must have certain knowledge and skills.

Other disadvantages are:

− during plasma welding, harmful gases and dust are formed;

− during the process, the worker contact with strong ultraviolet radiation, which has a negative impact on health;

− necessity of constant monitoring of the cooling due to the high operating temperature;

− huge noise during the welding.

All disadvantages are easily offset by the advantages of plasma welding. High efficiency and increased productivity outweigh the costs incurred in equipment and personnel training [1].

Plasma welding is suitable for working with almost any type of metals and alloys, including titanium and its alloys; aluminium and its alloys; magnesium and its

alloys; copper and its alloys; tungsten; high-alloy, low-alloy or unalloyed steels; cast iron; nickel alloys; various non-conducting metals; other dissimilar metals [3].

In plasma welding, the source of heat is a stream of gas, ionized in an arc, which during collision with a less heated body is deionized with the selection of a considerable amount of heat. This allows it to be considered as an independent source of heating. The temperature of the plasma jet depends on the degree of ionization of the gas. To increase it, a column of a column of compressed arc burning in a narrow channel is used, through which gas (argon, nitrogen, hydrogen) is fed under pressure, thus increasing the degree of its compression. Under such conditions, the gas temperature in the arc column reaches 30,000°C [4].

A device in which a plasma jet burns is called a plasma torch or plasmatron. Three schemes of plasma formation are possible: direct action arc, indirect action arc and combined arc [2].

In direct arc plasma welding, the welding object is a part of the welding chain. In plasma welding with an indirect action arc, the arc discharge burns between the electrode and the nozzle or between two electrodes in the plasmatron, while the welding object is heated by the heat of the plasma jet [1].

Plasma welding is primarily used in industrial enterprises. This is explained by the high cost of the plasma torch and the need for special training of personnel. For individual or household use, plasma welding may be too expensive as a method of work.

In industry, plasma welding can be used in almost all industries. Plasma welding is particularly used in industries that place high demands on the quality of the welded joint and the accuracy of the work, for example, in instrument making, the aerospace industry, the medical industry and many others. In addition, plasma cutting is of great importance in the chemical and petrochemical industries.

As the demand for high-performance and efficient manufacturing processes grows in the machine-building industry, plasma welding is likely to become an increasingly popular choice. So, the prospects of using plasma welding in the machine-building industry are promising.

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