



A UNIVERSAL METHOD OF PLASMA SURFACING FOR THE RESTORATION AND HARDENING OF AUTOMOTIVE PARTS

Bobomurod Abdusalomovich Abdumannonov¹

Lecturer at the Andijan Institute of Agriculture and Agrotechnologies,

Abrorbek Abbosovich Karimov²

Lecturer at the Andijan Institute of Agriculture and Agrotechnologies,

Izzatillo Rustamjon ogli Kimsanboev³

Is a student of the Andijan Institute of Agriculture and Agrotechnologies.

Shakhnoza Valizhon kizi Pulatova⁴

Is a student of the Andijan Institute of Agriculture and Agrotechnologies

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ABSTRACT

The article presents the results of theoretical studies on the restoration and hardening of automotive parts by the universal method of plasma melting, studies have shown that the productivity in the universal method reaches 28 g /A-hour and the increase in productivity in this method of surfacing is mainly achieved due to more efficient use of heat losses going to overheating of the product and into the environment.

The rapid failure of a number of automotive parts is primarily due to the low wear resistance of the rubbing surfaces. One of the ways to improve the quality, reliability and durability of machine parts is the widespread use of wear-resistant coatings during their restoration.

One of the progressive methods of applying wear-resistant coatings is plasma surfacing, which makes it possible to weld powdered hard alloys on worn surfaces as on an iron base (sormite, US-25, FBX-6-2, etc.) so on nickel (PG-KHN80SR 2,3,4, etc.). One of the reasons for the slow introduction of various methods of plasma surfacing in machine-building and repair enterprises is the need to use a significant amount of gases, especially expensive and scarce argon.

It is known that plasma surfacing with powders consumes 1.5-2 liters per minute for plasma formation, 4-8 liters for powder transportation and 14-20 liters for protection of the welding bath.

The research carried out in the creation of a universal method of plasma surfacing has significantly reduced the consumption of gases and the replacement of argon protective gas with cheaper nitrogen and carbon dioxide.

The reduction of gas consumption was achieved by changing the design of the lower part (anode) of the plasma burner (Figure 1.), which provides for the supply of powder by transporting gas around the plasma-forming channel and then through a conical protective nozzle to the surfacing zone. Powder particles, as heavier, enter the welding bath at a given angle, and the gas is directed in the opposite direction when leaving the protective nozzle,

providing reliable protection of the welding bath from the harmful effects of the air environment. In this case, the gas transporting the powder simultaneously performs protective functions, which makes it possible to abandon the independent protective gas flow and the protective nozzle, thereby reducing gas consumption by 50-60% and reducing the size of the burner.

When identifying the effect on the quality of surfacing of various elements of deoxidizers, it was found that the addition of 6% (by weight) aluminum powder to powdered hard alloys on an iron base can be used as a protective (transporting) gas. When using carbon dioxide in iron-based alloys, it is recommended to add 2-3% ferrosilicon.

However, it should be noted that nitrogen in combination with powdered aluminum provides a higher quality of surfacing than when protected in carbon dioxide.

The addition of 1.5-2% aluminum powder to additive powders is also useful when used as a protective (transporting) argon gas. This ensures a higher quality of the formation of the deposited layers and prevents the appearance of individual pores.

Additional studies of plasma surfacing separately with powders and wires made it possible to develop a universal plasma surfacing method designed for surfacing using a plasma arc of cylindrical, end and flat surfaces of machine parts using powders, wires, tapes and their simultaneous combination as a filler material. The surfacing process is carried out in an environment of various protective gases with the additional use of self-fluxing powders.

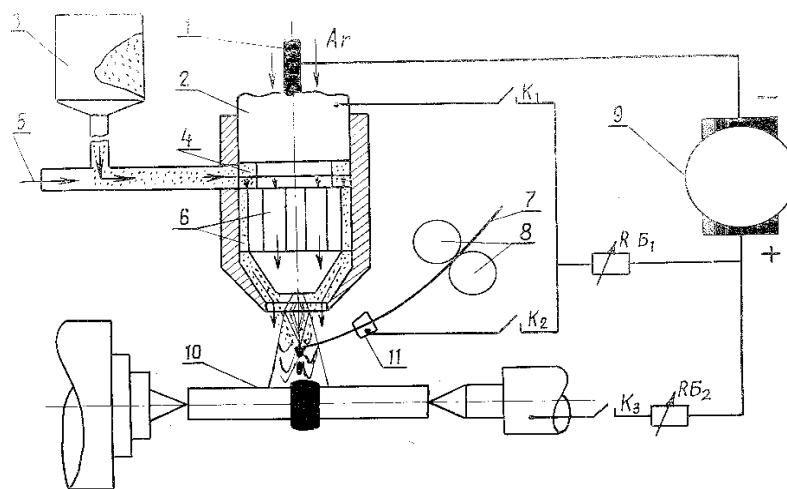


Fig. 1. Schematic diagram of the universal plasma surfacing method: 1-tungsten electrode; 2-water-cooled nozzle-anode; 3-powder dispenser; 4-recess; 5-protective gas; 6-guide grooves; 7-filler current-carrying wire; 8-feeding mechanism; 9-welding converter; 10-product; 11-current-carrying mouthpiece RB1, RB2 - ballast rheostats; K1, K2, K3- contactors; Ar-plasma-forming gas argon.

The essence of the universal method lies in the fact that a filler current-carrying wire is simultaneously fed into the powder surfacing zone. The plasma arc that occurs between the burner, the wire and the part melts the surface of the product and the filler materials.

Due to the redistribution of current between the wire and the part carried out by ballast rheostats, it is possible to weld a layer with a degree of mixing with the base metal not



exceeding 5%. Depending on the thickness of the deposited layer and the diameter of the wire, the current supplied to the wire is 30-100 A, and to the part - 100-270 A.

Productivity in the universal method reaches 28 g / A-hour. The increase in productivity in this method of surfacing is mainly achieved due to more efficient use of heat losses going to overheating of the product and into the environment.

The required chemical composition and properties of the deposited layer are achieved by selecting and quantitatively combining the appropriate additive material.

This method allows you to weld layers of coatings with a thickness of 0.3 mm to 12 mm in one pass. Surfacing can be carried out along a helical line and with fluctuations of the burner. The width of the grip when the burner oscillates is up to 55 mm.

With combined surfacing (simultaneous use of wire and powder), the quality of protection of the welding bath is significantly higher compared to surfacing with a single wire.

The wear resistance and hardness of layers deposited with powders and their combinations with wires are significantly higher (1.5-4.8 times) than surfacings made with wear-resistant wires of solid cross section.

According to the nature and magnitude of wear of parts, mechanical characteristics of the required surfacing material, technical and economic indicators of methods for restoring and strengthening parts, the choice of the required method of plasma surfacing can be carried out in the following way:

- for structurally similar parts with wear from 0.1 mm to 1.5 mm - plasma surfacing with one powder;
- for cylindrical, conical or flat surface parts with wear from 0.6 mm to 8 mm - plasma surfacing with a simultaneous combination of powder and wire filler materials;
- for parts with low hardness that do not require heat treatment after restoration, with wear from 0.3 to 2 mm - plasma welding with wire.

The universal method of plasma surfacing, due to its technical and technological parameters, can be applied at machine-building plants, agricultural production and repair enterprises, as well as regional machine and tractor parks of the Uzagromashservice association system.

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