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To the Question of the Influence of the Composition of the Core of the Fluid-Correct Wire on the Properties of the Metal of the Weld

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ABSTRACT: The metal is deoxidized with ferromanganese, ferrosilicon. For additional deoxidation of the metal and binding of nitrogen to nitrides, titanium and aluminum are sometimes introduced into the core of wires of this type. Wires with a carbonate-fluorite type core are most often used as self-protective, but are also used in combination with additional protection with carbon dioxide.

KEY WORDS: ferromanganese, mechanical properties, welded joints, heat structures of flux-cored wires.

1. INTRODUCTION

Flux cored wire is a continuous electrode of tubular or other, more complex design with a powdered filler - a core. The core consists of a mixture of minerals, ores, ferroalloy metal powders, chemicals and other materials. The purpose of various components of the core is similar to the purpose of electrode coatings: protection of molten metal from the harmful effects of air, deoxidizing, alloying of metal, binding nitrogen into stable nitrides, stabilizing the arc discharge, etc.

The core components must, in addition, meet the generally accepted requirements for all welding materials: to ensure good formation of seams, easy separability of slag crust, penetration of base metal, minimum splashing of metal, absence of pores, cracks, slag inclusions and other defects, certain mechanical properties of seams and welded joints, etc. [1,4]

Cored wires are used for welding without additional protection of the welding zone, as well as for welding in shielding gas, submerged arc, electroslag welding. Wires used for welding without additional protection are called self-shielded wires. Materials included in the core of such wires when heated and melted in the arc create the necessary slag and gas protection of molten metal. Currently, cored wires for welding in carbon dioxide and self-shielded cored wires

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are most common. Depending on the diameter and composition of the flux-cored wire, welding can be performed in all three spatial positions [2,3].

Flux-cored wires can be classified according to their purpose, the method of protecting the metal from the effects of air, the type of core, and the mechanical properties of the weld metal.

The purpose of the wire is determined by the class of metal to be welded. Tubular wires are used for welding of low-carbon and low-alloy structural steels, alloyed steels, cast iron, non-ferrous metals and alloys. Wires for welding of low-carbon and low-alloy steels are the most widely used. According to the method of protection flux-cored wires are divided into two types: 1) self-shielded; 2) for welding with additional gas or flux protection. Depending on the composition of the core, wires can be divided into five types - rutile-organic, rutile, carbonate-fluorite, rutile-fluorite and fluorite.

The core of rutile-organic wire consists mainly of rutile concentrate and aluminosilicates (feldspar, mica, granite, etc.). Ferromanganese is used as deoxidizers, and starch or cellulose are used as gas-forming materials. Wires with a rutile-organic core are used as self-shielded wires. The core composition of rutile-organic type wires consists mainly of rutile concentrate, aluminosilicates and ores. The deoxidizers are ferromanganese, ferrosilicon, ferrotitanium and ferroaluminum. Rutile-type core wires are used with additional carbon dioxide shielding.

II.EXPERIMENTAL PART

Calcium, magnesium, sodium carbonates are used as gas-forming materials in the core of carbonate-fluorite type wire. Rutile concentrate, aluminosilicates, alkali earth metal oxides, fluorite concentrate are used as slag-forming materials. Metal is deoxidized with ferromanganese, ferrosilicon. For additional metal deoxidation and nitrogen binding into nitrides, titanium and aluminum are sometimes introduced into the core of this type of wire. Wires with a carbonate-fluorite core are most commonly used as self-shielded wires, but are also used in combination with additional carbon dioxide shielding.

The core of rutile-fluorite type wires consists mainly of rutile and fluorite concentrates, sometimes alkali earth metal oxides and aluminosilicates are used as slag-forming agents. Ferromanganese and ferrosilicon serve as deoxidizers. Wires with a core of this type are usually used with additional protection in carbon dioxide.

The core of fluorite-type wires consists mainly of fluorite concentrate, with small amounts of alkali earth metal oxides. Ferromanganese, aluminum and magnesium are used to deoxidize the metal. Aluminum also binds nitrogen of the weld pool metal into nitrides. Wires with a fluorite core are used as self-shielding wires.

III. EXPERIMENTAL RESULTS AND DISCUSSION

Iron powder is introduced into the cores of all types of wires in order to increase the welding performance and to give favorable welding properties.

Of the flux-cored wire designs used (Fig. 1), tubular wires are the most common (a, b, c). Introduction of a part of the shell inside the core (d, e, f, g, h) provides a more uniform melting of it and more effective protection of metal from air.

During welding the flux-cored wire undergoes heating and melting stages accompanied by oxidation of iron and alloying elements, decomposition of organic materials, carbonates and fluorides, complexation, etc. The development of these processes in the core has a significant impact on the interaction of molten metal with gases and slag and largely determines the technological performance of welding.

Heating of the cored wire sheath during welding is mainly due to the heat generated by the passage of welding current and the heat released in the active spot. In this case, a quasi-stationary temperature field is established in the section of the wire from the tip of the nozzle to the arc. Heat released in the active spot heats only a small area of no more than 1-3 mm at the end of the wire. In this area the wire sheath is heated to the melting temperature or higher. The area of the shell s in the cross section is usually 2-5mm2. Calculation shows that during the welding process the sheath of flux-cored wires at the exit can be heated to temperatures of about 1000° C.

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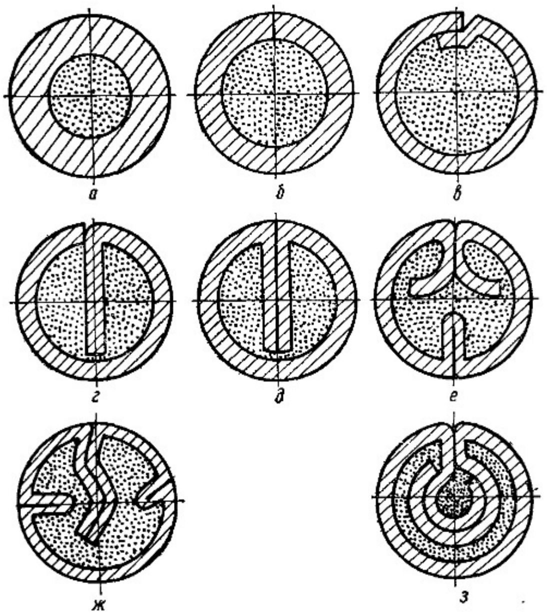

Fig.1. Construction of the flux-cored wire

The core is heated by heat transfer from the arc and the cladding. At high wire feed rates, the heat released at the end spreads over a shorter length than in the cladding, since the thermal conductivity of the core is 1-2 orders of magnitude lower than the thermal conductivity of the cladding.

The given calculations and experiments show that already when the flux-cored wire shell is heated at the exit, the processes of dissociation and oxidation of the core components develop intensively.

IV. CONCLUSION

Completeness of these processes by the time of wire melting depends on the composition of the core and the conditions of heat supply to its individual sections, determined by the welding mode, the size and design of the wire and the physical and chemical properties of the core.

At the department of "Technological machines and equipment" of Andijan Machine-Building Institute research is being conducted on the development of core composition using components based on local raw materials and technology of flux-cored wire production.

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