Technology of Welding Metal Products Under Flux Layer

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ABSTRACT

This article provides information on the technology of welding of metal products under the seam or superfluous layer of flux, its advantages and disadvantages, the brands of fluxes used in welding. The method of welding under the flux layer was also compared with other welding methods.

Keywords: Metal, Copper, Bronze, Lead, Molten, Manufacture, Welding Heat, Oxygen, Laser, Plasma, Ultrasound

Introduction

Metalworking began with the people of AD, who realized that they needed another sharp stone to break the stones. The first processed metal was copper, as this metal plastic was considered a soft and common metal. Copper was mainly welded, preheated and then welded under pressure. Copper, bronze, and lead metals were made of cast iron. The parts to be joined were molded and heated, and the joints were pre – prepared molten metal wells. In the manufacture of products from iron and its alloys, the products were made by heating in a blacksmith's furnace to the level of "welding heat" and then annealing. This method is called forging. Welding techniques have evolved very slowly, so often the changes in welding equipment, devices, and techniques have not changed significantly over the centuries.

The dramatic changes in technology began in the late 19th and early 20th centuries. Khamfri Devi was the first to study and discover arc discharge. The arc discharge was not quickly put into practice with a high heat source and high illumination because there was no source to supply the current required to supply the arc. Such sources appeared only in the late XIX century. At the time of the opening of the summer discharge, electrical engineering was still in its infancy, and there was no electrical engineering industry. Leading English physicist M.Faradey discovered electromagnetic induction in his experimental study of electromagnetism and thus developed the principle of devices for generating electricity and generators.

The English physicist D.Maksvell developed an equation based on mathematical calculations of the properties of the electromagnetic field generated in the process.

French scientist Z.T. Gramm developed a ring anchor for a mechanical electromagnetic machine, which can act as an electric generator, whose work is to convert mechanical energy into electrical energy. Avgust De Meritens invented the method of electric welding with insoluble carbon electrodes. N.N.Benardos invented arc welding technology and types of welded joints (three – to – three, top – to – top, etc.), which are still used today; when welding thick metals, he used the method of placing the weld joint sideways.

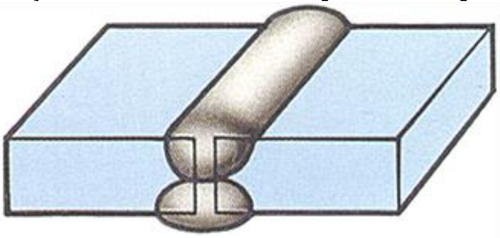

Figure 1. Welding three – to – three welding methods

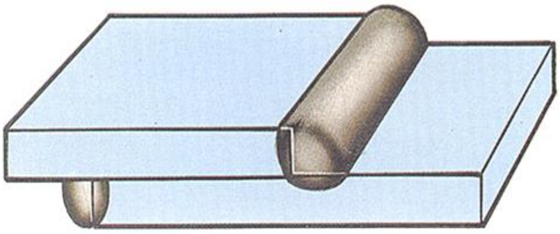

Figure 2. Overhead – top welding method

When welding thin tin sheets, the weld joint preparation is prepared by welding by removing the edge of the sheet. To improve the quality of welding, they used flux: quartz sand, marble as flux in steel welding; in copper welding – bur and ammonia were used.

French scientist Anri Lui Le Shatele developed gas – assisted welding as a result of studying the combustion of gas mixtures. He reported to the French Academy of Sciences on the formation of a high – temperature flame using a mixture of acetylene and oxygen. It was first used in the early 20th century to weld flammable gases in an oxygen mixture. In France, an acetylene – oxygen burner was tried for cutting. With the rapid development of industry and welding of metals in all areas of technology: termite compounds, electron beams, lasers, high – temperature plasma, ultrasound and other new effective welding methods are used.

Materials And Methods

Arc welding under flux – this is arc welding, in which the arc burns under the welding flux. When welding under flux, the weld arc burns between the work piece and the welding wire. Under the influence of the arc, the wire melts and, depending on its capacity, is transferred to the welding zone. The bow is covered with a layer of flux. The welding wire (with arc) is moved by a special mechanism (automatic welding) or manually (semi – automatic welding) depending on the direction of welding. Under the influence of summer heat, the base metal and flux melt. The molten wires, flux, and base metal weld form the bath. The flux in the form of a liquid curtain protects the welding zone from the air. With the help of a spring, the molten welding wire drips into the metal welding bath, where it mixes with the molten base metal. As the arc moves farther, the metal in the bath begins to cool, as the heat begins to decrease and then hardens to form a weld. The molten flux (slag) solidifies to form a layer of slag on the weld surface. The insoluble excess flux is cooled and reused.

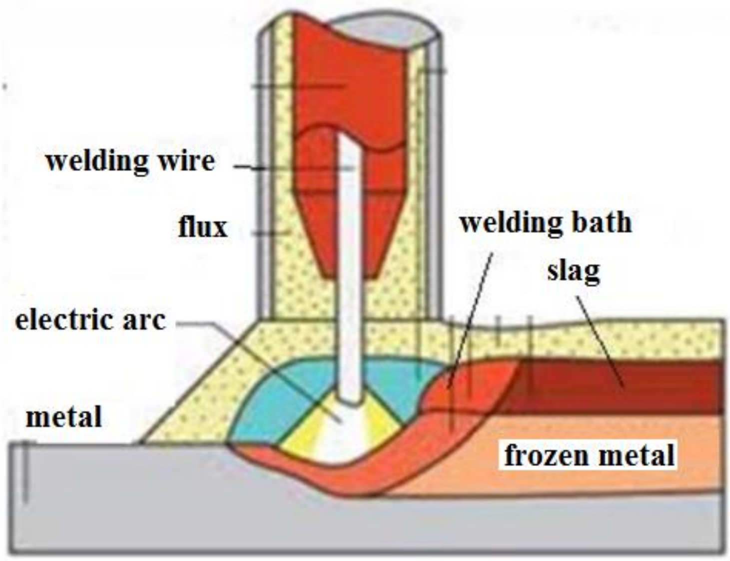

Figure 3. Welding process under the flux layer

The flux – protected weld has high plasticity, required strength, density, corrosion resistance, and low hydrogen content.

Fluxes used in welding

As a weld in the welding of metal parts, the effect of the properties and quality of fluxes is great, as they help to ensure the chemical composition, structure, toughness, work efficiency of the weld.

Depending on the method of preparation of fluxes, they are divided into dilute and non – dilute types.

For the preparation of liquefied varieties, the specified amount of appropriate substances is obtained, crushed, announced, mixed, then heated to 1400° C, melted granules are obtained – then dried, ground and sifted. The base of these fluxes consists of oxides of Si, Mn, Ca, Mg, Al and other elements. In the preparation of non – dilute fluxes, a certain proportion of crushed substances is obtained, mixed in a glass solution and granules of 1 – 3 mm. They are then heated to 300 – 400° C and baked. In doing so, the liquid glass binds the substances tightly. Then they are crushed and sorted. These fluxes are called ceramic fluxes.

Table 1 shows the brands and composition of fluxes used in the welding of low – carbon steels as an example.

Table 1

Components	**OSTs – 45**	**AN – 348**	**AN – 348 – A**
SiO_2	43 – 45	42,4 – 45,5	41,0 – 43,5
MnO	38 – 43	31,5 – 35,5	34,5 – 37,5
CaF_2	6,0 – 8,0	6,0 – 7,5	3,5 – 5,5
K_2O and Na_2O	–	1,0 – 1,5	–
CaO	to 5,0	6,5 – 9,5	to 5,5
MgO	1,0	0,7 – 3,5	5,5 – 7,5
Al_2O_3	2,5	to 2,5	to 3,0
FeO	1,5	1,5	1,5
S	0,15	0,15	0,15
P	0,15	0,15	0,15

Table 2 shows the diameter, welding mode and speed of the electrode wires used to weld metals of different thicknesses using an electric arc with an electrode wire under the flux layer of low – carbon steels in alternating current.

Table 2

Welded metal thickness, mm	Welding area, mm	accumulation type	Electrode wire diameter, mm	Current power, A	Current voltage, V	Current voltage
5	0 – 2	One – way flight – three	2	400 – 425	20 – 30	38 – 40
10	2 – 4		5	700 – 750	34 – 38	28 – 30
20	5 – 7		5	950 – 1000	40 – 41	18 – 20
50	10 – 12	– “–	5	1200 – 1800	44 – 48	10 – 12

Conclusion

During welding, an electric arc burns under a layer of flux between the welding area of the metal to be welded to the electrode wire, and the heat dissipating melts the tip of the electrode wire and the welding area and part of the flux. In the combustion zone of the arc, a zone filled with metal, flux vapors, and gases was formed between the molten flux and the welding bath. The arc was tilted slightly in the opposite direction from the vertical position to the welding direction. The liquid squeezed in the direction of the metal arc flowing, forming a metal bath. The separating liquid slag rose to its surface due to its lightness from the metal.

The poor heat transfer of the slag, the presence of a metal bath under a layer of liquid slag, and the slow cooling of the bath resulted in it being much cleared of dissolved gas and mirror additives. When the metals are welded, the solid slag layer on the weld surface is separated. In this method, the type of flux, electrode wire brand, diameter and welding mode are selected depending on the type and thickness of the metals to be welded.

Fluxes have played an important role in obtaining thorough, integral welded joints by ensuring the stable combustion of the welding arc, the weld metal composition, structure. The flux type was selected according to the type of metal to be welded, the expected hardness of the weld, and the welding method.

As a result, high – quality welds were obtained by welding metal parts under a layer of flux.

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