Testing Of Welding Electrodes Made Based on Local Raw Materials

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Abstract

This article presents the optimal composition of welding electrode samples obtained on the basis of local raw materials. The results of comparing the obtained welding electrode samples with state standards and imported products with their technical characteristics are presented. The following conclusions were drawn from the conducted tests: during welding, there was no coming off electrode coatings, interruption of the welding cycle, and no deformation of steel wires; it was found that the samples of welding electrodes obtained on the basis of local raw materials fully meet the standard requirements, and the cost of this welding electrode is cheaper than the welding electrodes (made in China and Russia) used in our country.

KeyWords:local raw materials, steel wire, welding electrode, electrode covering, deformation change

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Introduction

One of the main tasks of the chemical industry is to provide the construction industry with new, high-quality products. Metals are the main part of construction and engineering materials, and the state of their mutual welding is also gaining importance. A lot of scientific research is being conducted on the creation and development of welding electrodes and their components [1-4]. It is known that welding of steel wires is a technological process that creates an inseparable joint as a result of plastic deformation of metals, alloys and various materials or interatomic bonding with heating between the parts to be joined [1]. When welding steel structures and metals, the requirements for welding electrodes and coatings are different depending on the areas of their use. The welding and technological properties of the coated welding electrode and the mechanical properties of the weld metal largely depend on its coating [2-4].

At this point, replacing the welding electrode and the raw materials used in the preparation of this electrode with local raw materials as much as possible, that is, localization is one of the urgent tasks facing the construction and engineering industry of our country today. One of the main reasons for this situation is the import of welding electrodes to our country, and at the same time, its high cost. Recently, we have been conducting a lot of scientific research on the creation of raw materials available in our country instead of imported welding electrodes [5-10].

Experimental part

Materials

The following raw materials were used to obtain welding electrode coatings in laboratory conditions: Rutile, titanium (II) oxide, ferromanganese, ferracilisil, marble, mica, boron, starch, cellulose and feldspar.

Experimental procedure

The processes for obtaining the welding electrode are as follows: all the components necessary for the welding electrode are crushed and sifted until they become powder.

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All components in the form of sifted powder are mixed in the calculated mass. The resulting mixture is coated on a steel wire with a diameter of 2 and 4 mm and a length of 450 mm. The resulting welding electrode wire is dried at 180 °C.

Results and discussion

The obtained new electrode samples were compared with state standards and imported products for their technical characteristics. For the production of welding electrodes, 2 different sizes of welding electrode samples were tested by coating the surface of wires with a diameter of 2 and 4 mm. New welding electrodes were obtained at the electrode manufacturing workshop of "DAVR METALL" LLC and tested in the company's laboratory.

Welding electrodes were prepared using 10 different ratios of steel wires and different components for 2 different diameter welding electrodes. Table 1 below shows their composition.

Table 1. Content of local products covered for one welding electrode, %

The name of local raw materials	Experimental samples, (%)									
	1	2	3	4	5	6	7	8	9	10
Rutile	11	12	13	14	15	17	18	19	20	21
Titanium (II) oxide	5	5	4	4	3	3	2	2	1	1
Ferromanganese	5	6	7	8	19	10	11	12	13	14
Mica	2	3	4	5	6	7	8	9	10	11
Marble powder	5	5	7	7	8	9	7	5	4	1
Ferrosilicil	36	34	32	30	18	27	26	25	24	23
Boron	8	9	10	11	8	4	5	6	7	8
Starch	12	11	10	10	9	8	7	6	5	4
Feldspar	10	10	9	8	11	12	13	14	15	16
Cellulose	6	5	4	3	3	3	3	2	1	1

The test results are as follows: it was found that the adhesiveness of sample 1 to steel wires for the welding electrode is very low compared to the other samples, sample 2 comes off and separates from the wires during welding, and the melting process is somewhat difficult.

It was found that the component product in sample 3 is well connected to the steel wires for the welding electrode, the welding process is continuous, and the melting process meets the requirements (Table 2).

All samples were experimentally tested according to State Standards. In samples 1 and 2, it was observed that the main part of the component turned into waste due to incomplete combustion. Sample 3 was observed to burn completely and form a solid "bridge" with the weld metal.

Table 2. State Standard with the composition of imported products based on local raw materials. compare the requirements

Examples of welding electrodes	State standard requirements				
	Adhesion property to wire, g/cm2	The duration of the welding process, minutes	Moisture resistant, %	Strength of seams	Amount of slag formation
Standard (Sweden KO 53.7)	0.022-0.046	0.92-0.96	88-92	71-82	18-26
Local (Example 3)	0.018-0.030	0.91-0.93	87-96	71-83	20-25
Import (Russia)	0.020-0.035	0.90-0.91	82-90	72-85	17-28
Import (China)	0.021-0.040	0.93-0.97	88-95	71-83	21-24

Conclusion

The following conclusions were drawn from the conducted tests:

1. During welding, it was not observed that the components would come off, the welding cycle would be interrupted, and the wires would undergo various deformation changes.
2. The localized welding electrode (sample 3) fully meets the standard requirements and its efficiency is 100%.
3. The welding electrode created on the basis of domestic raw materials is cheaper than the components (China, Russia) used in the enterprise.

In conclusion, it can be said that it is desirable to use the welding electrode created on the basis of the components of the proposed localized sample 3 because it allows to reduce the cost of the manufactured product and cover the place of the imported product.

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