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**Композиционные материалы**

**METHODS FOR OBTAINING ELECTRODE COATINGS FROM LOCAL RAW MATERIALS**

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**Abstract.** This article presents the types of steel wires and the activity of surface tension on their surfaces, as well as technologies for producing welding electrode components based on local raw materials. In addition, the temperature-dependent conditions of a new sample obtained from local raw materials were studied and compared with analogues in terms of quality and efficiency.

**Key words:** electrode, hydrogen, oxygen, sulfur, weld, component, quartz, sand, dolomite, kaolin, rutile, titanium (II) oxide, ferromagnets, marmalade powder, ferrotitanium, mica, boron, starch, feldspar, cellulose.

**Introduction.** At present, the range of welding electrodes produced is expanding, gaining particular competitiveness in the world market. One of the important tasks is to ensure their quality, increase the durability and service life of structures and equipment. Extensive scientific research is being conducted in the world by leading scientific centers and higher educational institutions of the world, aimed at developing energy- and resource-efficient welding production technologies.

Currently, expensive imported raw materials are used in the production of electrode coatings. Due to insufficient attention to the study of the problems of the integrated use of mineral raw materials and the formation of a weld metal with high physical and mechanical properties, the cost of coated electrodes for arc welding is increasing, and the production of coated electrodes using local mineral raw materials is limited. The essence of these problems is that in order to ensure the integrated use of local raw materials, it is necessary to develop a scientific basis for the selection of materials and components of the charge composition.

Today, the number of industrial sectors related to metal processing is increasing in our republic. 30 thousand tons of electrodes used for welding are exported to our country annually, mainly from China. As a result of the implementation of electrode production technology and the establishment of production facilities, new types of products are produced based on local raw materials. This, in turn, leads to the production of products that can replace imports and save foreign exchange. In addition, 98% of the raw materials that will go to the products planned for production are available in our republic. The product is environmentally friendly and its efficiency is not inferior to that of analogues.

**Research methods and objects.** Research to determine the optimal option of the coating necessary for the electrode from the structural point of view in laboratory conditions. The importance of drying coatings from 90°C to 180 °C using a reactor was studied based on calculations. All substances are measured with high precision on an electronic analytical balance.

**Results and discussion.** The electrode fillers are rutile, titanium (II) oxide, ferromanganese, marble powder, ferrotitanium, mica, boron, starch, feldspar and cellulose.

**Table 1**  
**Composition of local products coated for one electrode, %**

Local raw material name	Experimental images, %									
	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
Ferromargens	5	6	7	8	9	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
Ferrotitanium	36	34	32	30	28	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 most optimal option was determined through 10 experiments conducted in the laboratory, localizing these substances (Table 1). It was found that the electrode consisting of rutile (15%), titanium (II) oxide (3%), ferromanganese (9%), maromar powder (8%), ferrotitanium (28%), mica (6%), boron (8%), starch (9%), feldspar (11%), and cellulose (3%) gave a higher effect than the electrodes with the remaining compositions.

**Table 2**

Sequence number	Experimental samples 273K					
	1	2	3	4	5	6
1	10	20	20	10	20	40
2	40	40	40	15	35	50
3	70	60	65	20	50	60
4	100	80	95	25	65	70
5	130	100	125	30	80	80
6	160	120	150	35	95	90
7	190	140	170	40	110	100
8	220	160	180	45	125	110
9	180	150	170	50	140	120
10	160	130	135	55	155	130
11	130	110	107	60	170	140
12	100	90	80	65	185	150
13	70	70	50	70	200	160
14	40	60	30	75	215	170
15	10	40	10	80	230	180

Initially, as the temperature rises, the gas-forming substances in the electrode components melt. As a result, the substances on the surface of the electrode stick to the wire rod (Fig. 2). When the heating process is raised to 180°C, the hardeners ensure that all the components adhere firmly to the metal rod. The temperature is then lowered during the process so that the components gradually solidify.

It has been experimentally proven that carrying out the process at constant high or low temperatures has negative consequences (Fig. 3).

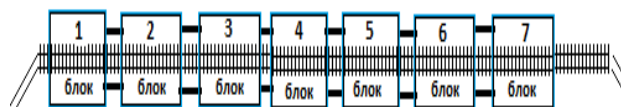


Figure 1. Description of the drying process

Conducting the heating process at a constant temperature of 180°C has been shown to adversely affect the brittleness of the electrode components and the activity of the slag-forming substances. For example, the above situation was observed in experiments 1 and 5.

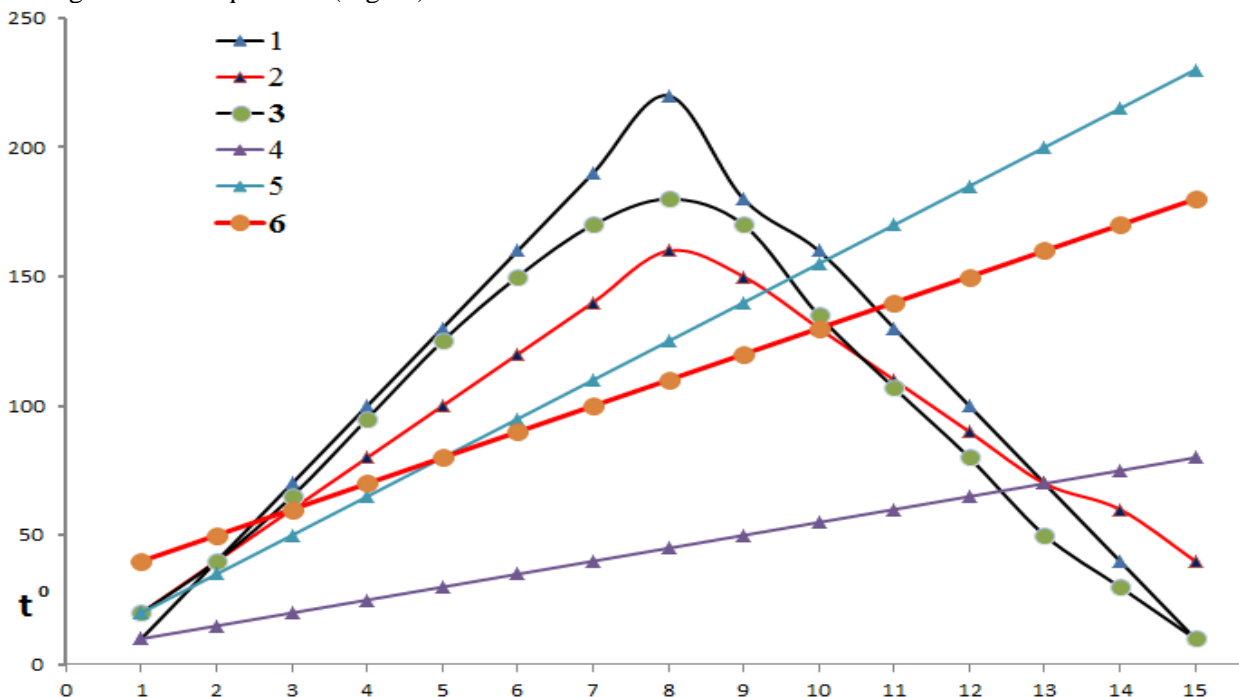


Figure 2. Diagram of temperature change of heating columns  $t^{\circ}$

If the heating process is carried out at a constant temperature below 180°C, it leads to a destruction of the function of gas-forming and stabilizing substances (experiments 2 and 4). As a result, the components on the surface of the metal rod became brittle. As a result, the electrode components begin to disintegrate, unable to withstand weak mechanical action. During welding, the electrode life is reduced and the casting continuity is lost. Experiments 1-6 show that in experiments 3 and 6, the composition of the electrode components did not change. But it takes 3-4 hours to cool the electrodes from the 6th experiment. The drying section produces finished product after the third experiment. The electrode obtained in this experiment is strong in all respects. Its welding continuity and casting time fully meet international standards.

The welding electrodes consist of a metal rod with a coating on the top. Occasionally there are uncoated electrodes on the top. Metal rods or welding wire is a actually molten electrode. Welding wires used in the manufacture of

electrodes are produced with a diameter of 1 - 12 mm and a length of 450 mm [4].

A single electrode with a diameter of 4.0 mm weighs 51.3 grams and 5 mm 78.1 grams. There are a number of parameters to consider when optimizing welding work. In addition to the most important parameters that directly affect the physicochemical properties of the result of the work - the type of electrode coating, the weight of the electrode should be taken into account, depending on the type of surface.

The electrodes are coated with diameters from 2.5 mm to 4 mm. Often, to determine the need for electrodes, the person in charge calculates the consumption of electrodes per 1 p / m of suture. This method allows you to control the individual consumption of electrodes. It is known that the weight of the electrode is affected by diameter, length, type of coating and other factors.

We compare the weight, diameter and length of the new electrode with the Swedish KO 53.7 electrode and the Japanese LB-52U electrode.

Swedish KO 53.7 and Japanese LB-52U electrode specific gravity with new electrode.

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