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FLUX-CORED WIRES FOR WEAR- AND HEAT-RESISTANT SURFACING AND SPRAYING

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The results of development and industrial implementation of economically alloyed flux-cored wires are presented, differed by the fact, that the deposited metal and coatings produced with their use, are characterized by resistance to wear and gas corrosion. 4 Ref., 1 Figure.

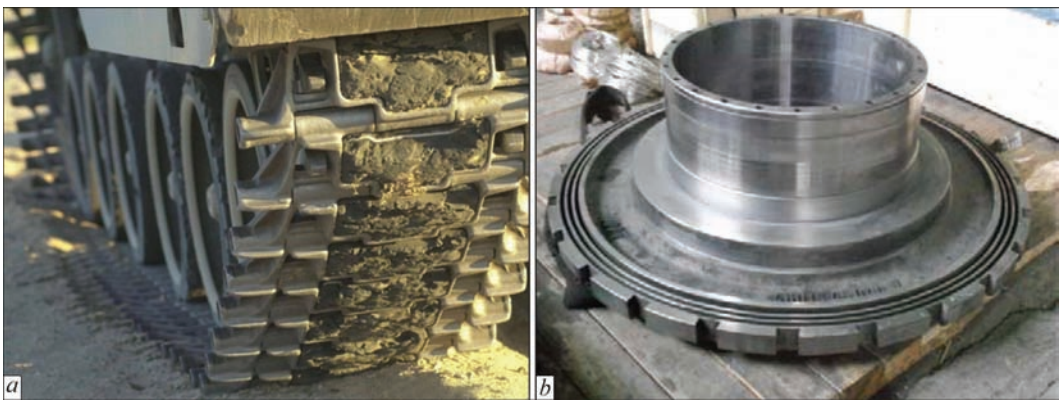
Keywords: *arc welding, surfacing, flux-cored wires, wear resistance, heat resistance*

Wear-resistant flux-cored wires of the type 150Kh8T2Yu provide a metastable austenite (MSA) structure in the coating. They show a high resistance to wear (abrasive, shock-abrasive, hydro- and gas-abrasive, erosive, cavitation, adhesion, fatigue, etc.). At contact loading, the energy of external action is consumed in the first turn for the conversion of MSA into dispersed martensite [1]. As a result, both the hardness from *HV*0.1–500 to *HV*0.1–800 and the wear resistance of such materials are increased during operation. The rational fields of application of surfacing and spraying differ due to peculiarities of formation of coatings by these methods [2, 3]. In particular, they are used for surfacing hardening by arc surfacing or metallization (Figure).

Heat-resistant flux-cored wires of the base system Fe–Cr–Al, additionally alloyed with Ti, B, Y during their tests for heat resistance at 700 °C for 24 hours showed that the specific loss of mass of metallization coating is by an order lower than the similar values for pearlitic and martensitic-ferritic steels 12Kh1MF and 1Kh12V2MF for boiler construction and are comparable with the values of austenitic steels 1Kh18N12T and Kh23N18 [4].

The selected combination of chromium and boron content provides the formation of strengthening phases of complex carboborides $(Fe, Cr)_2(B, C)$ of hardness *HV*0.1–1400 and a high ability to resist fracture by abrasive particles.

The adding of aluminium and yttrium into the charge of flux-cored wire provides a decrease in the degree of oxidation of particles of the sprayed material and improves the interaction conditions in the «particle-substrate» contact, which predetermines an adhesion strength at the metallization of 50 MPa and also the formation of complex oxides $(Fe, Al, Y)_2O_3$ with high protective properties.



Examples of application of wear-resistant MSA-wires: *a* — surfacing of spindels of caterpillar tracks; *b* — deposition of coating of 5 mm thickness on 500 mm diameter support surface

The presented wear- and heat-resistant wires with the diameter of 1.2–1.6 mm are produced serially using a roller mill for formation of a workpiece and can be delivered to the consumers.

1. Korobov, Yu.S., Filippov, M.A., Shumyakov, V.I. et al. (2013) Metastable chrome austenite as a structural factor for improvement of wear resistance of deposited metal and sprayed coatings. Ed. by S.S. Chernyak. In: *Metal and metallurgy experts*. Irkutsk, IGUPS, 40–46 [in Russian].
2. Kulishenko, B.A., Balin, A.N., Filippov, M.A. (2004) Electrodes for wear-resistant surfacing of parts subjected to abrasive and shock-abrasive impact. *Svarochn. Proizvodstvo*, **11**, 28–32 [in Russian].
3. Korobov, Yu.S., Shumyakov, V.I., Filippov, M.A. (2016) Development of iron-based flux-cored wires for producing of wear- and temperature-resistant thermal coatings. In: *Current problems of welding production: Transact*. Ed. by M.A. Ivanova, I.A. Iliina. Chelyabinsk, YuUrGU, 284–289 [in Russian].
4. Korobov, Yu., Nevezhin, S., Filippov, M. et al. (2016) Study of high velocity arc sprayed heat resistant coatings from Fe-CrAlBY cored wire. Thermal spray. Fostering a sustainable world for a better life. In: *Proc. of the Int. Thermal Spray Conf. and Exposition ITSC 2016* (10–13 May, 2016, Shanghai, China), 852–856.

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