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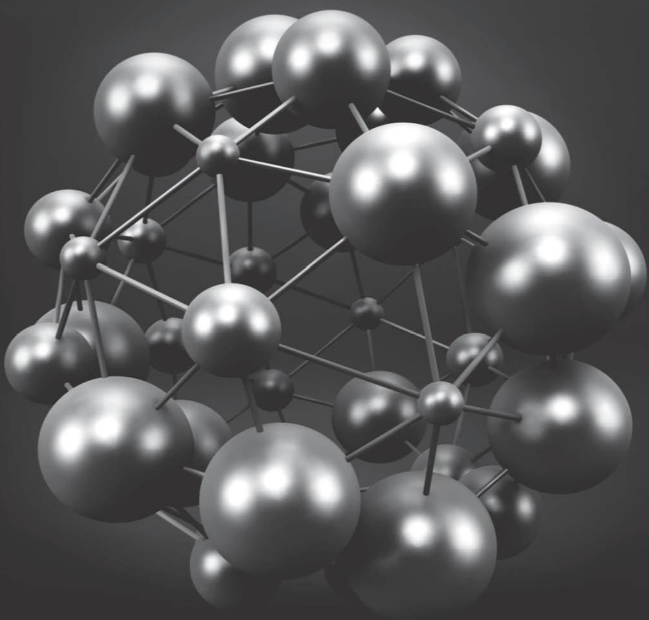
Materials and Applications



Editors

Vladimir I. Kodolov | Gennady E. Zaikov | A. K. Haghi

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CHAPTER 13

PRODUCTION OF ELECTRODES FOR MANUAL ARC WELDING WITH USING THE COMPLEX MODIFIERS

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ABSTRACT

This work describes weld and processing characteristics of welding electrodes manufactured with the admixture of complex modifiers (complex nanopowders) and compares them with standard electrodes. It was found that the admixture of complex nanopowders allows increase of mechanical properties of weld metal up to 20% and improvement of chemical composition, particularly, increase of deoxidants content (Si, Mn).

Steel plates were used for welding: SS type St3, 300 mm long, 50 mm wide, and 4 mm thick. On the surface of the plates a bead of the electrode metal was welded. For welding, electrodes 4 mm in diameter were used, types MP-3. The BA306-U3 rectifier was used as a source of supply. Welding was performed in single-pass under following conditions: amperage 140–160 A, voltage 24–26 V. Mechanical properties and chemical composition of the weld metal are presented in Tables 13.1 and 13.2.

TABLE 13.1 Mechanical Properties of Weld Metal.

MP-3 electrodes of Ø4.0 mm	σ_B (MPa)	δ (%)	KCU, at 20°C (J/cm^2)
Serial	460	25	159
Experimental	492	28	192
GOST 9467-75 requirements	460	18	08

σ_B—yield stress; δ—elongation; KCU—impact strength.

TABLE 13.2 Chemical Composition of Weld Metal.

MP-3 electrodes of Ø4.0 mm	Mass fraction of elements (%)				
	C	Si	Mn	S	P
Serial	0.07	0.03	0.47	0.025	0.046
Experimental	0.07	0.05	0.61	0.025	0.046
GOST 9467-75 requirements	–	–	–	0.040	0.045

Mechanical properties and chemical analysis of filler metal were measured according to the following methods:

- yield stress and elongation were measured according to GOST 1497-84;
- impact strength of weld seam metal was measured according to GOST 6996-66; and
- chemical analysis of filler metal was tested according to GOST 7122-81.

As Table 13.1 shows, prototype electrodes, compared with series models, provide increase of yield stress by 9%, relative elongation by 11%, and impact strength by 20%. This is due to the admixture of electrode modifiers into electrode compound; they produce integrated effect on weld metal, and technologies of nanopowder admixture into electrode during its production, that is, into soluble glass, using mechanocavitation unit of activation type.

Complex nanopowders promote mechanical properties of filler metal and alloy-transfer efficiency; however, welding materials with nano-