line has not only reduced the labor requirement for the production but has also improved the quality of the articles, due to a uniform basis and constant dimensions of the units to be welded, provided by the design of all appliances and stands. For instance, the labor required for the assembly and welding of the body shell, the application of the connecting flange by welding, the welding of the main pipes to the body, and the welding of the ribs has been reduced by an average of 40–60%. A particularly strong effect on the increase in the productivity was achieved in the manufacture of heavy gate valve bodies \(D_c = 400-600\) mm. The total labor required for the assembly and welding operations in the manufacture of these bodies on the continuous production line was reduced by a factor of 1.5–2.

The total annual savings achieved by the full introduction of the continuous mechanized production section exceeds 230,000 rubles, due to a decrease in the total labor required for the assembly and welding operations, reduction in the expenses for the welding materials, and a reduction in the production platform.

**SURFACING OF DEFECTS IN CASTINGS OF HIGH-STRENGTH SPHEROIDAL-GRAPHITE CAST IRON**

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During surfacing of defects in critical parts cast from high-strength spheroidal-graphite cast iron, it is necessary that the built-up metal correspond to the matrix metal in strength, corrosion resistance, wear resistance, and a number of other properties. This requirement is met only if the built-up metal is spheroidal-graphite cast iron.

It is possible to obtain high-strength spheroidal-graphite cast iron in the built-up metal with various welding methods [1, 2]. However, it is preferable to use mechanized welding methods because they contribute to an increase in labor productivity, improvement of welders' working conditions, and more stable production of a high-quality welded joint.

The mechanized method of welding high-strength spheroidal-graphite cast iron is technically feasible when a powder wire is used as the electrode. It is known [3] that powder wires containing silicocalcium ensure production of spheroidal-graphite cast iron with high mechanical properties in the built-up metal. However, there are no literature data on the use of such wires for surfacing high-strength spheroidal-graphite cast iron.

In the All-Union Scientific-Research Institute for Compressor Machinery Construction, beads were built up automatically on specimens with dimensions of \(200 \times 100 \times 30\) mm cast from high-strength spheroidal-graphite cast iron of the following composition: 3.4–3.84% C; 2.18–2.21% Si; 0.49–0.57% Mn; 0.011–0.05% S; 0.1–0.14% P; 0.04–0.1% Mg (ultimate strength \(\sigma_u = 43-45.3\) kgf/mm²; \(\delta = 0.67-2.6\%\); structure Gsh1-Gsh4-Gfs1-Gfs2-P30-Tsp2-Tsp4). A powder wire containing silicocalcium [2] was used with a constant regime: a welding current \(I_w\) of 490 A, an arc voltage \(U_a\) of 26 V, a welding speed of 10 m/h, and an electrode gap of 55 mm. The specimens were preheated to various temperatures at 50°C intervals up to 750°C. Two specimens each were heated to each preassigned temperature. After surfacing of the beads, one specimen was cooled in air, and the other specimen was cooled together with the furnace preheated to a temperature equal to the temperature of the previous heating. A chip was removed from each surfaced bead to determine the chemical composition of the weld metal. In addition, two specimens each were cut from the beads for metallographic analysis, one of which was heat treated according to the following regime: heating to 950°C, holding at this temperature for 20 min, and cooling in air. The chemical composition of the weld metal ranged within the following limits: 3.4–3.52% C; 2.5–2.7% Si; 0.6–0.7% Mn; 0.008–0.011% S; 0.08–0.1% P; and it was close to the composition of the matrix metal.

After surfacing of the beads on the specimens, transverse cracks were formed in the weld metal during cooling at 400–450°C without preliminary heating. Pores were not observed on the weld surface. Preliminary heating of the specimens to 300°C or above contributed to complete elimination of crack formation.

As a result of metallographic analysis of the surfacings, the following was determined. During surfacing on specimens heated to 300°C, the method of subsequent cooling did not affect the shape of the graphite and the structure of the weld-metal matrix (Fig. 1). The graphite was spheroidal in shape and punctuated. The structure of the weld-metal matrix consisted of ledeburite and troostite. Cementite, ledeburite, and troostite were observed in the fusion zone.

When the preheating temperature was increased to 600°C, the size of ledeburite particles in the weld metal decreased, and the size of the graphite globules increased, but the nature of their distribution remained as before. The preheating temperature had an especially significant effect on the structure of the fusion zone. As the preheating temperature was increased, the amount of ledeburite and cementite decreased. The cementite lattice became ruptured. Pearlite appeared in the fusion zone. This was especially noticeable at a preheating temperature of 600°C. The amount of cementite and ledeburite in the weld-metal matrix decreased.

During surfacing on specimens preheated to 600°C, the method of subsequent cooling affected the structure of the fusion zone and the amount of spheroidal graphite in the weld metal. During cooling of the specimens after surfacing with the furnace, the amount of cementite in the fusion zone decreased, and it also coagulated. The metal matrix in this zone consisted mainly of pearlite, and the amount of spheroidal graphite in the weld metal increased.

The method of cooling the specimen after surfacing had an especially strong effect on the cementite decomposition process and the stability of the austenite in the weld metal during subsequent heat treatment (Fig. 2). Thus, in the case of the specimens cooled in air after surfacing and subsequently heat treated...