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PECULIARITIES OF INFLUENCE OF DEFECTS IN CAST BILLETS OF STEEL 110G13L ON MECHANICAL PROPERTIES OF JOINTS DURING FLASH-BUTT WELDING

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The features of defects formation in butt welds, made by flash-butt welding of cast billets of steel 110G13L (GOST 7432–87) with austenite rolled billets of steel 12Kh18N10T (GOST 5949–75), which are used in manufacture of welded railway frogs, were investigated. It was established that casting defects, being located in the butt weld zone, lead to formation of defects and, depending on conditions of their formation, affect the strength properties of welded joints in different ways.

Keywords: *pulsed flash-butt welding, high-manganese steel 110G13L, rail steel M76, austenite insert*

At the E.O. Paton Electric Welding Institute the technology and equipment for flash-butt welding of railway frogs [1] were developed, the main feature of which is the application of a pulsed flashing [2], which allows producing joints of high-manganese cast steel 110G13L with rail steel M76 through an insert of rolled chromium-nickel austenite steel 12Kh18N10T. The frog with welded-on rail ends is shown in Figure 1.

The actual task at the modern stage is the increase of reliability and life of operation of railway frogs. Its solution is closely connected with the development of rational methods of non-destructive testing both of a ready product (welds) and also incoming materials, which are used in producing of a welded frog.

The purpose of this work is the investigation of influence of weld defects, connected with available defects in initial materials before welding, on mechanical properties of the joints. This is especially important in welding of cast billets, as far as this problem practically was not investigated.

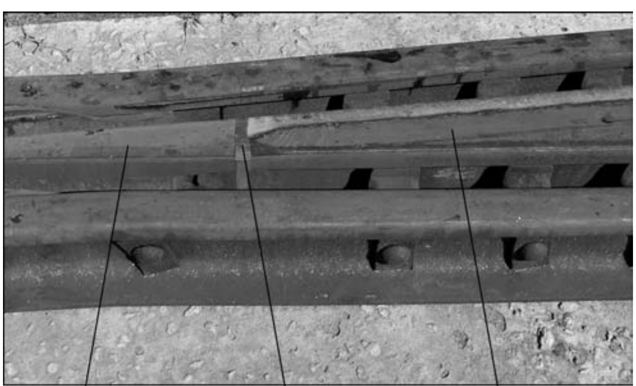

Figure 1. Frog with welded-on rail ends

The evaluation of influence of defects of butt welds, occurring as a result of getting the defects of casting (cavities, pores) into the zone of welded joint, on strength properties of the latter and their detection using radiographic method of inspection were conducted on specimens of a rail profile R65. For this purpose the batch of castings of steel 110G13L was cast with violation of casting technology which resulted in formation of cast defects. The ends of castings were subjected to radiographic inspection to the depth of up to 100 mm, from the results of which the sites of location of defects and their sizes were determined. After that the facing of specimens was carried out in such a way that during welding a defect could get into the zone of joining. In the specimens of castings, where natural defects were absent, the holes were drilled which simulated the hollows in the casting. The mechanical tests of specimens were carried out according to the TS U 27.3-26524137-1342:2006 [3]. Before the tests the radiographic inspection of welds on specimens was carried out to check up the presence of defects.

Having performed the mechanical tests of welded specimens on static bending in the areas, where defects of casting caused the fracture along the line of joint of 12Kh18N10T to 110G13L, the sections were cut out and metallographic examinations were carried out. The sections were also cut out from the defective sites, which were found in welds using radiographic inspection, though they did not lead to fracture of specimens along the joining line. The investigations of microstrucutre were performed using optical microscope «Neophot-32», and the analysis of chemical heteroge-