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CHANGE IN THE MICROSTRUCTURE OF HADFIELD STEEL AFTER HEAT TREATMENT

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Annotation
The article describes the technology of melting Hadfield steel with such temperature conditions at which the quality of the casting increases. The structure of the steel was studied using a scanning electron microscope.

Keywords: Hadfield steel, melting technology, TESCAN VEGA 3 microscope, crucible furnace.

Introduction

Hadfield steel is a steel containing about 13% manganese Mn and 1% carbon C. The steel has high wear resistance, withstands high pressure and shock loads, and has high ductility. Steel 110G13L is classified as high-manganese austenitic wear-resistant steel for castings with special properties. It has a high resistance to wear when subjected to high pressures or shock loads, and is highly hardened at the same time.

Under the conditions of the laboratory section of the Department of Foundry Technologies and Artistic Processing of Materials of NUST MISIS, a technology was developed for melting steel 110G13L in an induction crucible furnace UIP-63-10-0.017 (Fig. 1). Samples for studying the structure of this steel were cast by filling casting into CTS molds (Fig. 2). The metal was poured into the mold at a temperature of 1410°C. Samples for the manufacture of the steel structure were cut with a vulcanite wheel from the casting shown in Figure 3. The heat treatment of the samples was carried out in a resistance furnace according to the following modes presented in Table 1.

Figure 1 – УИП-63-10-0,017Figure 2 – Ready-to-fill form from XTS

Figure 3 – Casting for sample making

Figure 4 – Microscope TESCAN VEGA 3

Table 1 - Recommended hardening temperature for different groups of samples

Number	Carbon content, %	Hardening temperature, C	Holding time, h
1	1,3909	800	30 minutes
2	1,3909	1100	30 minutes

Sections were prepared according to the standard procedure. Studies of the steel structure were carried out on a scanning electron microscope TESCAN VEGA 3 (Fig. 4). The microstructures of Hadfield steel depending on the heat treatment mode are shown in Figures 5 and 6.

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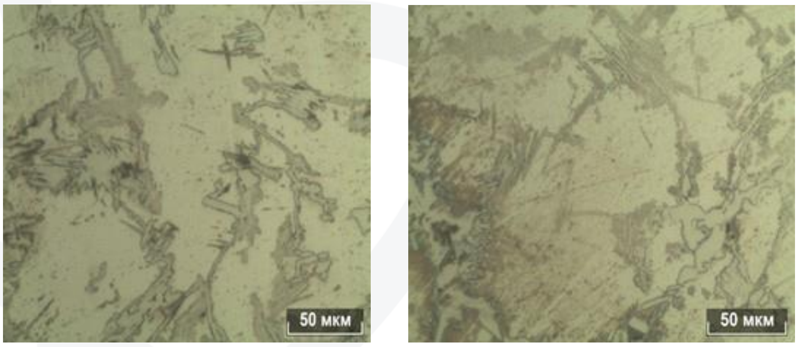

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Figure 5 - Microstructure of steel 110G13L (a) without heat treatment, (b) with heat treatment (T = 800°C, holding time 30 minutes)

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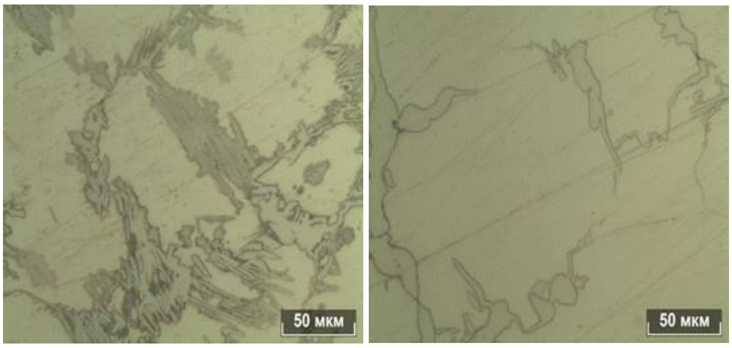

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Picture 6 - Microstructure of steel 110G13L (a) without heat treatment, (b) with heat treatment (T = 1100°C, holding time 30 minutes)

In the presented drawings of the microstructure of steel 110G13L, one can see that at a temperature of 800°C, long inclusions of carbides both were and remained. There are almost no changes in the structure. And at a temperature of 1100°C, needle-like inclusions of carbides become more rounded and begin to dissolve. Obviously, for complete dissolution of carbides, it is necessary to increase the holding time.

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