TO A MATTER APPLICATION OF POWDER WIRE FOR SURFACING ROLLERS

N.Z. Khudaykulov,
Senior Lecturer of the department "Technological machines and equipment" of Tashkent State Technical University named after Islam Karimov
M.M. Payazov.
Assistant of the department "Technological machines and equipment" of Tashkent State Technical University named after Islam Karimov

Mechanized surfacing of rolling rolls is used in almost all metallurgical plants. To ensure the maximum durability of the deposited layer, flux-cored wire of the ПП-3Х2В8 brand is most often used [1]. The surfacing increases the durability of rolls by an average of five times, reduces their consumption, sharply reduces mill downtime, etc.

In addition, many years of experience have shown that the adopted surfacing technology has significant drawbacks. Although the deposited layer wears out slowly, it cracks rather quickly, as a result of which the surface of the roll sometimes crumbles.

GOST 10543-63 provides for a number of wire grades for surfacing heat-resistant and more easily processed steels (for example, Нп-30Х 5, Нп-35Х2G2В, Нп-45Х4В3Ф). However, the small volume of wire production of these grades limits their practical application.

In this regard, a new grade of flux-cored wire was developed for submerged-arc surfacing of hot rolling rolls, to which the requirement of maximum surface cleanliness of calibers is imposed. So, for example, on finishing and pre-finishing rolls of pipe-rolling and section-rolling mills, a coarse grid of heat and mowing is unacceptable, therefore, it is desirable to replace the 3Х2В8 chromium-tungsten steel with a more perfect one.

Chrome-molybdenum steels are successfully used for the manufacture of tools intended for processing red-hot metal. Chrome-molybdenum hot die steels have a unique combination of maximum toughness with very high strength, wear resistance and thermal endurance. The chemical composition of the most characteristic steels of this group is presented in table. 1 [2].

Table 1.
Nominal chemical composition of chromium-molybdenum die steels

A type become	Content,%							
	C	Mn	Si	Cr	Ni	W	Mo	V
H11	0,40	0,30	1,0	5,00	-	-	1,35	0,40
H13	0,40	0,30	1,0	5,00	-	-	1,35	1,00
H12	0,35	0,30	1,0	5,00	-	1,3	1,50	-
H10	0,40	0,55	1,0	5,00	-	-	2,50	0,35
A9	0,50	0,40	1,0	5,00	1,5	-	1,50	1,00

In the USA and Japan, steels of this type are widely used in the manufacture of all kinds of stamps and molds. Steel N11 was intended primarily for molds for injection molding of silumin. Distinctive features of this steel: the possibility of air hardening from relatively low temperatures, low deformation as a result of heat treatment, acceptable dross resistance when cooled in air, high resistance to thermal cracking during multiple changes of heating and cooling, erosion resistance by molten aluminum and not too high content of dopants [3].Subsequently, other steels were created, presented in the table.

In terms of viscosity, chromium-molybdenum steels are unmatched among tool steels; in hot hardness they are inferior to chromium-tungsten steels, not to mention high-speed. Excellent resistance to thermal shock makes chromium-molybdenum steels preferred for a wide variety of hot tools. The execution of stamps from these steels is especially valuable, cooled during operation with water or emulsion.

Studies of the thermal resistance of die steels Have shown that there is a relationship between thermal resistance and toughness at normal and elevated temperatures. The change in the volume of steel under cyclic thermal loads creates significant stresses. Steel with increased toughness is more capable of stress redistribution and is less prone to cracking.

In the effect of the composition of a solid solution, the conditions of its decomposition and coagulation of precipitated carbides on the impact toughness and the tendency of the metal to form cracks was studied.

Retained austenite with a high tungsten content degrades thermal conductivity and increases stresses under cyclic thermal loads.

To ensure high thermal stability and toughness of the metal, a certain degree of coagulation of carbides is required.

Fig. 1. Microstructure of deposited metal of 25Х5ФМС type
(etching with nitric acid, X900)

When tempering tungsten steels, carbides Me6C Ии Fe_3C; are precipitated from the solid solution; and when tempering steels alloyed with molybdenum and chromium, along with carbide Me6C, Me23C6and Me2C are precipitated.

Tungsten carbides precipitate at higher temperatures and are less capable of coagulation than molybdenum and chromium carbides of the Me23C6 type. Therefore, an increase in the tungsten content delays the decomposition of the solid solution, complicates the coagulation of carbides, which in turn reduces the tempering impact strength and thermal resistance of steel.

As a result of the investigations carried out, a flux-cored wire ПП-25Х5ФМС was proposed, when surfacing, a layer of chromium-molybdenum steel is obtained. Its chemical composition depends on the type of flux and the surfacing mode. An AH-20 flux is usually used. Chemically neutral fluxes AH-70 and AH-15M are also suitable, but in this case, the deposited metal contains more carbon and the surfacing is harder.

Chemical composition of metal deposited with flux-cored wire ПП-25Х5ФМС under AH-20 flux (in the third and subsequent layers): 0.20-0.30% C, 0.8-1.3% Si, 0.4-0.9 % Mn, 4.8-5.8% Cr, 0.9-1.4% Mn, 0.3-0.6 V, no more than 0.04% S and 0.04% P, Metal hardness *HRC*42-46, its structure -martensite and retained austenite (Fig. 1).

Since in the process of rolling the working surface of the roll heats up to 600-700 ° C [1], an important characteristic of the deposited metal is its hardness at operating temperatures.

The hardness of the deposited metal of the 25Х5ФМСtype was measured at high temperatures using a device manufactured by Pomp Seldi. Measurement conditions: vacuum 1.5-10-2 mm, etc. Art., load 6 к Г, time under load 20 sec. The experimental results are shown in Fig. 2. There, for comparison, data on the metal deposited by wires ПП-3Х2В8 and MMK-61 are given.

Resistance to cracking is characterized by the following test results of samples: after 50 cycles of heating to 800 ° C and cooling in water, the total length of cracks on steel 4Х2В8 is 240 mm, on steel 4Х5ФМС - 10 mm.

The effect of preheating on the tendency of the deposited metal of the 25Х5ФМС type to crack was studied on composite specimens.

One composite sample was tested at each temperature (Fig. 3). As you can see, the minimum heating temperature, excluding the formation of cracks, is equal to 460oC, while for the deposited metal of the 3Х2В8 type it is 550oC.

During the tests, the rolls of finishing stands (third and seventh) of the “30-102” mill were welded, which fail mainly due to the development of the heat grid. Surfacing was carried out on a roller surfacing machine under an AN-20 flux with a flux-cored wire ПП-25Х5ФМС Ø 3,2 mm in the mode: Iс в = 320÷340 α, Uд = 26 ÷ 30 в, VН = 40 m / h.

To prevent cracks, induction heating of the roll up to 350 °C with power frequency current was used. After surfacing, the roll was subjected to low-temperature tempering for 1 hour at 400 ° C, followed by slow cooling at a rate of 40-60 °C / hour. Under the box. No pores or cracks were found in the deposited metal.

The durability of rolls deposited with flux-cored wire ПП-25Х5ФМС is, on average, 1.3-1.9 times higher than that of rolls deposited with ПП-3Х2В8 wire. The shallow depth of the flare grid on rolls deposited with ПП-25Х5ФМС wire allows them to be reused after machining without surfacing, due to which the service life of the rolls increases two to three times.

table 2

Resistance of deposited rolls (in tonnes of rolled products) for one installation in a stand

Wire for hardfacing	stands				
	III	IV	V	VI	VII
ПП-3Х2В8(medium durability) ПП-25Х5ФМС (experienced Rolling)	3380 4093 4828	3550 3550	3320 5069 5973	2750 3493 4206 4436	2280 5793

Metal deposited with ПП-25Х5ФМС wire lends itself better to cutting than metal of the 3Х2В8 type. For example, turning during the calibration of a roll deposited with ПП-3Х2В8 wire lasts 6.4 hours, and a roll deposited with ПП-25Х5ФМС lasts 4.8 hours.

It should be noted that the heating temperature of the rolls during ПП-25Х5ФМС surfacing (350-380°C) is lower than when surfacing withПП-3Х2В8 wire, which reduces the heating time and, consequently, the power consumption.

List Of Used Literature

1. FD Kashchenko, Study of the distribution of alloying elements in the deposited metal and the development of the technology for surfacing hot rolling rolls. Dissertation for the degree of candidate of technical sciences, E.O. Paton Electric Welding Institute, 1966.
2. I.I. Frumin, Automatic electric arc surfacing, Metallurgizdat, Moscow, 1961
3. S.N. Zhiznyakov. Manual arc welding. Materials. Equipment. Technology / S.N. Zhiznyakov, Z.A. Sidlin. - Kiev: Ecotechnology, 2006 .-- 368 p.