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THE ANALYSIS OF THE THERMIC TREATMENT TECHNOLOGY APPLIED TO THE MILL ROLLS CAST BY STEEL ADAMITE TYPE

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ABSTRACT
In the paper an analysis on the thermal treatment technology, applied to the rolling cylinders, casted of hypereutectoid steel, Adamit type (OTA3) is worked out, with the purpose of obtaining some corresponding hardness and their use in the production practice.
Diagrams of applied thermal treatment are presented, as well as the hardness values registered respectively the obtained microstructures (both at casting and after the application of thermal treatments).
Key words: mill rolls, thermic treatment, hardness, steel, Adamite type.

1. INTRODUCTION
A very important problem connected to the mill rolls casted of hypereutectoid steel Adamit type (OTA3) is that of establishing a corresponding thermal treatment which provides the possibility of processing, as well as the obtaining of some final hardness at high values, able to carry out a good wear strength.
The aim of thermal treatments application in the case of the mill rolls casted of hypereutectoid steel, has a multiple character, respectively [1,2,3,4]:
- eliminate the internal tensions which have very high values;
- decrease the hardness obtained at casting (~370…400HB), till the values between the interval 280…300 HB, in view to increase the processing by splinting;
- correct the primary structure by destroying the cementite network, increase of the perlite grains and its fineness in order to assure the imposed mechanical properties and especially the growth of the rolls face (not only in the superficial stratum but also in depth) at values of 380…420 HB.

The verification of the table's hardness is made in three equidistant points and on three generators at 120^o and on the necks in two points situated at 180^o one against the other, after which an arithmetical means is done [4]. Thus, in order to obtain the characteristics of the hardness and the wanted microstructure, to the mill rolls of Adamit type steel are applied two thermal treatments, primary and secondary, whose diagrams are presented in fig. 1.

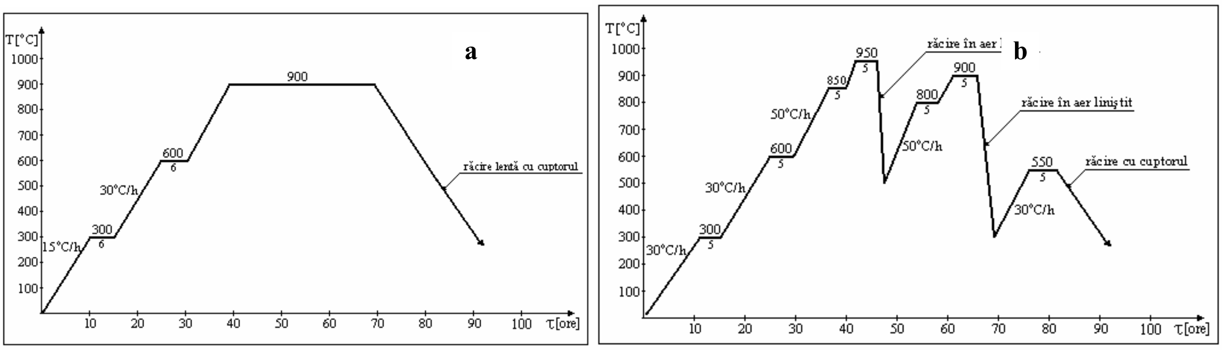


Figure 1. The thermic treatment applied to the mill rolls of Adamit type steel: a - primary thermic treatment; b - secondary thermic treatment.

2. THE ANALYSIS OF THE THERMIC TREATMENT TECHNOLOGY APLIED TO THE MILL ROLLS

The mill rolls meant to the throttling of profiles are obtained by the direct casting method. The scheme of the rolled raw casted roll, and of the passed roll that is going to be obtained by the chip removing process is presented in fig. 2.

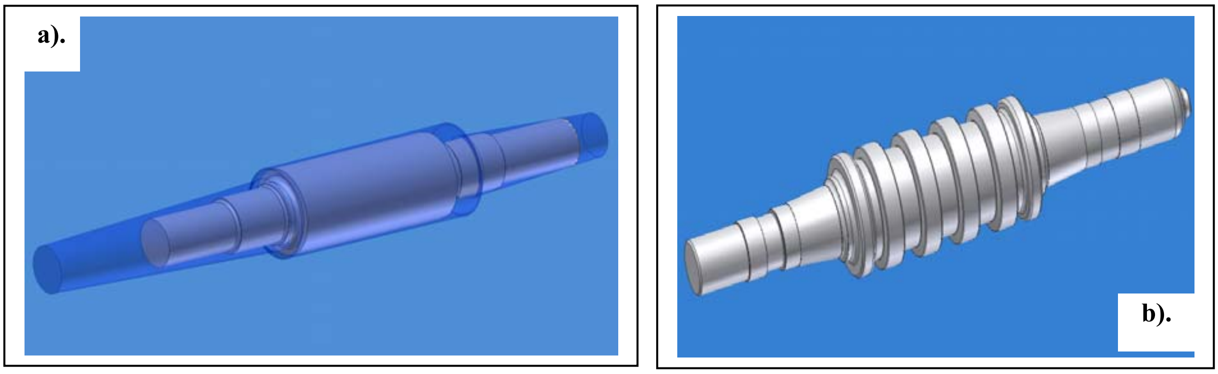


Figure 2. Roll meant to the throttling of profiles: a - scheme of the rolled raw casted roll, which is going to be obtained; b - passed roll, meant to the throttling profile I.

The obtaining of some corresponding structures at the table's surface, in the case of rolls with smooth face, doesn't represent a special problem, but the obtaining of some homogeneous structures and uniform characteristics on a depth bigger than 60…70 mm from the table's surface represents the main problem of manufacturing the rolls for profiles. This problem is more difficult to be solved, as the depth of the calibres is bigger.

After doing the analyses, both from the industrial practice and of the specialized literature, a series of specifications can be done, connected to the thermal treatments applied to the mill rolls casted of Adamit type steel.

First of all, we can specify the fact that the structure, in casted state (fig.3), can be very different from the point of view of the secondary cementite proportion and of its form and repartition around the perlite grains [3]. Thus, with the growth of the carbon percentage the quantity of free cementite increases and it is distributed as a network round the perlite grains, with bigger and bigger thickness. As high speeds of cooling, the secondary cementite separations are distributed under needle form in the pearlite mass, the Widmannstatten structure being obtained in this way. The destruction of the cementite continuity network or even the spheroidisation, can be done by thermal treatment. Also by thermal treatment the degree of the pearlite dispersion can be increased and obtained the cementite's globulisation. [3]. After applying the primary thermic treatment the decrease of hardness takes place (at values between the interval 250…290 HB on the face and 250…280 HB on necks), in order to proceed the chip removing process operation for rolling; the homogenization of the chemical composition, distribution of the carbides network and their globulisation (fig.4).

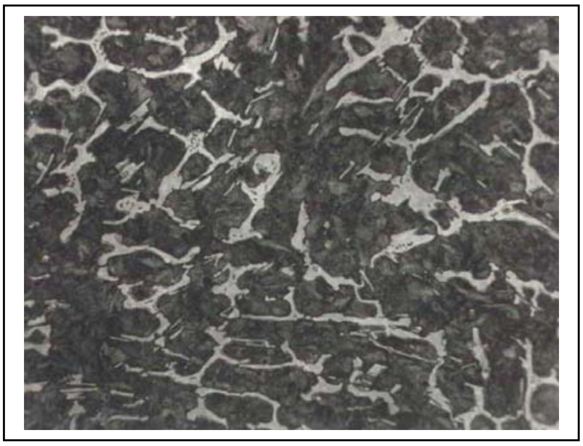
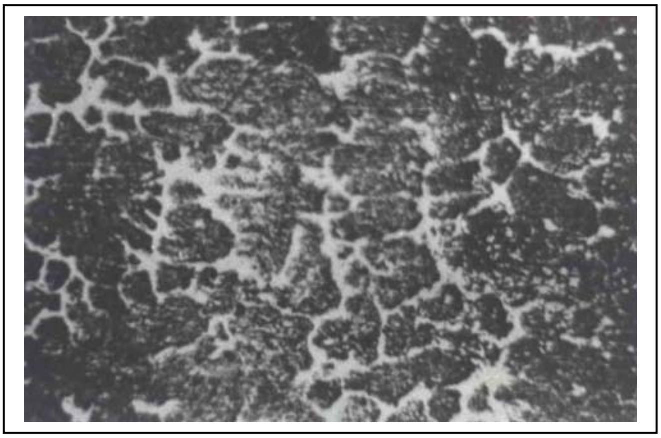


Figure.3. Microstructure of the roll's face (in casted state), nital attack 2%, growth 100:1.

Figure 4. Microstructure of Adamit steel, after primary thermic treatment (cementite under the form of network + carbides of globulisation); nital attack 2%, growth 100:1.



After preceding the primary thermal treatment and the rolling of the rolls, the secondary thermal treatment is done to assure, on the roll face the physic-mechanical properties required by the throttling process, especially the growth of its hardness [2]. The face's microstructure (fig.5) after applying the secondary thermal treatment is made out of the metallic mass of base bainitico-martensitic, carbide islands and fine, rare inclusions of graphite.

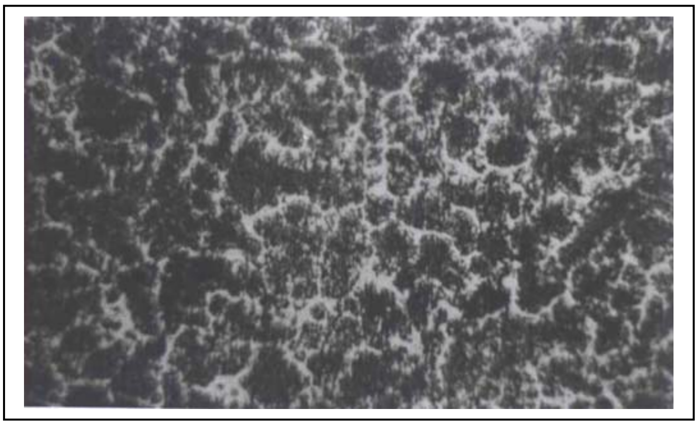


Figure 5. Adamit steel microstructure, after the secondary thermic treatment; nital attack 2%, growth 100:1

3. CONCLUSIONS

The thermal treatment applied to the rolls casted of hypereutectoid steel, of know chemical composition, assures the finishing of the granulation, but their wear remains therefore high. To

increase the resistance at wear and the mechanical resistance of the rolls we resort to the alloy of the steel with Cr, Ni and Mo. The alloy elements form together with the ferrite and cementite solid solutions, much stronger and harder, making also the obtainance of the structures with fine granulation.
The great hardness obtained at casting and the inadequate structure of the rolls, impose applications of thermal treatments. Thus, after the analyses done in the industrial practice we establish the following:

- in raw casting state, the mill rolls Adamit type have a high hardness (392…399 HB) and therefore, they are subdued to a preliminary thermal treatment of softening, after which the hardness is decreased to 260…285 HB, so that they can be subdued to the mechanic chip removing process;
- after the mechanic process, the rolls are applied a secondary thermal treatment (steeling), after which the hardness increases at values of 380…440 HB on table's' face and 290…310 HB on necks, hardness that assure a good behavior in exploitation.

To conclude, we can establish that the hardness obtained at casting, respectively after thermal treatment applied, it is very important because of the fact that it plays a main role in the throttling process, with direct influences on the exploitation hardness.

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