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EXPERIMENTAL RESEARCHS REGARDING THE DETERMINATION OF TRACTION RESISTANCE FOR THE HYPEREUTECTOIDE STEEL

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Abstract. The paper introduces the possibilities of determining the material characteristics of the Adamit-type steel meant for casting hot rolling cylinders. The experiments have been carried out on 17 test rings cut off the cylinders that are to be used. The test rings have been cut at the upper part, respectively at the upper roll neck, as well as at the lower one, the lower roll neck. We determined the traction resistance, as well as the structural characteristics.

1. INTRODUCTION

A particularly actual problem for the steel making companies is the low exploitation endurance of the rolling cylinders, as they are the most stressed parts in the rolling train.

The rolling cylinders cast of Adamit-type hypereutectoid steel are massif pieces, vertically cast, the mould being assembled in casting pits on the floor of the foundry. The Adamite-type steels have Carbon contents ranging within 1,2-2,2% and are alloyed with Cr, Ni, Mo, being used on those rolling trains that require high wear resistance (usually on the fore-finishing stands on the profile rolling trains).

The reference bibliography shows that the best results in terms of physical-mechanical characteristics and exploitation are obtained for the following chemical structure: 1,7-2,2%C; 0,6-1,5%Si; 0,7-0,9%Mn; 1,0-2,0%Ni; 0,7-1,5%Cr; 0,3-0,5%Mo; max. 0,04%P; max.0,02%S [3].

Because the reference literature offers little information on the material characteristics of the Adamit-type hypereutectoid steel meant for casting hot rolling cylinders, we carried out tests on rings sampled from cylinders cast in a metallurgical company.

2. EXPERIMENTAL RESEARCHES

After having undergone the secondary thermal treatment [2], the cogged cylinders were cut off into rings in order to determine the cross-section hardness, the micro-structures, the mechanical characteristics etc. The test rings were cut by lathing, under the same conditions in which cylinders are grooved.

The test rings have been cut off 17 cylinders, in view of determining the mechanical characteristics of the material which the rolling cylinders are cast of. The test rings have been cut at the upper part, respectively at the upper roll neck, as well as at the lower one, the lower roll neck.

We mechanically cut out of the test rings several pieces of material in order to obtain the test rods to be used in traction breaking tests and in order to determine the microstructures [1], [4], [5].

Moreover, in fig.1 one can also notice the breaking structure. Analysing the breaking structure of the test ring cut off cylinder no. 0946 one can notice its bright crystal look, which reveals the fragile character of the break [4] (fig.1).

Reference literature, [6], show that for hypereutectoid steels the presence of secondary cementite at the limit of perlite grains increases their fragility. Resistance, elongation and necking decrease with carbon content [6].

Fig. 1. Test ring no. 0946 and its structure.

We sampled 11 test rods out of the test rings at the Mechanical Workshop of the Faculty of Engineering of Hunedoara (fig.2); their dimensions are given in fig. 3.a.

Fig. 2. Traction trying machine.

The test rods (having a diameter of 6 mm and a cross section of 28,2743 mm^2) have been traction break tested and the results we obtained are given in tab.1.

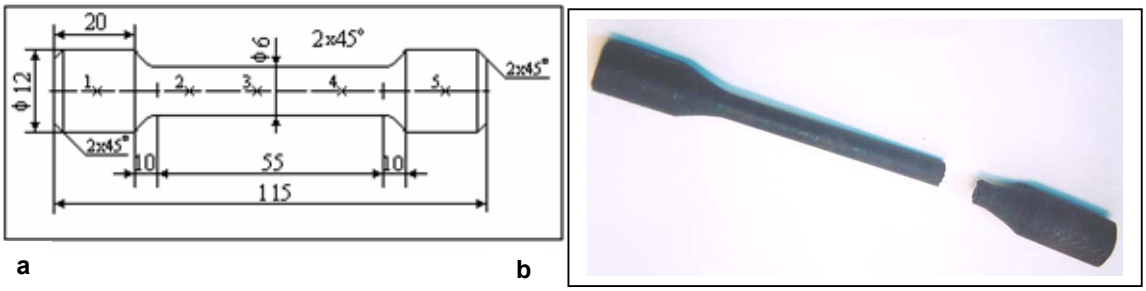

Figure 3. The test rod to be used in determining the mechanical characteristics of the Adamit-type steel: a-dimensions; b-test rod after the traction breaking test.

Table 1. The mechanical characteristics obtained for the test rods obtained out of the test rings.

Test rod no.	No.of cylinder out of which the test rod was cut	C [%]	F_r [daN]	$R_m = \frac{F_r}{S_o}$, [daN/mm^2]
Test rod I	0961	1,85	1710	60,47895
Test rod II	0962	1,85	1620	57,29585
Test rod III	0944	1,86	1710	60,47895
Test rod IV	0945	1,86	1690	59,77159
Test rod V	0946	1,86	1735	61,36315
Test rod VI	0947	1,86	1715	60,65579
Test rod VII	0957	1,89	1675	59,24108
Test rod VIII	0958	1,89	1700	60,12527
Test rod IX	0959	1,89	1720	60,83263
Test rod X	0954	1,99	1670	59,06424
Test rod XI	0952	1,99	1700	60,12527

The diagram of the break resistance variation with respect to the carbon content of the steel used in casting the cylinders is given in fig. 4.

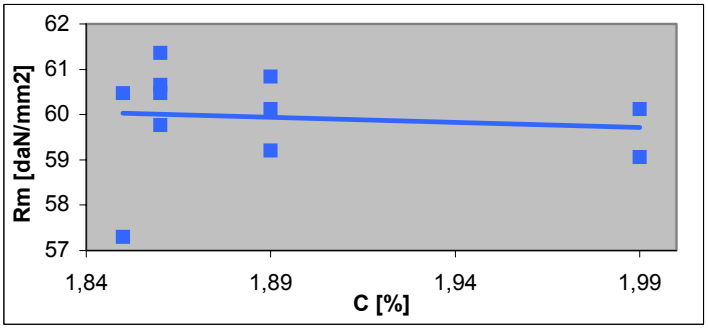

Fig. 4. The influence of the carbon content upon the mechanical resistance of Adamit-type steels, used in casting the test rings.

The diagram given in fig. 4 above, shows that the mechanical resistance of the Adamit-type hypereutectoid steel to be used in casting cylinders for hot rolling decreases insignificantly when the carbon content increases.

The resistance we registered have values ranging between 57,29585 and 61,36315daN/mm^2.

3. CONCLUSIONES

The experiments carried out on test rings cut off cylinders cast out of Adamit-type steel, in view of determining the mechanical characteristics lead to the following results:

- The resistance and hardness of the cylinders are determined, as in the case of pig iron cylinders, by the contents in Carbon;
- An increase in the Carbon contents within the structure range, results in the decrease of mechanical resistance and therefore in an elongation, respectively in an increase of hardness and therefore the resistance to wear;
- the mechanical resistance of the Adamit-type steel an insignificant decrease once the content in carbon increases and the elongation is 0,86%, the metallic material being very fragile.

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