ISSN 1533-9211

DOI 10.17605/OSF.IO/Z72QB

INCREASING TO WEAR CAPABILITY AND LONGEVITY OF THE DETAILS OF THE MACHINES WITH USING HIGH WARM-UP TERMAL PROCESSING

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Abstract

The Problem of increasing to wear capability and longevity material worker mechanism agricultural machines is more actual. Defining importance in shaping the features to constructive toughness material worker mechanism agricultural machines has, as well known, variation of the structured condition. Defining importance in shaping the features to constructive toughness material worker mechanism technological machines has, as is well known, variation of the structured condition. The Possibilities of his (its) change traditional way three-dimensional thermal processing practically exhausted. Regulation of the final structure opens Together with those new horizons to account of the directed change start (source) of the structure, directly preceding realization to stage terminating heating. For this purpose, article is studied structured conversions become under different type of the thermal processing, which vastly affect the specified characteristic.

Keywords: toughness, wear capability, toughness, limit to fluidity, striking viscosity, longevity, defects crystalline lattices, density, grain, heat stability, depth to toughness, stability.

INTRODUCTION

The main operational and technological properties of steels are determined by their alloying. Alloying allows achieving the necessary hardenability, hardening of the solid solution, and hardening due to the dispersion of the second phase. Alloying elements in die steel, for hot deformation, provide resistance to coagulation of particles of the second phase (carbides). In particular, the strength, viscosity, and heat resistance directly depend on the amount and dispersion of carbides, their resistance to coagulation during heating, as well as on the elements of the fine structure of the structure: the size of the blocks, the level of micro-distortion, the density of dislocations and the degree of their fixation.

Increasing the wear resistance and reducing the softening of die steels is achieved by introducing 3-5 % carbide-forming elements, nickel and chromium are introduced to increase the hardenability and grinding of grain. In this case, not only carbides of the M_3C type are formed in the steel , but also $M_{23}C6$, M_7C_3, M_6C, M_2C, MC. Since the coagulation of carbides occurs after the decomposition of martensite, the dissolution of small carbides of the M_3C type, the increase in resistance to coagulation is associated with the formation of carbides MC (VC) and M_2C (Mo_2C or W_2C) [1]. The stability of carbides of the M_6C (Fe_3Mo_3C) type is somewhat less. Carbides of the M_7C_3 and $M_{23}C_6$ types ($Сч_7C_3$ and $Сч_{23}C_6$).) Are even less resistant to coagulation. Heat-resistant die steels, complex-alloyed with chromium, molybdenum, tungsten, vanadium, are prone to secondary hardening during tempering. The maximum hardening (peak of secondary hardening) is achieved after tempering at 500 - 550 ^{0}C. A higher

The Seybold REPORT

ISSN 1533-9211

DOI 10.17605/OSF.IO/Z72QB

tempering temperature leads to softening.

The hardness increases most intensively during secondary hardening with an increase in the content of carbon, chromium and silicon in the steel. In addition to the formation of special carbides of the M_7C_3 and $M_{23}C_6$ types, chromium dissolves in ferrite, increasing the strength, and dissolves in carbide phases of the M_6C, MC and M_2C types, contributing to a more complete dissolution of special austenite carbides when heated for quenching.

The thermal background, the initial structure of the steel, strongly affects the properties after the final heat treatment. The most pronounced influence of thermal previous history affects the phenomenon of structural inheritance. Structural inheritance is expressed in the restoration of the original grain in shape and orientation after phase recrystallization. Numerous studies in the field of structural inheritance have been conducted by acad. Sadovsky V.D. with others. In particular, it was found that the formation of a fine structure during final heat treatment occurs under the conditions of inheritance of elements of the initial submicrostructure [2].

In many cases, in order to improve the service properties of finished products, pre-heat treatment is carried out, i.e., an optimal thermal background is created. These methods include all modes of heat treatment with multiple phase recrystallization [3].

Such heat treatment includes the first phase recrystallization with heating to extreme temperatures, accelerated cooling, the second phase recrystallization with heating to the temperatures usually accepted for this steel, quenching and final tempering.

The essence of the method of heat treatment with double phase recrystallization by the optimal mode is to create the necessary thermal prehistory of steel. During the first phase recrystallization, heating is carried out to extreme temperatures of 1100 ^{0}C for carbon and low-alloy steels. After accelerated cooling from these temperatures, a structure with the maximum level of defect of the crystal structure is formed.

At high-temperature heating, the dissociation of refractory nitride, carbonitride and oxygen-containing phases occurs and their transition to a solid solution. This process is intensive in the area of heating temperatures of 1100 ^{0C}. The beginning of the dissolution of these phases is characterized by the chemical micro-uniformity of the solid solution. In this case, during cooling, during the γ-α transformation, a structure with an increased level of defect in the crystal structure is formed.

The determining value in the formation of the characteristics of the structural strength of the materials of the working mechanisms of technological machines is, as is known, the variation of the structural state. The possibilities of changing it by traditional methods of volumetric heat treatment are almost exhausted. At the same time, the regulation of the final structure opens up new horizons due to the directed change of the starting (initial) structure immediately preceding the implementation of the final heat treatment stage. This can be achieved by implementing known or developing original schemes and modes of heat treatment at the preparatory stage of heat treatment.

The Seybold Report
ISSN 1533-9211
DOI 10.17605/OSF.IO/Z72QB

One of the possible options for improving the technology and improving the service properties of heat-treated products is the use of heat treatment with multiple heating, including phase recrystallization [1].

One of the possible options for significantly improving the service properties of heat – treated products is the use of heat treatment with repeated phase recrystallization. Cyclic heat treatment has been most fully studied and has found practical application. Its essence consists in a sharp acceleration of diffusion processes due to alternating heat exchange. If the cyclic processing is carried out with multiple phase recrystallization, then there is a rapid grinding of the grain and on this basis an increase in the yield strength, impact strength [2].

EXPERIMENTAL WORK. MATERIAL

Accordingly, the total heat treatment time is significantly reduced. During cyclic processing with heating to subcritical temperatures, the acceleration of diffusion processes leads to rapid coagulation of cementite plates with the formation of granular structures [3]. However, the introduction of alloying elements into steel that slow down the diffusion of carbon in ferrite significantly reduces this effect.

An increase in the density displacement depend on cyclic heat treatment, is also observed, which should be associated with the development of micro plastic deformation during sudden heat changes. The increase in the displacement density depends on the temperature-time conditions of cycling, the possibility of inheritance of elements of the sub microstructure during a new heating-cooling cycle [4]. However, after the final quenching and tempering, the density of displacement does not differ much from that obtained after quenching and tempering according to normal modes. Currently, a large number of methods of thermocyclic processing have been developed in relation to certain alloys [5].

Another way to sharply accelerate diffusion processes is to increase the process temperature. In the sixties of the last century, a number of works were devoted to the acceleration of chemical-thermal, thermal treatments by using high-temperature processes. However, these processes had clearly negative sides – this is the growth of grain, an increase in the fragility temperature, etc. Therefore, heat treatment with double phase recrystallization seems to be a more acceptable process [7].

In particular, in the same years, Japanese patents were published, which described the double hardening of ball bearing steel, which increased the durability of ball bearings several times. This was explained by the grinding of grain and secondary carbides of steel. More complete researching on the formation of the steel structure during heat treatment with double phase recrystallization have shown that there are optimal modes that ensure the grinding of austenitic grains, the dispersion of excess phases and the maximum displacement density [3].

ISSN 1533-9211

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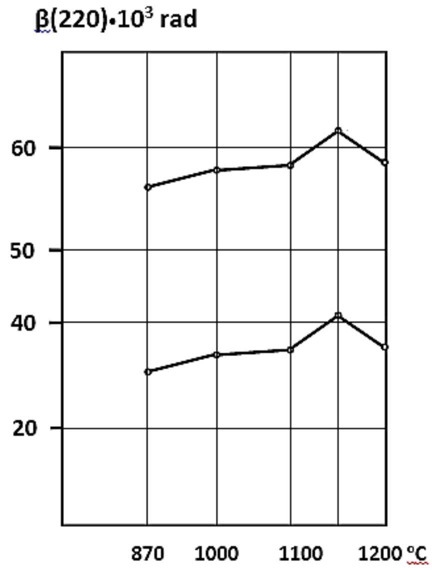


Previous quenching temperatures, °C

Figure 1: Change in the parameters of the structure of steel U8A depending on the previous quenching and medium tempering

These modes include the first phase recrystallization with heating to extreme temperatures. As shown by L.I. Mirkin [4], for carbon and low-alloy steels, the extreme temperature is at 1100°C. After heating the steel to this temperature and cooling, an increased dislocation density is formed.

The results of research on the formation of the steel structure during heat treatment, with double phase recrystallization, are given in [4].

RESULT AND DISCUSSION

They show that there are optimal heat treatment modes with double phase recrystallization, which ensures the formation of structures with fine austenitic grain, the dispersion of excess phases and the maximum displacement density (Fig.1).

These modes include the first recrystallization with heating to extreme temperatures, which are within 1100-1150 ° C for carbon and low-alloy steels. At these heating temperatures, not only the dissolving of the carbide phase occurs, but dissociation and the beginning of dissolving of the refractory phases is observed [5].

The Seybold REPORT

ISSN 1533-9211

DOI 10.17605/OSF.IO/Z72QB

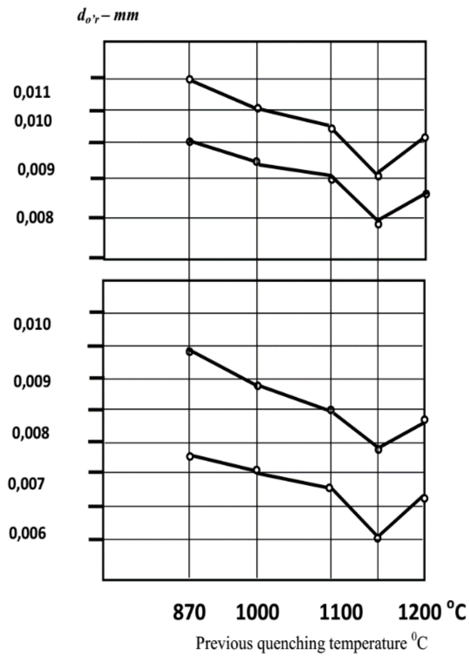


Figure 2: Change the diameter grain depending on temperature of the preliminary heating

Our work has shown that extreme temperatures cover a wider range of 1100-1150°C, and the formation of the maximum defect of the crystal structure is associated with the beginning of dissolving of refractory admixture phases in steel, the formation of zones with chemical micro-uniformity, which, when cooled, leads to an increase in the density of dislocations in the α-phase [6].

METHOD

Since equally oriented small grains retain partially coherent boundaries, significant micro-distortions of the crystal lattice are created inside this complex. Thus, the general level of defects in the crystal structure consists of: the results of martensitic transformation during previous quenching, from the researching of the elements of the initial sub microstructure during transformation, from the creation of lattice distortion as a result of the inner grain texture (Fig. 2) [7].

Repeated phase recrystallization, carried out with heating to the usually accepted temperatures, takes place under the conditions of inheritance of the elements of the original sub microstructure.

Therefore, after the final heat treatment, extreme temperatures of the first phase recrystallization are observed, leading to a maximum of the defect of the crystal structure after repeated quenching, depending on the temperature of the final tempering [8].

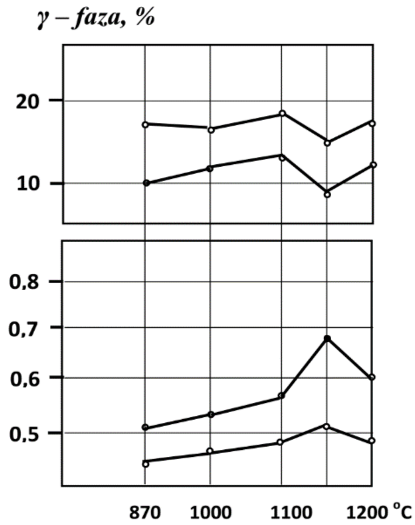
ISSN 1533-9211
DOI 10.17605/OSF.IO/Z72QB

Such noticeable changes in the structure of steel after heat treatment according to the optimal modes of double phase recrystallization significantly affect the properties.

Thus, after a new $\alpha - \gamma - \alpha$ transformation, a structure with a high displacement density, fine grain, and dispersion phases is formed [6]. This contributes to a noticeable increase in the elastic limit and rate of fluidity of steel, an increase in relaxation resistance and a significant increase the wear resistance out (Fig. 3).

There is some increasing of the rate of fluidity, the strength limit of steel, but the wear resistance increases very noticeably (Fig. 4) [9].

Recently, an increase in the elastic limit and relaxation resistance has been established. The obtained effects previously determined the application areas of the developed technologies of heat treatment with double phase recrystallization.



Previous quenching temperatures °C

Figure 3: Change contents carbon phase depending on temperature of the preliminary heating

This technology was used to increase the wear resistance of the screw elements of the spindles of the cotton collect machines, the blades of the grind thrower machine, the cold-deformation tools, cutting tools made of non-heat-resistant steels [10].

CONCLUSION

In recent years, the effectiveness of heat treatment with double phase recrystallization has been shown to improve the performance of elastic band rings of high-pressure chambers for the synthesis of super hard materials.

The use of heat treatment technology with double phase recrystallization allows to significantly increase the durability of products (from 1.3 to 3 times) without significant complication of the

ISSN 1533-9211

DOI 10.17605/OSF.IO/Z72QB

technology on standard equipment. The economic effect is achieved due to a sharp reduction in the consumption of metal and labor resources.

It can be seen from Figure 3 that the change in the total omission of seeds occurs in the opposite proportion to the change in the thickness of the top of the tooth.

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