

## STRUCTURED CONVERSION BECOME UNDER DIFFERENT TYPE OF THE THERMAL PROCESSING

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**Annotation:** 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. 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.

## СТРУКТУРНЫЕ ПРЕВРАЩЕНИЯ СТАЛИ ПРИ РАЗЛИЧНЫХ ВИДОВ ТЕРМИЧЕСКОЙ ОБРАБОТКИ

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**Аннотация:** Проблеме повышения износостойкости и долговечности материалов рабочих механизмов технологических машин является весьма актуальной. Определяющее значение в формировании характеристик конструктивной прочности материалов рабочих механизмов технологических машин имеет, как известно, варьирование структурного состояния. С этой целью

статье изучено структурные превращения стали при различных видов термической обработки, которые значительно влияют указанных свойств

**Ключевые слова:** прочность, износостойкость, прочность, предел текучести, ударная вязкость, долговечности, дефекты кристаллических решетки.

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.

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].

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 microplastic 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 submicrostructure 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 [8].

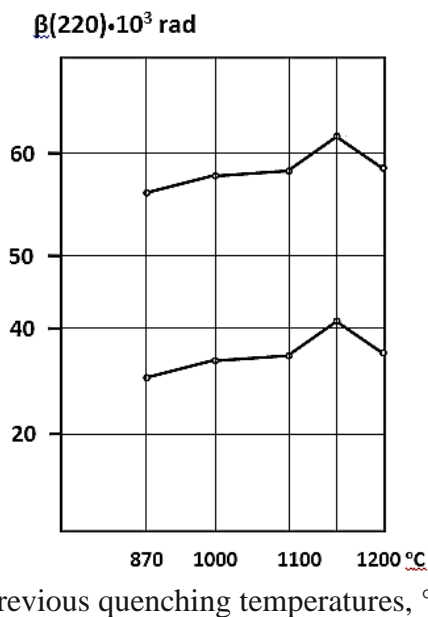


Fig. 1. Change in the parameters of the structure of steel U8A depending on the previous quenching and medium tempering.

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 [9].

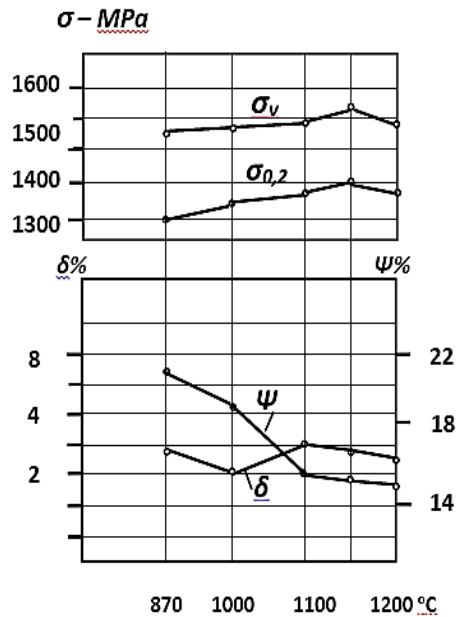
They show that there are optimal heat treatment modes with double phase recrystallization, which ensures the formation of structures with fine austenitic grain, the dispersion of excess phases and the maximum displacement density (Fig.1).

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 [10].



Fig. 2. Change in the grating period of steel U8A depending on the temperature of Previous quenching and intermediate tempering

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  $\alpha$ -phase [11].



Previous quenching temperatures. °C

Fig. 3. Changes in the rate of fluidity, tensile strength and impact resistance of U8A steel depending on the temperature of previous quenching and intermediate tempering.

Since equally oriented small grains retain partially coherent boundaries, significant micro-distortions of the crystal lattice are created inside this complex [12]. 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 submicrostructure during transformation, from the creation of lattice distortion as a result of the inner grain texture (Fig. 2).

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 submicrostructure.

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 [13].

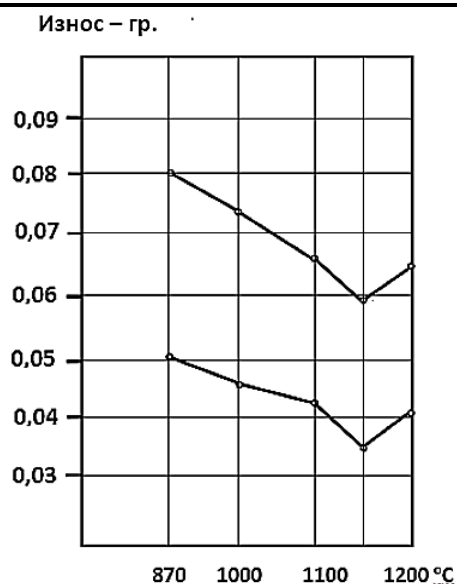
Such noticeable changes in the structure of steel after heat treatment according to the optimal modes of double phase recrystallization significantly affect the properties.

Thus, after a new  $\alpha - \gamma - \alpha$  transformation, a structure with a high displacement density, fine grain, and dispersion phases is formed [14]. 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).

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 4. Change in wear out resistance depending on the Previous quenching temperature

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 machines, the cold-deformation tools, cutting tools made of non-heat-resistant steels [15].

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

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