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The choice and creation of the environmentally friendly hardening environment made of the components manufactured in the Republic of Uzbekistan

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ABSTRACT: The work object consisting in the choice and creation of the environmentally friendly hardening environment from local raw materials is set. The analysis of conditions of application of hardening environments on the basis of water-soluble polymers is made for achievement of the goal, pilot studies of processes of tempering of steel 12X18H10T in different environments are conducted.

It is established that use of water-soluble polymers as hardening cooling medium improves an ecological situation, but for different in a standard size and a grade of materials of products is necessary to select the corresponding composition of solution.

KEY WORDS: water-soluble polymers, hardening liquid, cooling speed.

I.INTRODUCTION

Nowadays works on research of substitutes of the mineral oils used as hardening environments were carried out. In resent times, it is developed more than ten times[1]. Many hardening environments are solutions of different substances in water.

Water-soluble polymers are most widely used. It is possible to classify all hardening environments on the basis of the water-soluble polymers produced in the CIS countries as follows [2]. On a basis:

- Polyacrylamides (PAA and ZSP-1);
- Incomplete iron salt of polyacrylic acid (PK-2);
- Modified cellulose (VP-3);
- Sodium salt of a carboxymethyl cellulose (Na-KMTs);
- the hydroxylethylatedalkylphenol (TOSOL);
- copolymer of a chloroprene with methyl methacrylate and methacrylic acid ("Nairit").

The majority of these received industrial application. In particular the PAA (ZSP-1) environment yields good results at scraper tempering from induction heating.

Quite satisfactory results at volume tempering of thick-walled products are yielded by tempering in the environment on the basis of Na-KMTs [3].

Lack of water solution of polyacrylamide (PAA) is the big instability of refrigerating capacity at temperature change. For the purpose of improvement of the cooling properties when tempering by immersion enter additives of mineral salts into PAA solutions: chloride sodium, soda, chloride ammonium. At the same time the maintenance of PAA 0.2-0.5% are normal.

Solutions on a basis sodium- carboxymethyl cellulose (Na-KMTs) are widely used at the Russian engineering plants (the Nev plant software, Izhora Plant, NPO “Atommash”, etc.). Speed of cooling can be regulated concentration of Na-KMTs polymer and mineral additives. Use 2% of Na-KMTs from 2% drills. Cooling of large details in the environment of 1.5% of Na-KMTs without adding of chloride sodium takes place more slowly, than in oil and solution has low firmness at operation. Therefore add 15% of NaCl.

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From all considered structures the most universal solution on the basis of copolymer of methacrylic acid with acrylonitrile in the ratio of monomeric links (up to-10) – (50-50) after oil and concentration of copolymer of 0.1-10.0% (UZSP-1) is considered. This solution underwent long-term use in software "Tashselmash" when tempering twisted elements of spindles of mechanical cotton pickers from steel 65G. It allowed to exclude use of mineral oil and to considerably improve an ecological situation in workshop. There were sufficient introductions to water solution only of 0.7% of a concentrate of UZSP-1 that the speed of cooling decreased to the values providing lack of cracks when tempering, extremely limited information is available about an opportunity to use as the component of the hardening environment, copolymer of acrylic acid and acrylamides produced under the "Uniflok" trademark [4]. At the same time need of development of the program of the standardized complex for certification of hardening environments – oil substitutes is emphasized.

II.METHOD OF RESEARCH

Preliminary experiments were made by removal of curves of cooling with the special thermometer made of steel 12X18H10T.

The thermometer heated up in the furnace without the protective atmosphere to temperature of 870±5 °C and was maintained within 5 min. Then during less than 2 sec., moved in cooling medium. The volume of liquid was 2 l, and temperatures of liquid changed from 20 to 40 °C. Temperature changes in the course of cooling registered on a self-balancing potentiometer of KSP-4.

III.RESEARCH PART

Determined the average speed of cooling around pearlite transformation by curves of cooling, in the range of temperatures of 870-275 °C, and in the range of temperatures of martensitic transformation for carbonaceous and low-alloy steels of 275-55 °C (fig. 1.2).

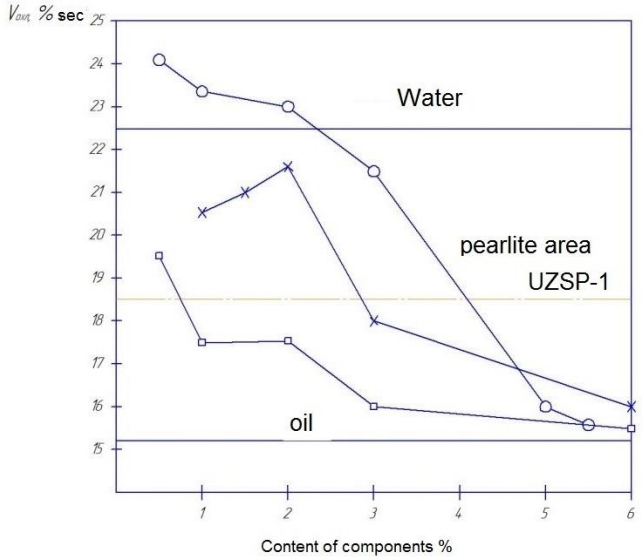

Fig.1. Influence of maintenance of polymeric components in hardening liquid on cooling speeds, an interval of 870-275 °C.
o – Na-KMTs, x – methyl acrylate, □ – Na-KMTs + 2% methyl acrylate

Preliminary experiences showed that Na-KMTs solution is the least suitable as cooling speed strongly depended on change of concentration of solution. In this respect more favorably uses solutions of "Uniflok". The required speeds of cooling corresponding of 0.7% to UZSP-1 solution are reached at the maintenance of a component in solution about 3%.

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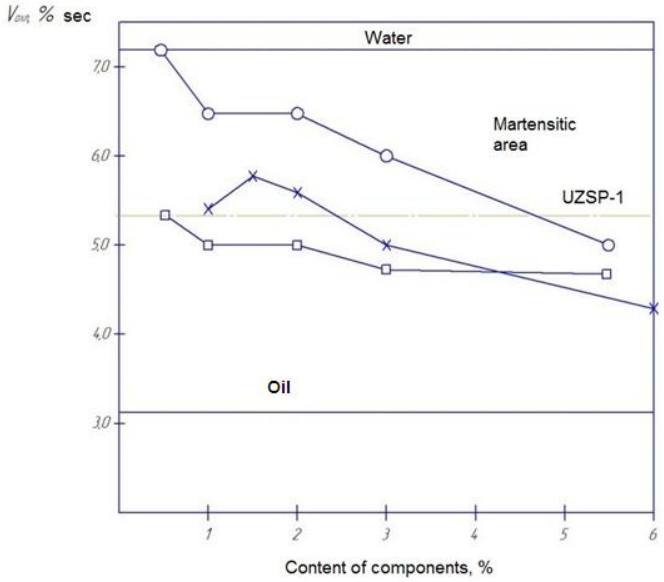

Fig. 2. Influence of maintenance of polymeric components in hardening liquid on the cooling speed, intervals 275-55ºC.
o – Na-KMTs, x – methyl acrylate, □ – Na-KMTs + 2% methyl acrylate

IV.CONCLUSION

In general on a problem of use of water-soluble polymers, it is possible to make the following conclusion.

1. Use of water-soluble polymers as hardening cooling medium sharply improves an ecological situation.

2. Water solutions of polymers completely cannot replace hardening oils as cooling speed in the field of temperatures of martensitic transformation in water solutions leads at the same time to reduction in the rate of cooling around temperatures of pearlite transformation.

3. Use of water solutions of polymers as the hardening environment allows to receive cooling speeds smaller, than when tempering in water and higher, than when tempering in oil. It allows at heat treatment of products and the tool from carbonaceous and low-alloy steel (in comparison with cooling in oil) at simultaneous decrease in hardening tension (in comparison with cooling in water).

4. For each group of standard sizes of products and a steel grade it is necessary to select composition of solution individually.

5. From the considered components in the Republic of Uzbekistan Na-KMTs (The Namangan chemical plant) and the medicine "Uniflok" (Navoiyazot) are made for preparation of hardening cooling liquid.

6. Experiences of use of hardening cooling liquids from the components manufactured in the Republic of Uzbekistan is not available.

Due to the above experiments, by definition of refrigerating capacities of solutions of the polymers manufactured in the Republic of Uzbekistan were made. Na-KMTs of production of the Namangan chemical plant and the medicine "Uniflok" of production of “Navoiazot” software were used. As reference liquids used water, mineral oil and 0.7% UZSP-1 solution.

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