WEB OF SCIENTIST: INTERNATIONAL SCIENTIFIC RESEARCH JOURNAL
ISSN: 2776-0979, Volume 3, Issue 2, Feb., 2022

INFLUENCE OF QUENCHING AND TEMPERING TEMPERATURES ON THE STRUCTURE FORMATION OF 4XMFC AND 4X5MF1C DIE STEELS

Ochilov A.
Master student, Materials Science department,
Tashkent State Technical University

Karimov Sh. A.
[2]Professor, Materials Science department,
Tashkent State Technical University

Abstract

The article considers the possibility of using high-temperature heat treatment modes for 4XMFC and 4X5MF1C steels. It seems possible in the manufacture of hot pressing matrices, where the main criterion is the preservation of the steel structure at an elevated operating temperature of 500-600 ^{0}C.

Keywords: quenching, tempering, austenite, phase, crystal lattice, defects

Introduction

Quenching of steels from different temperatures during heating usually involves the growth of austenitic grains and when the steel is cooled, a structure with large-needle martensite is obtained. The presence of alloying elements somewhat reduces the increase in the intensity of austenitic grain. It is known [1] that the main barrier to the growth of austenitic grains is the intractable blunt-headed phases. These are mainly carbides and nitrides. In our case, for 4XMFS and 4X5MF1C steels, the main obstacle to the growth of austenitic grains is carbides of alloying elements Cr, Mo, V.

In previous studies [2], it was found that when quenching tool steels of type 9XC, XVG from extreme temperatures of 1100-1200^{0}C, a structure with an increased dislocation density is formed.

It was found [3] that at these temperatures the initial stage of dissolution of refractory impurity phases occurs. All this in general leads to the appearance of chemical heterogeneity of austenite and the growth of austenitic grains. With abrupt cooling during quenching, an increased level of defects in the crystal structure of the α-phase is formed.

In the tempering process in these steels, the reverse process occurs, the release of carbides and impurity phases in the form of fine particles [4]. This process, in turn, affects the percentage of residual austenite formed. Therefore, it was of interest to

WEB OF SCIENTIST: INTERNATIONAL SCIENTIFIC RESEARCH JOURNAL
ISSN: 2776-0979, Volume 3, Issue 2, Feb., 2022

investigate the effect of quenching and tempering temperatures on the amount of austenitic grain, the percentage of residual austenite in steels 4XMFC, 4X5MF1C.

For the research, steel samples were prepared that underwent heat treatment consisting in quenching in oil from various temperatures from the standard for each grade of steel to a temperature of 1200 °C and tempering from 500 °-600 °C. The tempering temperature is selected based on the data on the operating temperatures of these steels. The value of austenitic grain was determined according to GOST 5639-82. The amount of residual austenite was determined by the ratio of the intensity of the X-ray lines of (211) α-phase and (200) γ-phase after heat treatment. The results of the research are presented in Figure 1,2,3. The results of the research are presented in Fig. 1,2,3.

Analyzing the data obtained on the structure formation of 4XMFC and 4X5MF1C steels when using high-temperature heat treatment modes, it can be noted that:

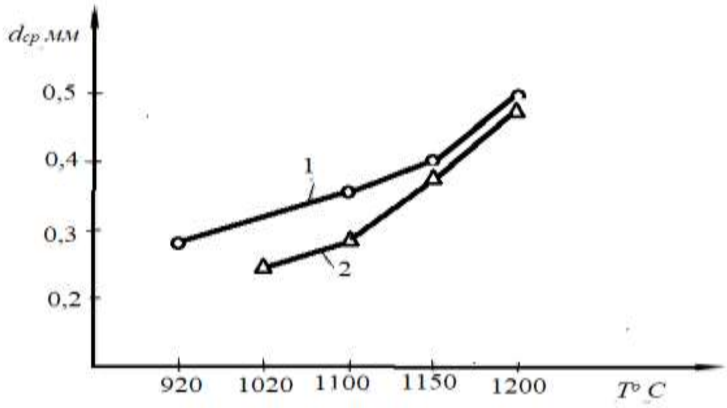

Fig.1. The value of austenitic grain of steels depending on the tempering temperature: 1 - steel 4XMFC, 2 - steel 4X5MF1C steel

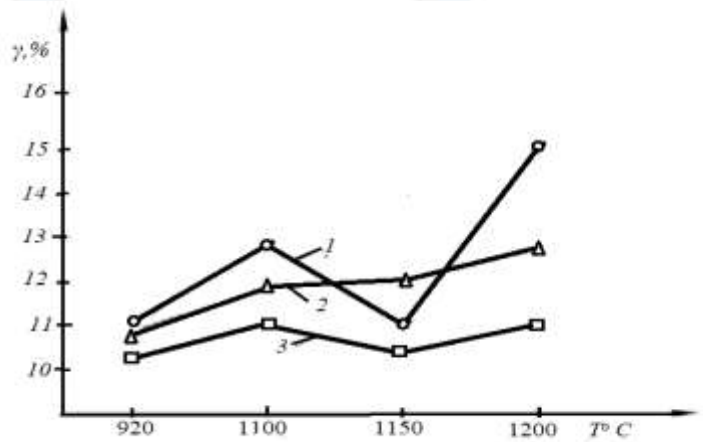

Fig.2. The content of residual austenite after quenching from various temperatures:
1- without tempering, 2 - 550^{0}C tempering, 3- 600^{0}C tempering

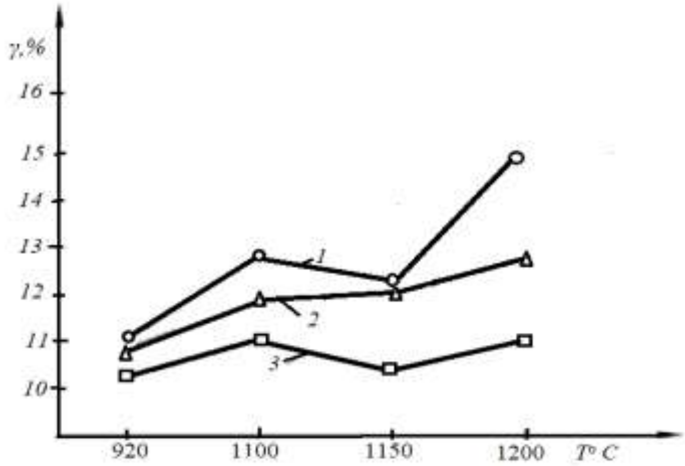

Fig.3. The content of residual austenite after quenching from various temperatures of steel 4X5MF1C
1- without tempering, 2 - 550^{0}C tempering, 3- 600^{0}C tempering

b) With an increase in the quenching temperature of 1100 °C, the residual content first increases, and then at a temperature of 1150 °C falls almost to the initial state (quenching from standard temperatures) and increases again when quenching from 1200 °C.
c) The lowest value of residual austenite is obtained when applying a 600 °C tempering.
Thus, the use of high-temperature heat treatment modes for 4XMFC and 4X5MF1C steels is possible in the manufacture of hot pressing matrices, where the main criterion is the preservation of the steel structure at an elevated operating temperature of 500 - 600 ^{0}C, where the lowest content of residual austenite is guaranteed.

References

1. Mukhammedov A.A. The infhence of thermal history on the structure and properties of steel. The physics of metals and metallography. Vol. 74.№5 1992 P. 482-487.
2. Sposob termicheskoy obrabotki [Heat treatment method] A.S.SSSR №113 33.06. ot 8.09.84.
3. Fedulov V.I. Puti povysheniya stoikost visokonagrujennogo instrumenta goryacheu vysadki golovok boltov [Ways to increase the durability of a high-loaded tool for hot landing of bolt heads]. Lite i metallurgiya 2016 №1 S. 120-129.
4. Goldshteyn M.I. Grachev S.V. Specialnie stali [Special steels] M: Metallurgiya 1985, 407 S.

5. Ziyamukhamedova Umida Alijanovna, Bakirov Lutfillo Yuldoshaliyevich, Miradullaeva Gavkhar Bakpulatovna, & Bektemirov Begali Shukhrat Ugli (2018). Some Scientific and technological principles of development of composite polymer materials and coatings of them forcotton machine. European science review, (3-4), 130-135.
6. Bektemirov B. S., Ulashov J. Z., Akhmedov A. K., & Gopirov M. M. (2021, June). TYPES OF ADVANCED CUTTING TOOL MATERIALS AND THEIR PROPERTIES. In *Euro-Asia Conferences* (Vol. 5, No. 1, pp. 260-262).
7. Jalilova, D. A., Alikulov, A. K., Khasanov, O. A., & Abidov, A. I. (2022). REVIEW OF MODERN METHODS FOR IMPROVING COMPLEX PROPERTIES OF Cu-Cr ALLOY. *Web of Scientist: International Scientific Research Journal*, *3*(1), 890-900.