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Chemical Heat Treatment of Tool Steel

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ABSTRACT: This article discusses several types of chemical and thermal treatment. One of them is nitriding of steels, which is the most well-known and common method of surface hardening of parts in modern industrial plants.

KEYWORDS: chemical-thermal treatment, nitriding, alloy, cutting tool, reliability, durability, diffusion, strength, viscosity, wear resistance.

I.INTRODUCTION

At present, a lot of experience has been gained in the application of various methods of chemical and thermal treatment of tool steels, when the surface layers of steels are subjected to diffusion saturation by the elements of the introduction, which results in the formation of a new one on the surface of the product.

There are several types of chemical and thermal treatment, depending on the environment in which the product is heated. The most common of them are: cementation, nitriding and cyanidation [1].

Nitriding is a technological process of chemical and thermal treatment, in which the surface of various alloys or metals is saturated with nitrogen in a special nitriding medium. Now to the cutting tools is more and more attention is paid to reliability and durability. Nitriding increases hardness and wear resistance, increases corrosion resistance.

The task of reducing the intensity of wear of steel parts and increasing the service life has been and remains one of the main tasks of Metalworking. There are a number of technological methods for processing tool steels , which can significantly increase the wear resistance. World experience shows that nitriding is economically feasible to increase the hardness, wear resistance and corrosion resistance of steels [2].

Nitriding is one of the most well-known and common methods of surface hardening of steel parts in modern industrial production. The nitriding process is based on diffusion saturation of the surface of the workpiece with nitrogen, which greatly increases the hardness of the surface layer, its wear resistance, endurance limit and corrosion resistance in environments such as atmosphere, water, etc., When the nitriding of the metal is formed multi-layered diffusion layers consisting of nitride surface area and the diffusion sublayer of the zone of internal nitriding. The size of the products after nitriding changes little. In installations of Russian production as a source gas, a source of molecular nitrogen using ammonia.

Nitriding can be subjected to various types of steels: structural, tool and others. Nitriding of tool steels allows to increase their hardness by 1.5...2 times, and the best combination of mechanical properties is achieved for this type of steel with a thickness of the nitrided layer of 0.01...0.025 mm, the recommended temperature is 510-520^{0}C, with a process duration of 15-20 minutes. With this mode of nitriding, a nitrogen layer with a high hardness of HV 1340-1460 kgf/mm^2 is formed. Depending on the size of the processed product temperature and duration of the process may vary. The strength and viscosity after nitriding decreases with increasing depth of the diffusion layer.

For the manufacture of various cutting tools is widely used structural steel, reinforced nitriding. This steel is pre-hardened and tempered to avoid decarburization, which can lead to the peeling of the nitrided surface. The nitriding

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itself is carried out at temperatures of 500-5200C, which at a process duration of 15-30 minutes allows to obtain layers with a maximum thickness of 1.1 mm and a surface hardness of HV 1100-1200 kgf/mm^2.

The nitriding process consists of the following steps:

1. To obtain increased strength and toughness –pre-heat treatment.
2. To obtain the final dimensions of the part-machining.
3. To protect against nitrogen diffusion, a thin layer of liquid glass or tin is applied to the parts of the product that are subjected to nitriding.
4. Nitriding.
5. Final grinding or fine-tuning of the dimensions of the part.

Classification of nitriding processes is given in table 1.

Main types of nitriding:

1. Gas nitriding
2. Liquid nitriding
3. Nitriding of electrolytic solutions
4. Ion-plasma nitriding
5. Nitriding in glow discharge
6. Nitriding in an arc gas discharge in an environment in which there is no hydrogen.

Now in various branches of mechanical engineering nitriding of surfaces of steels is applied. The main requirement for such products is to increase wear resistance, corrosion resistance and fatigue strength, as well as contact endurance. According to D. L. Williamson, providing high accuracy of the geometric parameters of the nitrided part in the absence of deformation, as well as simple and reliable methods of saturation of individual elements of the parts make ion nitriding a very cost-effective method of chemical and thermal processing, especially in batch production.

A necessary condition for ensuring wear resistance during wear is high surface hardness. The hardness of the diffusion zone is lower than that of the outer zone of the joints, and its values decrease from the boundary of the two zones of the layer to values corresponding to the hardness of non-nitrided steel. The character and quantity of alloying elements in steel and the nitriding regime have a great influence on this characteristic.

The main purpose of nitriding steels is to increase wear resistance. The harder the nitrided layer, the higher the abrasion resistance. High wear resistance of steels after ion nitriding is especially typical for parts operating under friction conditions without lubricant.

Thus, it can be noted that no matter how nitriding is carried out, it is necessary to strive to reduce energy resources, increase safety and environmental friendliness of the process.

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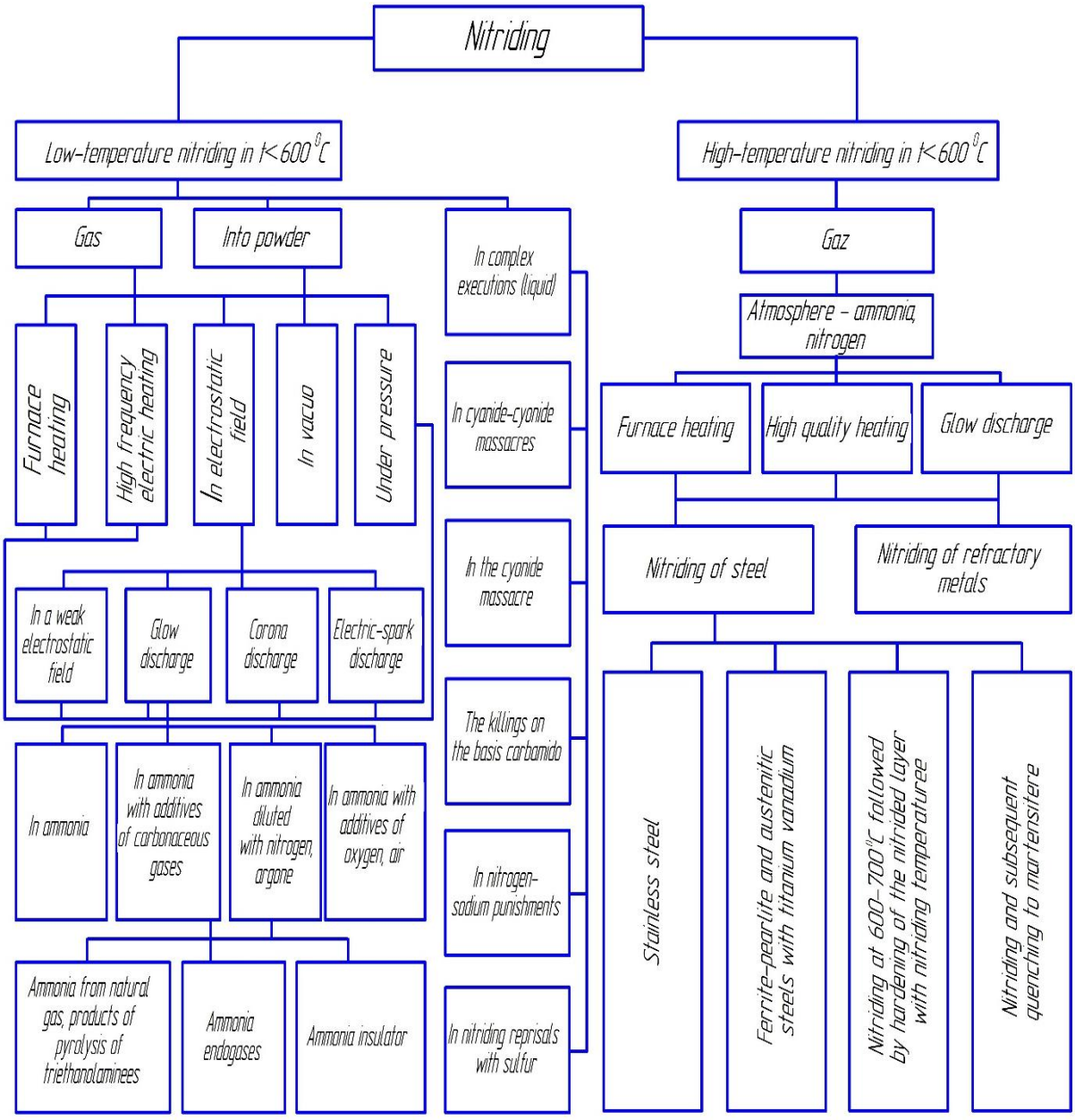
CLASSIFICATION OF THE PROCESSES OF NITRIDING.



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