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Vacuum Installation of Technology of Deep Ion-Plasmic Nitriding Disc Saw Of Fiber Separating Machines

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ABSTRACT: The technology of obtaining a deep-nitrated layer on a disc saw of a sawing cylinder for a short period of time (0.5-2 hours) and the subsequent standard heat treatment is considered. The results of resistant characteristics test of disc saw made of У8Г steel and processed according to the deep nitrating technology are presented.

KEYWORDS:. Deep nitrating, circular saw, sawing cylinder, ion-plasma nitrating, heat treatment, resistance, У8Г steel.

I.INTRODUCTION

The saw cylinder of the fiber separation machine is designed to capture the teeth of the saw blades of the fly fiber, detach it from the seeds and carry it through the slotted gaps in the grate to the air removal device. In addition, simultaneously with the separation of the fiber, the saw cylinder, coming into contact with the raw roller on the arc of the fiber capture in the working chamber, rotates it, which creates conditions for a constant supply of fresh bats to the saw blades [1-3].

The following technological requirements are set for the saw cylinder: it must have a high gripping capacity to ensure the desired performance and smooth rotation of the raw roller; saw blades must be rigidly fixed to the saw cylinder shaft, not to change its position during operation. When the cylinder rotates, the saws pass strictly along the center of the slit gap between the grates [3-6].

According to the number of saw blades on the shaft of the saw cylinders are divided into 80, 90 and 130-saw cylinders and cylinders with even more saws. At the same time, increasing the number of saws over 90 requires changing the dimensions of the fiber separation machine.

Ion-plasma nitriding is a multi-factor process of chemical and thermal treatment. The structure, phase composition and characteristics of the diffusion layer formed in the glow discharge conditions are determined by a number of technological factors. By controlling them, you can adjust the thickness of the nitrided layer and its structural state, which determines the complex of the necessary properties of the hardened parts, taking into account the conditions of their operation. In addition to the usual technological factors that affect the efficiency of ion nitriding (temperature and duration of saturation, the composition of the gas medium), it has additional, due to the specifics of processing in the glow discharge (working gas pressure, electrical characteristics, interelectrode distance; configuration of parts and their location in the cage). Most of these factors are among themselves in a complex and yet insufficiently studied relationship. Therefore, the currently used ion nitriding processes are based on empirical data and experimental selection of rational modes of surface hardening of certain alloys [7].

The problem of increasing the efficiency of the circular saw unit of the saw cylinder of the fiber separation machine by increasing the resistance of the tooth can be solved through the use of ion-plasma nitriding. This technology makes it possible to significantly speed up the process of saturating the surface of the saw teeth with nitrogen, compared to traditional furnace nitriding. Thus, when nitriding saws of the saw cylinder node volunatarily machine carbon steel U8G plasma two-step vacuum-arc discharge (DVDR) for one hour, a layer with effective

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thickness up to 100 μm and hardness of up to 11.8 GPA. The resistance of the teeth of a circular saw that has undergone such treatment increases by 1.5-2.5 times compared to an unazed circular saw.

The proposed technology compares favorably with other known methods of hardening a circular saw in that a relatively deep diffusion layer with a high concentration of nitrogen is created in the steel [8]. During the subsequent hardening of the circular saw, nitrogen diffuses deep into the product, increasing the hardness and heat resistance of the steel at a depth of 0.7—1 mm.

The method of ion-plasma nitriding by the method of DVDR allows due to the high emission capacity of the plasma to provide cleaning, heating and high rate of nitrogen diffusion deep into the metal. Thanks to this solution, a high nitrogen concentration can be achieved in a short time (0.5—2 hours) in a thin (up to 200 microns) surface layer [9].

The implementation of the deep ion-plasma nitriding technology was carried out at the STANKIN-APP-1 plant (Fig. 1). The object of the study was a u8g steel circular saw and samples of the same steel for subsequent measurement of microhardness and phase analysis. In order to avoid deformation of the disc saw at high temperature conditions during the ion nitriding process, the tooling was developed, since the thickness of the disc saw is 0.95 mm (Fig.2).

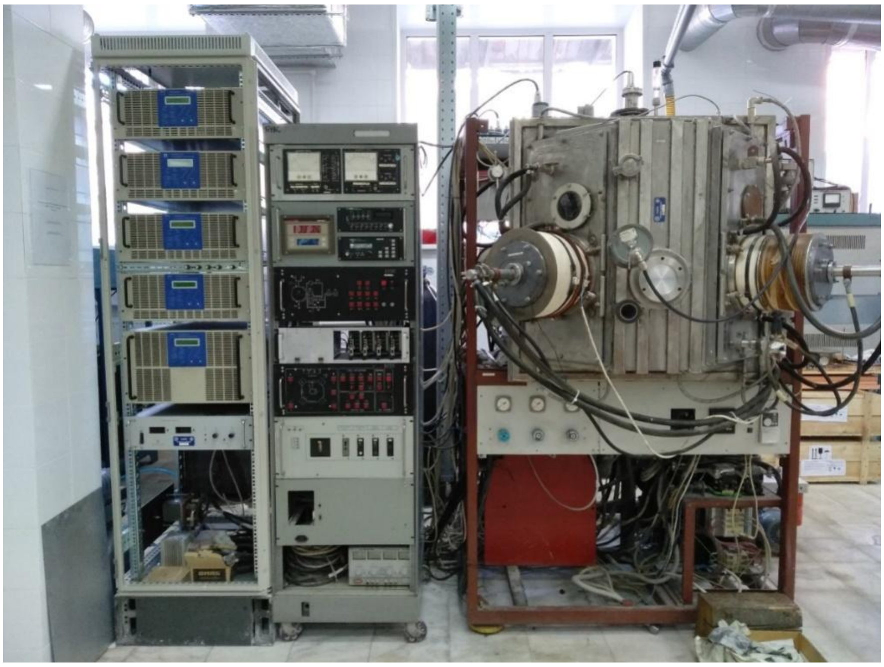

Fig.1. Vacuum installation "STANKIN-APP-1".

Technical characteristics of the installation for applying wear-resistant coatings "SANKIN-APP-1".

- Available coatings-TiN, (TiNbAl) N, (TiCr) N, ion nitriding
- The number of arc evaporators-6, the possibility of installing planar evaporators
- The size of the working chamber – Ø800x800
- Vacuum pumping system with steam oil pump
- Preliminary cleaning of the surface of products in a smoldering and two-stage vacuum-arc discharge and metal ions.
- The maximum weight of the cage is 100 kg.
- Power 50 kW

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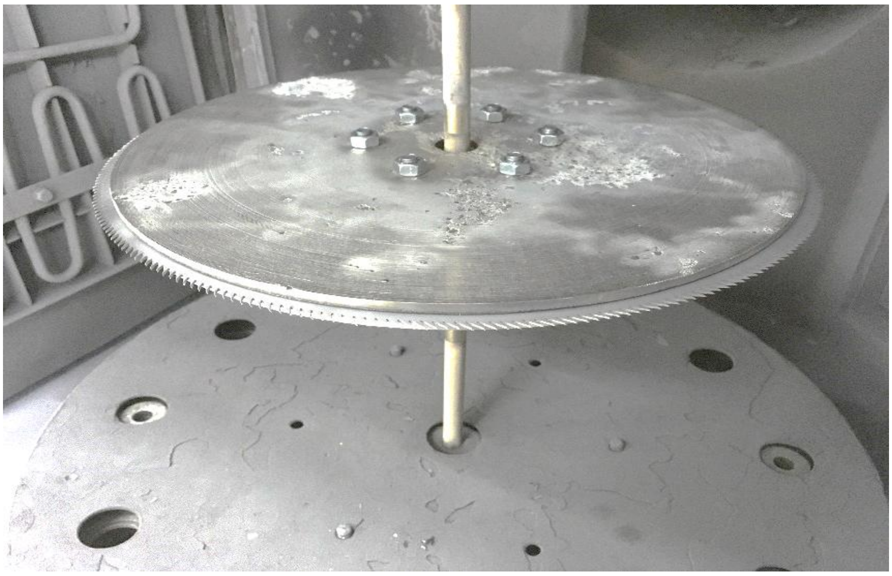

Fig.2. Disk saw with snap-in, placed in the vacuum chamber of the installation "STANKIN-APP-1".

Disk saw, after mechanical processing annealed steel tooling was placed in the vacuum chamber of the installation "STANKIN-APP-1". Then, it was heated to 650 °C in an argon medium at a pressure of 0.4 PA with simultaneous ionic cleaning of the surface. Ion-plasma nitriding was carried out at 650 °C in a pure nitrogen medium for 1 hour at the arc current ID = 80 A and the current of the additional anode ID = 75 A, while a bias voltage U = -700 b was applied to the table with the part. After nitriding, the disk saw slowly cooled down in the chamber to room temperature.

The results of measuring microhardness after ion-plasma nitriding are given in Chapter III, which allows us to indirectly judge the high concentration of nitrogen in a thin surface layer.

The created high concentration of nitrogen in the thin surface layer is necessary for further diffusion of nitrogen deep into the steel during the subsequent hardening process.

High hardness and heat resistance of steel U8G after processing, as well as a large depth of the hardened layer cause increased resistance of the teeth of the circular saw (Fig.3).

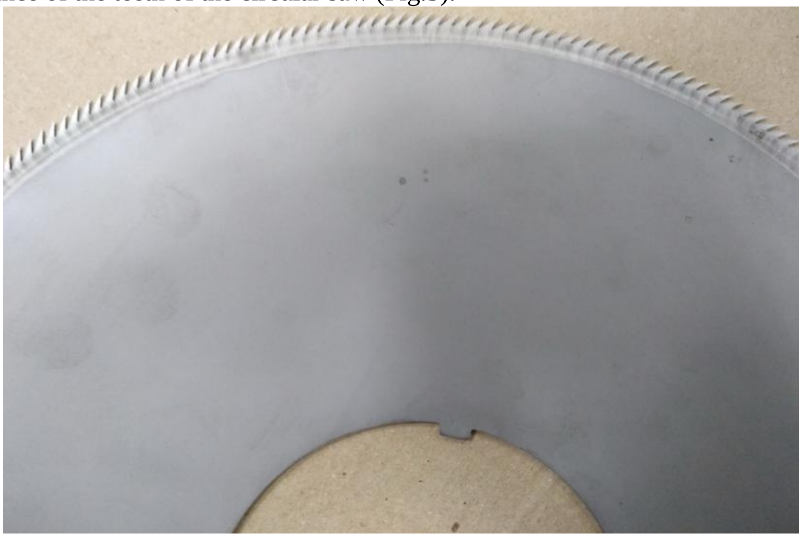

Fig. 3. Disc saw after nitriding.

For example, the resistance of teeth after deep nitriding is 2 times higher compared to non-nitrided ones.

Based on the above, we can draw the following conclusions.

1. A more suitable technology of deep ion-plasma nitriding was selected and its practical implementation was made on u8g steel disc saws.
2. Deep nitriding technology allows you to get a depth of the diffusion layer of more than 1 mm with increased hardness and heat resistance, while the process of saturation with nitrogen does not exceed 1 hour.
3. The results of resistance tests show the feasibility of using this technology for circular saws. The total resistance of the teeth of a circular saw made of U8G steel increased 2-2. 5 times compared to a circular saw without nitriding.

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