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NITROGEN HELPS THE CULTIVATOR WORKING OF THE ORGANS OF THE SIRTED COATING, HARVEST SHARING, LEARNING MICROSTRUCTURES

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Abstract

The article examines the structural and phase changes in surface diffusion nitride-oxide coatings obtained during nitriding in a gas environment followed by oxidation of ferrite-pearlite steels in water vapor, as well as the influence of phase changes on the corrosion properties.

Keywords: Ferrite, pearlite, nitriding, oxidation, diffusion coating, nitride layer, corrosion resistance.

Introduction

During nitriding of iron and its alloys in an environment containing ammonia at the saturation temperature of the eutectoid according to the "iron-nitrogen" phase diagram, the surface nitride zone consists of successive layers:

Fe_2N (ξ- phase)→ $Fe_{2\text{-}3}N$ (ε - phase) → Fe_4N (γ - phase). The ξ-phase is formed as a result of recrystallization of the ξ-phase during cooling in regions with nitrogen concentration of 11.0-11.35% (by weight).

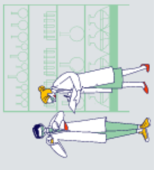
Methods

In the first stage of nitrooxidation for oxidation in water vapor, the processes of obtaining a nitride layer by nitration in ammonia were studied. As mentioned above, the pre-eutectoid and eutectoid temperature ranges were studied for the "iron-nitrogen" system. The microstructure of the nitride layers obtained after nitriding at a temperature of 620^0C (eutectoid temperature) is presented in Fig. 1.

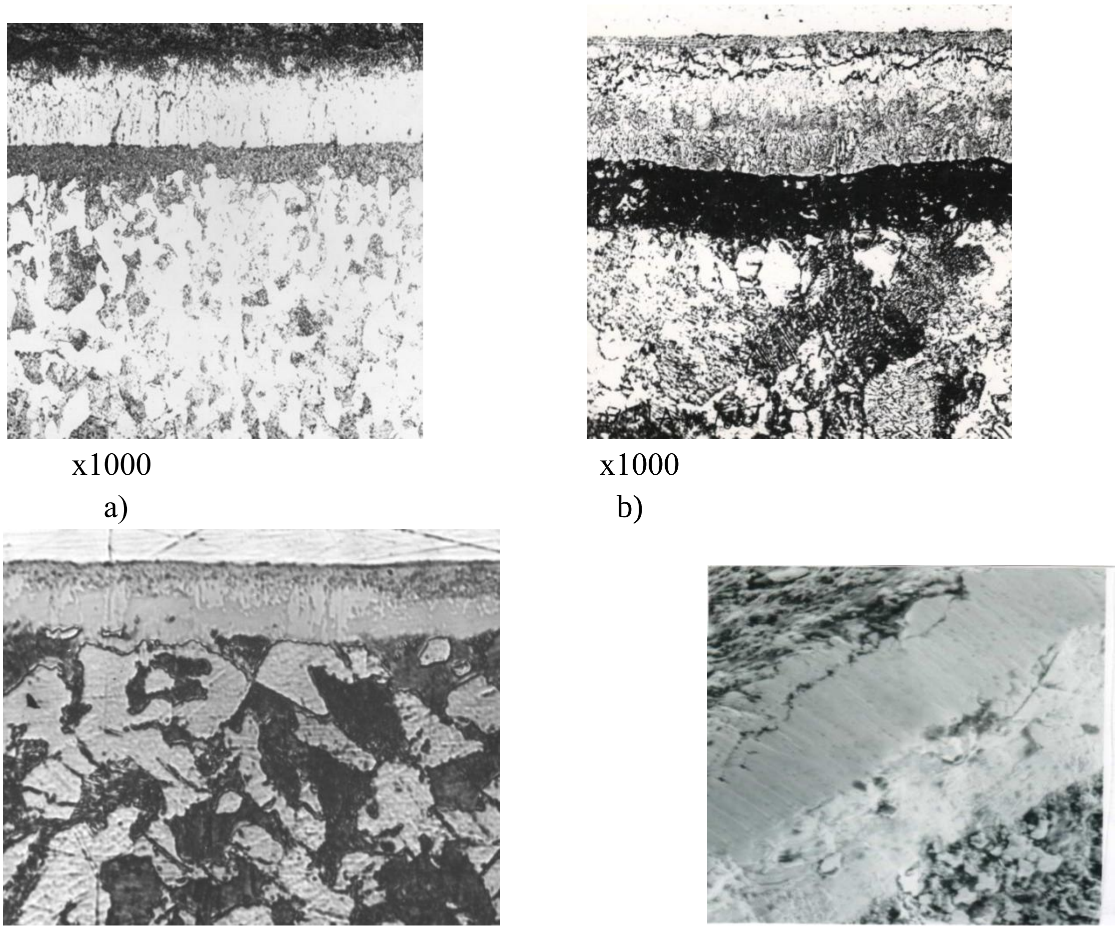
At the nitriding temperature above the eutectoid temperature (at 620 ° C), a columnar structure of the surface zone is observed in the nitrogen layer, its large crystals have a value equal to the thickness of the ε -phase.[1] A small number of pores and cracks are noted between the crystals, the boundaries between the crystals are very open. ξ- and ε-phase layers have a lot of pores, the walls of which are oxidized (Fe_2O_3) upon cooling.

Results and its Discussion

The formation of pores is related to the metastability of nitrite phases, from which nitrogen tends to be released in free form. This leads to the formation of a volume of gaseous nitrogen in dislocations, grain boundaries and developed voids, which, under high pressure, is first in



the atomic and then in the molecular state. Probably, under the influence of this pressure, pores are formed in dislocations (grain boundaries) in the nitride coating[2].



x1000
a)

x1000
b)

x1000
c)

x1000 (РЭМ)
g)

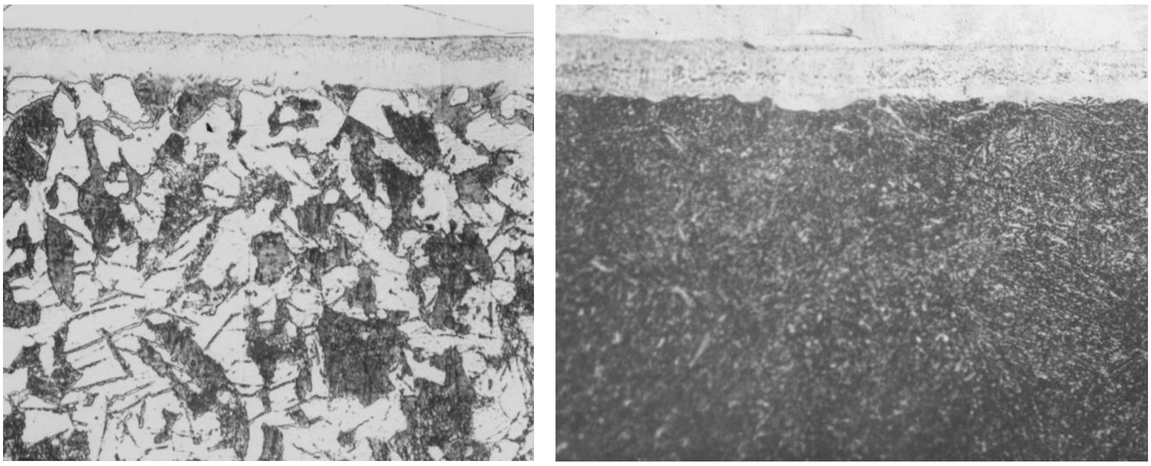
a – Steel 20, ammoniacal dissociation of degree acid nitrogenated a = 30-45%;
b - Steel 40X after softening ammonia a = 30-45% dissociation of degree acid is nitrogenized;
c - Steel 20, ammoniacal dissociation of nitrogenous acid a = 70-85%;
g - Steel 45, ammonia a = 45-60% dissociation of degree of acid is nitrogenized

Figure 1 shows the formation of microstructures of the nitrogen layer after nitriding at a temperature of 620^0C.

Carrying out the nitriding process at a high eutectoid temperature with a nitrogen-rich environment and subsequent rapid cooling leads to the formation of a γ-eutectoid phase that enters the nitrogen layer (Fig. 1, a and b). In nitriding of low-carbon steels, due to the small amount of carbon in the steel matrix, the formation of γ-eutectoid is slightly brighter (Fig. 1, a), and in carbon steels, the unabsorbed nitrogen layer is darker in color (Fig. 1, b).

At a low nitrogen potential eutectoid temperature, the nitride layer can be obtained by nitriding with slow cooling before the γ- eutectoid (Fig. 1, v), but the columnar structure and porosity of the ε- phase remain unchanged (Fig. 1, g.)[3]

When studying the nitride layer obtained at temperatures below the eutectoid temperature, it is characterized by the overall small thickness of the insufficiently developed ε-phase (Fig. 2).



x500 x500

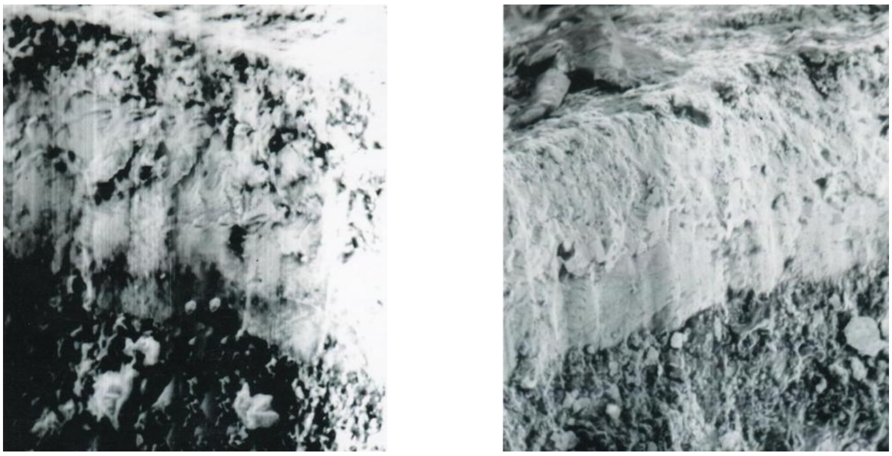
a) b)

a – Stal 20 (after annealing); b – Stal 40X (after improvement).

Figure 2 - Microstructure of steel after nitriding at 550^0C for 3 hours

If the nitriding process is at a temperature closer to the eutectoid temperature, obtaining a nitride phase with a very small number of pores and the required thickness of the ε-phase can be in a very short temperature range (from 570 - 590 ° C) (Fig. 3)[4].

In the microstructure of the nitride layers taken at the dissociation level of ammonia α = 30-45%, there are some pores in the saturated zone in the form of accumulation of matrix carbon and free nitrogen (Fig. image, b)[5].



x1000 (РЭМ) x1000 (РЭМ)

a) b)

a - ammonia dissociation level α = 30-45%;
b - ammonia dissociation level α = 45-60%.

Figure 3 - Microstructure of Stal 45 after nitriding at 580^0C for 3 hours.

The formation of pores in the nitride layer occurs when the atmosphere is saturated with this medium at a high nitrogen potential; in particular, accumulation of nitrogen from the atmosphere in the nitride layer and carbon from the steel matrix prevents the incorporation of carbon into the ε-phase with the formation of high-nitrogen nitride. The layer isomorphous to the ε-phase is the carbonitride phase - Fe(N,C) (ε΄-phase)[6].

Nitrite layer of the required thickness or ε+ε΄-phase mixture can be obtained by nitriding the steel by setting a certain value of ammonia α = 45-60% (nitrogen potential of the atmosphere) of the dissociation level in the atmosphere of the more developed ε-phase for pre-oxidation and in the furnace atmosphere[8].

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