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# EVOLUTION OF THE STRUCTURE AND PROPERTIES OF AISI 1020 STEEL SUBJECTED TO "ELION" NITRIDING IN A LOW-PRESSURE GAS DISCHARGE PLASMA*

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The nitriding technique for steel AISI 1020 with electron plasma component sample heating has been developed. A nitriding regime for 500 μm thick hardened layer formation has been revealed (Fig. 1). The steel surface layer microhardness increasing with an increasing in the nitriding temperature is shown that correlates with the relative content of the nitride phase. The maximum microhardness value in nitriding temperature range from 450 to 600°C was fixed at a temperature of 520°C in the near-surface layer at a depth of ≈10 μm. The steel wear resistance was established as depending on the nitrogen atoms concentration in the crystal lattice of α-Fe. The micropores in the steel surface layer nitrided at 520°C is shown to contributes the material wear increasing under dry friction conditions.

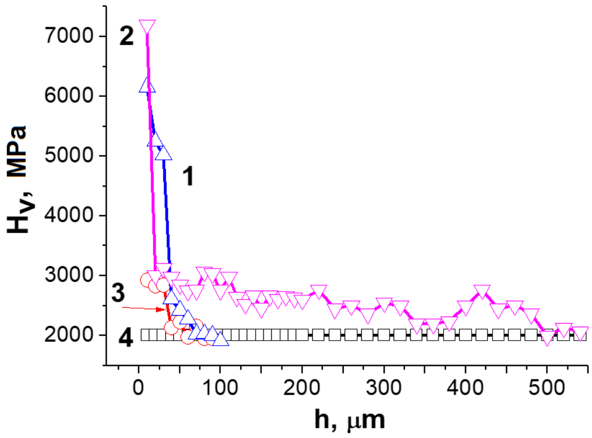


Fig.1. Microhardness profiles of AISI 1020 steel samples subjected to nitriding at temperatures of 600°C (curve 1), 520°C (curve 2), and 450°C (curve 3); curve 4 - AISI 1020 steel in the initial state

Nitriding of AISI 1020 steel samples was carried out in the “elion” mode, which provides efficient heating of the processed samples by the electronic component of the plasma.

It has been established (using X-ray microanalysis) that the nitrogen concentration in the surface layer of steel varies nonmonotonically, reaching a minimum value of 13.5 at. % at a nitriding temperature of 520 °C. It is shown that after steel nitriding at temperatures of 520°C and 600°C, the main phase (85 and 93 wt. %) of the surface layer of the samples is iron nitride of composition Fe4N; at a lower temperature, the main phase (97 wt. %) is a solid solution based on α-iron.

It has been found that the microhardness of the surface layer of steel increases with an increase in the nitriding temperature and depends in a correlated manner on the relative content of the nitride phase. It is shown that the maximum value of microhardness at nitriding temperatures of 450 °C and 600 °C is fixed on the nitriding surface; at a temperature of 520 °C - in the subsurface layer at a depth of ≈10 μm. The greatest thickness of the hardened layer (up to 500 μm) is achieved after nitriding at 520°C. It has been established that steel samples nitrided at 520°C are characterized by relatively high wear values, which is primarily due to the presence of micropores that contribute to material embrittlement.

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