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Improvement of Wear and Corrosion Resistance of Steel by Anode Plasma Electrolytic Nitriding

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The influence of the electrolyte composition on basis of ammonium chloride with ammonia or ammonium nitrate and the regimes of the anode plasma electrolytic nitriding of structural steel (0.45% C) on its properties was investigated. The structure of the steel surface after PEN is composed of an oxide layer (include FeO and Fe₃O₄ oxides), nitride-martensite layer (include martensite, retained austenite and Fe₄N и Fe₂-3N nitrides) and martensite-ferrite layer (include martensite, retained austenite and solid solution of nitrogen). It is shown that the electrolyte contained ammonium chloride and ammonium nitrate provides the saturation of steel with nitrogen up to 5.6wt.% and obtaining the hardened surface layer up to 0.09 mm with microhardness 1060 HV, decrease in the friction coefficient of 1.26 times, increase in the wear resistance of 2.37 times, decrease in the corrosion current density from of 61 to 4 mA/cm². The electrolyte contained ammonium chloride and ammonia provides the saturation of steel with nitrogen up to 2.4wt.% and obtaining the hardened surface layer up to 0.13 mm with microhardness 1200 HV, decrease in the friction coefficient of 1.42 times, increase in the wear resistance of 3.17 times, decrease in the corrosion rate of 1.58 times.

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Keywords

plasma electrolytic nitriding
diffusion saturation
microhardness
corrosion resistance
wear rate