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Increasing the wear resistance of austenitic steel 321 by electrolyte-plasma nitrocarburizing

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The purpose of this work is to increase the wear resistance of steel 321 by electrolyte-plasma saturation of the surface with nitrogen and carbon.
As a working electrolyte, a solution of the following composition was used: 10% (by weight) of glycerol, 7% (by mass) of ammonium nitrate and 8% of ammonium chloride. The treatment temperature varied from 650 ° C to 950 ° C in 50 ° C increments, with quenching from the heating temperature.
EDX analysis data show that when the heating temperature is increased from 650 to 800 ° C, an insignificant increase in nitrogen concentration is observed up to 0.2% at a depth of up to 15 μm. Further heating increases both the nitrogen content up to 2.32% and the depth of its penetration into steel (up to 35-40 μm).
In the temperature range from 650 to 800 ºC, the microhardness slightly increases from 242 HV_{50} to 279 HV_{50}. A further increase in the heating temperature increases the surface microhardness to 455 HV_{50}
X-ray diffraction analysis showed that after the PENC, mixed oxides of the composition Fe_2O_3 (hematite) and Fe_3O_4 (magnetite) are formed on the surface of the samples. A further increase in temperature reduces the intensity of these peaks, which indicates a decrease in the proportion of these phases. The initial roughness of the samples was 1 ± 0.1 μm. After processing, the roughness values of the surface are reduced by approximately a factor of 2 and are 0.65 ± 0.1 μm at all heating temperatures, which indicates an intensive dissolution of the steel surface under PENC. The roughness dependence on the treatment temperature was not found.
It was found that with dry friction by a counter-body made of alumina at a normal load of 5 N in a friction path of 100 m, the minimum value of mass wear of 3.0 mg is observed at a treatment temperature of 800-900 ° C. When rubbing an untreated sample under the same conditions, the mass wear is 4.0 mg. The coefficient of friction increases non-uniformly from 0.65 to 0.68 with increasing treatment temperature from 650 to 950 ° C.

Keywords
wear resitance
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