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Plasma electrolytic process compete gaseous plasma nitriding of AISI 1045 steelAhmad Reza Rastkar¹, Amir kiani¹, Faezeh Alvand¹, Babak Shokri¹¹Shahid Beheshti University, Tehran, Iran

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AISI 1045 (Ck45) carbon steel was plasma nitrided (PN) and plasma electrolytic nitrocarburized (PEN) at different conditions. The PN treatments were performed at temperatures of 500 and 550 °C in N₂:H₂ gas ratios of 1:3 and 3:1 and the working pressure of 10 mbar for 1 to 4 hours. The PEN processes were carried out at voltages of 250 to 400 volts and in alkali solutions of varying concentration for the time intervals of 10 to 60 min. Samples were examined by X-ray diffraction, optical, electron and atomic force microscopy, microhardness tests, roughness measurements and wear tests. The PN process produced compound layers of monophase γ (Fe₄N) or two phase ϵ (Fe₂₋₃N) and γ (Fe₄N) and PEN process formed a mixture of successive layers of γ (Fe₄N) and/or ϵ (Fe₂₋₃N) in combination with iron carbide (Fe₃C) on the surface of AISI 1045 (Ck45) carbon steel. The hardness of some PEN samples was as high as PN samples. The friction coefficient of PEN samples was not lower than that of [PN samples](#) and untreated material due to their greater porosity on the surface. However the friction coefficient of PN samples was lower than that of untreated samples. It has been observed that plasma nitriding increases the wear resistance of iron alloys up to several times. In this study, it was observed that some PEN processes improved the wear performance of AISI 1045 (Ck45) carbon steel to that of PN samples.

Keywords

plasma electrolytic nitrocarburizing

iron nitride

AISI 1045

alkali solution

nitrogen