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ABSTRACT

A plasma electrolytic nitrocarburizing (PEN/C) process was used to produce a protective coating on the surface of 45# carbon steel under a pulsed direct current power mode in a urea electrolyte. The effects of pulse frequency and duty cycle on the microdischarge characteristics and coating microstructure were investigated. The results show that the pulse frequency has a small effect on the breakdown voltage. However, the micropore size in the formed worm-like feature of the sample surface increases with increasing pulse frequency. Carbide, nitride and oxide phases were identified in the PEN/C layers. The microhardness increases with increasing pulse frequency. Increasing duty cycle results in a gradual decrease of the breakdown voltage. At low duty cycles, both crater-shaped regions and worm-like features were observed. However, the microhardness of the formed PEN/C layers exhibits a minute variation, in spite of the increase of the duty cycle.

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