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Corrosion resistance of DLC hard coatings deposited over nitrided PH stainless steel

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Diamond-like coatings -DLC -are thin and hard coatings which can be deposited by plasma assisted techniques, such as Chemical Vapour Deposition (PACVD). DLC films are known to be inert, very hard, with a low friction coefficient against steel and ceramic materials and it can be considered as a good coating for precipitation hardening steels (PH) to increase work life of components used in plastic injection molds where abrasion and corrosion are the main degradation mechanisms.

In this work a DLC film was deposited over ion nitrided PH stainless steel Corrax® with a Si interlayer in a CVD Plasma, where the plasma was generated and sustained by an asymmetric pulsed DC discharge. A nitrided sample was compared in all tests with a DLC coated sample and a duplex one (nitrided+coating). Nitriding has been carried out in an industrial facility with a pulsed DC discharge.

Raman spectroscopy indicated that the film was hydrogenated amorphous carbon, with 20% H_2. The nitrided case was 14 microns thick, and the coating, 1.5-1.8 microns. The coated samples showed no signs of corrosion after 100 h immersion in a salt spray fog test. In the electrochemical tests the nitrided steel sample and the only coated one had a better behavior than the non treated steel but the duplex sample (nitrided+DLC) was the best, with the higher breakdown potential in 3.5% NaCl solution.