MICROSTRUCTURE AND CORROSION BEHAVIOUR OF ION NITRIDED AISI 316L COATED WITH TITANIUM NITRIDE

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Abstract

AISI 316L stainless steel is widely used in medical implants and a nuclear and chemistry industry due to its excellent corrosion resistance but its low hardness limits their potential applications. Plasma nitriding and titanium nitride (TiN) coatings are usually employed to improve the surface hardness of tool steels. In this work Ti-TiN bilayer coatings obtained with a vacuum arc on previously nitride AISI 316L in order to improve not only hardness but also corrosion resistance compared with the samples which were only nitrided and the non-treated samples.

The samples were DC plasma nitrided in the industrial equipment (IONAR S.A., Argentina) during 20h at 420∘C with 20% nitrogen partial pressure and hydrogen. After that, they were coated by means of a DC cathodic arc running 130 A current discharge between a titanium cathode and the vacuum chamber employed as anode. The samples were placed 30 cm away from the cathode surface and one group of samples was grounded and another was connected to 6kV negative pulsed bias voltage. TiN films were obtained employing a continuous nitrogen flux of about 25 sccm and a working pressure in the range of 1-3.10-2 Pa. The structural properties have been characterized by means of an optical microscope, scanning electron microscopy (SEM) and X ray diffraction (XRD). The corrosion behaviour was evaluated etching the samples with Marble reagent and by means of anodic polarization tests in NaCl solution.

The Ti and the TiN peaks can be distinguished in the XRD patterns of the coated samples, meanwhile, the XRD patterns of the nitrided samples showed the expanded austenite phase, the SEM images showed a compact surface with the presence of macroparticles and the film thickness was about 1μm. All coated samples resisted the marble reagent attack and in the polarization experiment, the duplex coated samples presented the best behaviour, lower corrosion potential and higher breakdown potential, although the nitrided sample improved also its corrosion resistance compared to the non-treated steel.

Keywords: TiN coating, ion nitrided, corrosion behaviour, PBII&D

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