

TRIBOLOGICAL STUDY OF A MULTILAYER COATING OF Ta/ZrN PRODUCED BY DC MAGNETRON SPUTTERING ON AISI-316L STAINLESS STEEL

M. Flores-Martínez^a, C. Hernández Navarro^b and E.D. García-Bustos^{c*}

*edgarciab@conacyt.mx

^a Universidad de Guadalajara, CUCEI,

Blvd. Marcelino García Barragán 1421, Ciudad Universitaria, 44430 Guadalajara, Jalisco, Mexico

^b Tecnológico Nacional de México, Instituto Tecnológico de Celaya,

Av. Tecnológico y García Cubas, Celaya, Guanajuato, Mexico

^c Cátedras-CONACYT, Universidad de Guadalajara, CUCEI,

Blvd. Marcelino García Barragán 1421, Ciudad Universitaria, 44430, Guadalajara, Jalisco, Mexico

KEYWORDS

Ta/ZrN multilayer coatings; wear; magnetron sputtering; 316L stainless steel

ABSTRACT

The implantation of artificial joints, in particular for replacing failed hard tissues such as artificial hip joints, dental implants, is used to help plenty of people to reestablish the function of damaged parts in their bodies. There is an increasing interest in the development of novel coatings or surface modification treatments to improve functional properties (mechanical, wear, corrosion, fretting, weight, cost, bioreaction, etc.) of metal biomaterials, such as stainless steel, titanium, and CoCrMo alloys are commonly used.

In this regard, Ta/ZrN multilayer coating with different modulation ratios was obtained by magnetron sputtering system and deposited. The DC power was fixed for Ta and Zr target at 200W and 45 W respectively. The working pressure was maintained at the range of 6×10^{-3} Torr. The N_2/Ar relation was 0.5. Pre-sputtering of 10 min was performed for cleaning the target surface prior to starting the deposition, with time deposition of 120 min for each layer. The multilayer was produced with and without nitrate injection time periods, obtaining coatings of 3 μm . The coating was characterized chemically and structurally with Scanning Electron Microscope-Energy Dispersive Spectroscopy (SEM-EDS) (Fig.1), X-Ray Diffraction (XRD) respectively.

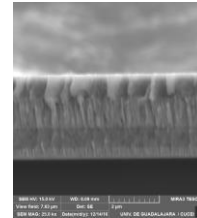


Fig.1 SEM image of TaZrN/TaZr multilayer coating.

The tribological tests were carried out by reciprocating sliding wear tests employing a 10 mm diameter Al_2O_3 ball as counter-body. The friction force was registered along the essays, the tests were carried out at applied loads of 0.5, 1, and 2 N, and a sliding time of 1800 sec at dry conditions. The wear tracks produced were characterized using optical microscopy (Fig-2), SEM, Raman spectroscopy and the wear lost was measured using stylus profilometer.

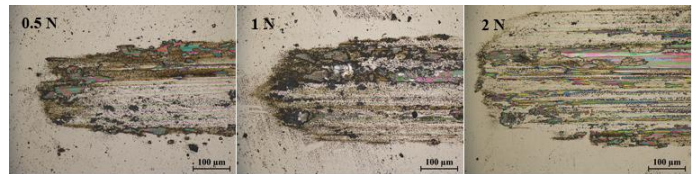


Fig.2 Optical micrographs of the wear tracks of the three layers TaZrN coating at different loads

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