

Improvement of adhesion and barrier properties of biomedical stainless steel by deposition of YSZ coatings using RF magnetron sputtering (Article)

[Sánchez-Hernández, Z.E.^{ab}](#), [Domínguez-Crespo, M.A.^a](#), [Torres-Huerta, A.M.^a](#), [Onofre-Bustamante, E.^a](#), [Andraca Adame, J.^c](#), [Dorantes-Rosales, H.^d](#)

^a Instituto Politécnico Nacional, **CICATA-Altamira**, Grupo CIAMS, C. P. 89600, **Altamira**, Tamps, Mexico

^b **CICATA - Altamira**, IPN. Grupo CIAMS, Carretera Tampico-Puerto Industrial **Altamira**, C. P. 89600, **Altamira**, Tamps, Mexico

^c Instituto Politécnico Nacional, Centro de Nanociencias Micro y Nanotecnologías, Departamento de DRX, C. P. 07300, Mexico, DF, Mexico

^d Instituto Politécnico Nacional, ESIQIE, Departamento de Metalurgia, C. P. 07300 Mexico, DF, Mexico

Abstract

The AISI 316L stainless steel (SS) has been widely used in both artificial knee and hip joints in biomedical applications. In the present study, yttria stabilized zirconia (YSZ, $\text{ZrO}_2 + 8\% \text{Y}_2\text{O}_3$) films were deposited on AISI 316L SS by radio-frequency magnetron sputtering using different power densities (50-250 W) and deposition times (30-120 min) from a YSZ target. The crystallographic orientation and surface morphology were studied using X-ray diffraction (XRD), scanning electron microscopy (SEM) and transmission electron microscopy (TEM). The effects of the surface modification on the corrosion performance of AISI 316L SS were evaluated in phosphate buffered saline (PBS) solution using an electrochemical test on both the virgin and coated samples. The YSZ coatings have a (111) preferred orientation during crystal growth along the c-axis for short deposition times (30-60 min), whereas a polycrystalline structure forms during deposition times from 90 to 120 min. The corrosion protective character of the YSZ coatings depends on the crystal size and film thickness. A significant increase in adhesion and corrosion resistance by at least a factor of 46 and a higher breakdown potential were obtained for the deposited coatings at 200 W (120 min). © 2014 Elsevier Inc.

Author keywords

316L stainless steel; Adhesion; Ceramic coatings; Corrosion; Magnetron sputtering