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Enhancement of rutile phase formation in TiO_2 films deposited on stainless steel substrates with a vacuum arc

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Abstract

The rutile phase of TiO_2 has raised a wide interest for biomaterial applications. Since rutile is generally synthesized at high temperatures, a deposition process based on a cathodic arc discharge has been investigated in order to obtain rutile coatings at lower temperature on stainless steel substrates. In this work, TiO_2 films were deposited on AISI 316L stainless steel substrates heated at 300 and 400 ºC with a negative bias of 120 V, employing Ti interlayers of different thicknesses. TiO_2 films of approximately 500 and 900 nm were grown on Ti interlayers with thicknesses in the range 0 - 550 nm. The effect of Ti interlayers on the crystalline structure of TiO_2 coatings was systematically studied with X-ray diffraction and Raman spectroscopy. The introduction of the Ti layer increased the rutile/anatase proportion either at 300 or 400 ºC, turning rutile into the main phase in the TiO_2 film. The largest amount of rutile for both temperatures was attained with a 55 nm Ti interlayer, the thinnest thickness studied.