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Structure and properties of TiO₂/TiN deposited on EBM modified stainless steel

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It is well known that the stainless steel alloys are widely used to manufacture stainless steel (SS) implant and instruments for medical applications. However, they have low shear strength and wear resistance. The application of hard PVD coatings on properly prepared stainless steel surface could basically improve the mechanical and functional properties.

The substrate material used in the present study was stainless steel 304. Previously, the substrates have been electron-beam modified followed by deposition of bilayered TiO₂/TiN coatings. This work concentrates on the nature and strength of the applied electron-beam surface modification (EBSM).

X-ray diffraction (XRD), atomic force microscopy (AFM), and nanoindentation were carried out to examine the effect of the EBSM and coating deposition on the crystallographic structure, phase composition, surface topography and mechanical properties of the bilayers. The results obtained in the present study for the hardness are discussed in the context of the crystallographic principles, and significant attention has been paid to the characterization of the phase composition and preferred crystallographic orientation. This, together with comparative analyses of the surface topography, quantitatively evaluated by statistical treatment of AFM data, are expected to give new knowledge of the processes which occur during the growth of TiN/TiO₂ coatings with and without electron-beam surface modification of the substrates.

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