Electrochemical and nanomechanical characterization of ZrN coated NiTi after plasma nitriding

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Abstract

Zirconium nitride (ZrN) thin films were deposited onto plasma nitrided NiTi shape memory alloy. The plasma nitriding process was made in the 100-500 °C temperature range, during 5 hours and after that, the samples were all coated with a ZrN thin film deposited at 500 °C during 90 minutes, maintaining fixed, all other deposition parameters. The deposition processes were carried out by direct current reactive magnetron sputtering using N2/Ar gas mixture. The nanomechanical properties, electrochemical behavior, phase composition, and texture were studied, using nanoindentation, electrochemical analysis, X-ray diffraction, scanning electron microscopy, Rutherford backscattering spectrometry and X-ray photo-electron spectroscopy. The results showed that nitriding process leads to the formation of Ni3Ti and TiN on NiTi surface. Also, the nitriding process influenced the deposition process once that the nanomechanical and electrochemical properties of ZrN thin films were influenced by the nitriding temperature. Furthermore, the color of the ZrN films deposited onto plasma nitrided NiTi alloy also changed with nitriding temperature. These results are discussed in terms of the diffusion of nitrogen and oxygen from NiTi nitrided layer to the ZrN thin film.

Keywords: corrosion, nitinol, plasma nitriding, biomaterials, shape memory alloy

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