

Structural, mechanical and corrosion resistance of Phosphorus-doped TiAlN thin film

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Doped TiAlN thin films are gaining unprecedented attention in recent times due to their functionality and tuneable properties to meet specific demands. The present article focuses on the influence of phosphorus-doped TiAlN thin films deposited using high-power impulse magnetron sputtering. Thin films of different elemental compositions of Ti, Al, and P were sputtered on AISI 5206 steel. The thin film cross-sectional morphology and architecture revealed dense and columnar structures. It was indicated that the (111) diffraction peaks in the XRD pattern shifted to higher angles, while the transverse optics (TO)/longitudinal optics (LO) frequency in the optic phonons region of Raman spectra shifted to the right with the modulation wavelength as the Al and P compositions increase. The elementary composition influences the mechanical properties with the maximum hardness of 28 GPa, and adhesion strength of 15 N attained in thin film with the highest Al and P content. The corrosion rate in all the thin films was reduced by at least two orders of magnitude compared with the uncoated samples. The addition of P increases the corrosion resistance of TiAl(P)N thin films.

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