A Facile Strategy for the Growth of an Anodic Oxidation Film of the Ti13Nb13Zr Alloy Driven by Residual Stress

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Anodizing offers a promising solution to improve the corrosion resistance of Ti and Ti alloys; however, the development of dense and thick anodic oxidation films remains an important scientific problem. Herein, we report a novel and facile strategy for the growth of an anodic oxidation film of the Ti13Nb13Zr alloy driven by residual stress. Under residual stress conditions, the gradient defect film on the Ti13Nb13Zr alloy surface is prepared. The change is coupled to an increase in surface defects and the surface Gibbs free energy, providing structural disorder and boosting the intrinsic activity of the Ti13Nb13Zr alloy surface, which strongly enhances the compactness, thickness and corrosion resistance of the Ti13Nb13Zr surface anodic oxide film. The thickness of the oxide layer increases up to 47.1% under the best residual stress condition. Furthermore, the donor density reduces by 500%, the self-corrosion potential increases by 30.4% and the self-corrosion current density decreases by 64.2%.

Keywords: Ti13Nb13Zr alloy; Shot peening; Residual compressive stress; Gibbs free energy; Corrosion resistance

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