

ZnO/TiO₂ Layered Nanostructures as Anti-Corrosion Coating for SS 304

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Abstract

Corrosion causes deterioration of materials and thereby effects materials' performance. Advances in the improvement of materials properties, in particular corrosion protection, can be achieved by surface coating and protective finishing. In this context, numerous approaches have been proposed, including corrosion inhibitors and organic/inorganic coatings. The use of inhibitors is favored in closed systems where the necessary concentration of inhibitor is more readily maintained meanwhile it presents some drawbacks such as toxicity, high cost and impossible to be used in open systems. Recently, the deposition of metal oxide (ZnO, TiO₂, SiO₂, Al₂O₃) coating layers as potential corrosion protection, has been widely reported in the literature.

The aim of this research work consists on the deposition of layer-by-layer (100-400) nm of ZnO/TiO₂ onto stainless steel 304 by cost-effective sol-gel dip-coating method. Detailed characterisation of the coatings has been carried out, Rietveld refinements of XRD patterns, surface morphology and topography by SEM and AFM, as well as optical properties. Corrosion measurements have been performed, potentiostatic (EIS) and potentiodynamic (Tafel plots). The obtained results indicate an excellent efficiency protection performance of 98% has been achieved.

Keywords: Corrosion; Stainless Steel; Sol-gel dip-coating; ZnO; TiO₂; Electrochemical impedance spectroscopy.