Corrosion Protection of AISI 316L Stainless Steel with the Sol-Gel Yttria Stabilized ZrO₂ Films: Effects of Sintering Temperature and Doping

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Nanostructured sol–gel zirconia (ZrO₂) films containing 3, 5 and 7 mol % Y₂O₃ of one and three layers were prepared on stainless steel X2CrNiMo17-12-2 (AISI 316L) surface by the dip coating method. Yttria stabilized zirconia (YSZ) deposited films were sintered at 400 and 600 °C. For the preparation of sol zirconium(IV) butoxide was used as precursor, *i*-propyl alcohol as a solvent with addition of nitric acid as a catalyst, acetylacetone as chelating agent and water for hydrolysis. Thickness of sol-gel YSZ films deposited on stainless steel was determined by glow-discharge optical emission spectrometry (GD-OES). It was found that thickness of deposited films is barely affected by yttria content while increases by increasing the number of layers and temperature of sintering. The crystal structure of films was determined by X-ray diffraction. The corrosion resistances of uncoated and coated specimens were studied by electrochemical impedance spectroscopy (EIS) and potentiodynamic polarization in simulated marine environment (3.5 wt. % NaCl aqueous solution) at room temperature. The influence of yttria stabilized zirconia (YSZ) layers number and temperature of sintering on the corrosion protection was examined as well. Sol-gel derived YSZ films are capable of appreciable improvement in corrosion resistance of stainless steel in the investigated corrosive medium.

Keywords: sol-gel, ZrO₂ films, GD-OES, electrochemical techniques

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