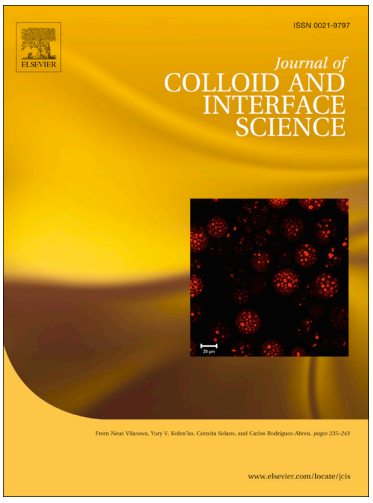

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Nanostructured superhydrophobic polysiloxane coating for high barrier and anticorrosion applications in marine environment

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Abstract

The use of epoxy and polyurethane coatings as marine topcoats, have been influenced by their inherent high surface energy property which increases their affinity to water and microorganisms. Thus, their susceptibility to degradation is enhanced. Because of this defect, recently, nanostructured hydrophobic and superhydrophobic polysiloxane coatings are being preferred as topcoats. But the appropriate nanoparticle size and matrix:filler ratio which provide guide for the design of desired topcoats are scarcely available. In view of this, a series of hydrophobic and superhydrophobic coatings were prepared by sol-gel process based on perfluorodecyltrichlorosilane (FDTS), different nanoZnO particles and poly(dimethylsiloxane) (PDMS):nanoZnO ratios. The liquid repellency, surface morphology and roughness of the coatings were conducted by use of contact angle goniometer, field emission scanning electron microscopy and atomic force microscopy, respectively. Additionally, the electrochemical and salt spray corrosion tests were conducted. According to the results, modifications of the coatings showed that anticorrosion performance was considerably influenced by the surface properties which were dependent on nanoZnO size and PDMS:nanoZnO ratio. Remarkably, the optimum effect was observed on the superhydrophobic coating based on 30 nm ZnO and 1:1 ratio. This displayed highest anticorrosion performance, and is therefore recommended as a guide for the design of marine topcoats.

Keywords: High-barrier performance; Electrochemical impedance spectroscopy; Perfluorodecyltrichlorosilane; Poly(dimethylsiloxane)-nanoZnO coating; Superhydrophobicity.

1. Introduction

Due to the great demand of steels for industrial construction of structural components, their protection and durability during service operations have become an inexhaustible research

PDMS = Poly(dimethylsiloxane). FDTS = Perfluorodecyltrichlorosilane. HDTMS = Hexadecyltrimethoxysilane. ZnO = Zinc oxide