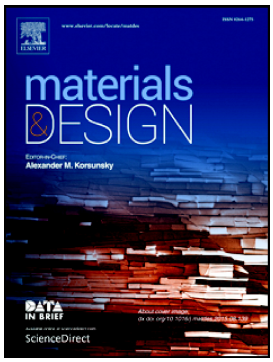

Fabrication of self-cleaning super-hydrophobic nickel/graphene hybrid film with improved corrosion resistance on mild steel

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Fabrication of self-cleaning super-hydrophobic nickel/graphene hybrid film with improved corrosion resistance on mild steel

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Abstract： A self-cleaning super-hydrophobic nickel/graphene hybrid film with hierarchical structure was successfully fabricated on mild steel (MS) by electro-deposition process followed by myristic acid modification. The surface morphology and composition were characterized by a field emission scanning electron microscope (FESEM) and attached energy dispersive X-ray spectrum (EDS). The results showed that the hierarchical nickel/graphene film was well formed with random pinecone-like nano-protrusions nickel array on every micro-graphene-protrusion. The super-hydrophobic surface exhibited excellent super-hydrophobicity with a static water contact angle (CA) as high as 160.4 ± 1.5° and a sliding angle (SA) as low as 4.0 ± 0.9°. The super-hydrophobic surface showed excellent anticorrosion performance, mechanical durability and long-term stability in 3.5 wt. % NaCl solution, which were characterized by electrochemical impedance spectroscopy (EIS), sandpaper abrasion and immersion tests. In addition, the super-hydrophobic surface also exhibited good self-cleaning performance.

Keywords: super-hydrophobic; mild steel; nickel/graphene hybrid film; corrosion resistance; self-cleaning

1. Introduction

In recent years, the worldwide cost for corrosion such as essential materials, equipment and services involving repair, maintenance, and replacement is about US $2.2 trillion, which is over 3% of the world’s GDP annually [1]. However, 20-25% of the cost can be saved if appropriate corrosion control technologies were applied [1]. Phosphating and chromating are traditional strategies and widely used for metal protection, nevertheless, both phosphorous pollution and high toxicity chromium (VI) are not environmentally friendly [2].