

Fabrication of Durable and Regenerable Superhydrophobic Coatings on Metallic Surfaces for Potential Industrial Applications

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Abstract : Fabrication of anti-corrosion and self-cleaning superhydrophobic coatings for metallic surfaces which are regenerable and durable in the aggressive conditions has shown tremendous interest in materials science. In this work, the superhydrophobic coatings on metallic surfaces (aluminum, steel, copper) were prepared by two-step and one-step chemical etching process. In two-step process, roughness on surface was created by chemical etching and then passivation of roughened surface with low surface energy materials whereas, in one-step process, roughness on surface by chemical etching and passivation of surface with low surface energy materials were done in a single step. Beside this, the effect of etchant concentration and etching time on wettability and morphology was also studied. Thermal, mechanical, ultra-violet stability of these coatings were also tested. Along with this, regeneration of coatings and self-cleaning, corrosion resistance and water repelling characteristics were also studied. The surface morphology shows the presence of a rough microstructures on the treated surfaces and the contact angle measurements confirms the superhydrophobic nature. It is experimentally observed that the surface roughness and contact angle increases with increase in etching time as well as with concentration of etchant. Superhydrophobic surfaces show the excellent self-cleaning behaviour. Coatings are found to be stable and maintain their superhydrophobicity in acidic and alkaline solutions. Water jet impact, floatation on water surface, and low temperature condensation tests prove the water-repellent nature of the coatings. These coatings are found to be thermal, mechanical and ultra-violet stable. These durable superhydrophobic metallic surfaces have potential industrial applications.

Keywords : superhydrophobic, water-repellent, anti-corrosion, self-cleaning

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