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Fabrication and Characterization of Zinc Based Superhydrophobic Coatings

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ABSTRACT

Zinc coatings are widely used in the surface finishing industry to improve the corrosion resistance of steel structures. Generally, an additional decorative hexavalent chromium layer is deposited for corrosion protection, which leads to carcinogenic chrome emissions. In this work, we present an electrodeposition based approach to fabricate superhydrophobic zinc coatings, that eliminates the need for the additional chrome layer while enhancing the corrosion resistance of the zinc coating by about one order of magnitude. Through electrodeposition in a highly conductive electrolyte, a multiscale needle and branch-shaped fractal morphology was obtained in the coatings, which were treated with stearic acid to obtain extreme water repellency in the prepared coatings, with contact angle of more than 160° and roll off angle of about 4–7°. Detailed microstructural and mechanical characterization studies are presented on the fabricated coatings under different processing conditions to demonstrate their durability, stability, longevity, and corrosion resistance. The presented process can be scaled to larger durable non-wetting coatings for diverse applications.

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