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Water-repellent coatings via electrodeposition

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The way that water wets a surface can be controlled by manipulating surface energies and/or surface topography. Although these factors can be controlled very well on the lab scale for certain kinds of materials, it is very challenging to achieve good control on compositionally heterogeneous surfaces such as stainless steel. Here, we show that mildly alkaline electrolytes can be used to produce zinc electrodeposits that, when capped with stearic acid to prevent oxidation, can improve the water repellent properties of stainless steel. The electrolyte composition and the applied potential during deposition influence the growth morphologies of crystallites within the electrodeposit. The capped electrodeposits display an impressive degree of water repellency, including extremely poor water droplet adhesion. We discuss physical and chemical factors that contribute to the water-repellent behaviours of these electrodeposits, and describe their potential applications to mitigate icing and corrosion in harsh offshore environments.

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