Nanosecond laser treatment for the design of superhydrophobic coatings with extremely long-ranged freezing delay, robustness to long-term contact with water, corrosion active media, cavitation, and abrasion

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An existing and emerging applications of laser-driven methods make an important contribution to the advancement in nanotechnological approaches for the design of superhydrophobic surfaces. In this study we describe the superhydrophobic coatings on various metals, designed by nanosecond IR laser treatment with subsequent chemisorption of fluorooxysilane. We have shown that one of the most important steps in fabricating the superhydrophobic coatings, i.e., surface texturing, applied to impart multimodal roughness, may be simultaneously used for modifying the physicochemical properties of the thick surface layer of the substrate itself.

Coating characterization reveals extreme water repellency, chemical stability in long-term contact with water, durable corrosion resistance in concentrated potassium halides solutions and excellent durability of functional properties under prolonged abrasive wear and cavitation loads. Besides, we will also show that the statistics of crystallization of ensembles of water and brine droplets deposited on the superhydrophobic coating show the long-term (hours) freezing delay at temperature of -20 °C.

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