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Bioinspired gradient surfaces with controlling of water collection/repellency

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Inspired by the roles of micro- and nanostructures in the water collecting ability of spider silk, a series of functional fibers are designed by using nanotechnology-related methods. The "spindle- knot/joint" structures demonstrate the cooperation of multiple gradients in driving tiny water drops to collect water at micro- and nano-level. The geometrical-engineered thin fibers display a much higher water capturing ability than normal fibers in fog flows; the bead-on-string heterostructured micro-fibers are capable of intelligently responding to environmental changes in humidity; the tiny water droplets can be controlled the transport in directions by designing the temperature, photo, rough-responded surfaces on fibers; the continuous size spindle-knots fiber can realize the droplet transport in a long distance for water collection in efficiency. By integrative gradient features of surfaces between spider silk and beetle back, a kind of wettable star-shape pattern surface also realizes the effect of water repellency rather than others. To develop the functional surface, the wettable gradients in different modes are fabricated onto the high adhesive surfaces, thus the high adhesive surface realize the controlling of droplet spreading in directions. Otherwise, learning from butterfly wing and plant leaf display water repellency and low-temperature superhydrophobicity, bioinspired surfaces with optimal micro- and nanostructures display distinctly anti-icing, ice-phobic and de-ice abilities. It also demonstrated further that the oriented or asymmetric features on geometries at micro- and nano-level can generate the driving of droplets and directional transport of drop, etc. These studies are greatly significant to help to design the novel functional engineering wettability-controlled surfaces.

Biography

Yongmei Zheng, PhD, is a Professor at the School of Chemistry and Environment, Beihang University. Her research interests are focused on bioinspired surface materials with gradient multi- structures for functions including water collection, transport of the condensed droplet, low- temperature superhydrophobicity, anti-icing, anti-frosting at interfaces and so on. Her publications are included in Nature, Adv. Mater., Angew. Chem. Int. Ed., ACS Nano, Adv. Funct. Mater., Small, Chem. Commun., J. Mater. Chem. A, Nanoscales, etc., with 12 Cover stories. She has published 1 book - titled *"Bioinspired Wettability Surfaces: Development in micro- and nanostructures"*.

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