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BIOINSPIRED WETTABILITY SURFACES: DEVELOPMENT IN MICRO- AND NANOSTRUCTURES

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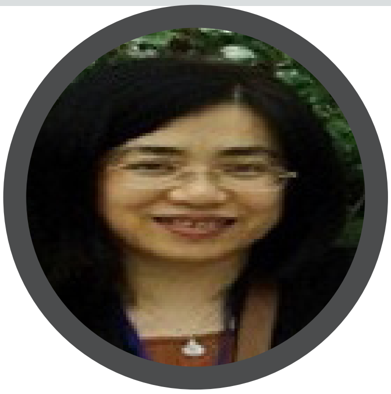

Biological surfaces create the enigmatical reality to be contributed to learning of human beings. They run cooperate between of endlessly arranged various-style gradient micro- and nanostructures (MN) that greatly provide with excellent functions via natural evolvement. Such biological surfaces with multi-gradient micro- and nanostructures display unique wetting functions in nature, which have inspired researchers to design originality of materials for promising future. In nature, a combination of multiple gradients in a periodic spindle-knot structure take on surface of spider silk after wet-rebuilding process in mist. This structure drives tiny water droplets directionally toward the spindle-knots for highly efficient water collection. Inspired by the roles of gradient MNs in the water collecting ability of spider silk, a series of functional fibers with unique wettability has been designed by various improved techniques such as dip-coating, fluid-coating, to combine the Rayleigh instability theory. The geometrically-engineered thin fibers display a strong water capturing ability than previously thought. The bead-on-string heterostructured fibers are capable of intelligently responding to environmental changes in humidity. Also a long-range gradient-step spindle-knotted fiber can be driven droplet directionally in a long range. An electrospun fiber at micro-level can be fabricated by the self-assembly wet-rebuilt process, thus the fiber displays strong hanging-droplet ability. The temperature or photo or roughness-responsive fibers can achieve a controlling on droplet driving in directions, which contribute to water collection in efficiency. Besides, inspired by gradient effects on butterfly wing and lotus leaves, the surfaces with ratchet MN, flexible lotus-like MN are fabricated successfully by improved methods, which demonstrate that the gradient MN effect rises up distinctly anti-icing, ice-phobic and de-ice abilities. These multifunctional materials can be designed and fabricated for promising applications such as water-collecting, anti-icing, anti-frosting, or anti-fogging properties for practical applications in aerospace, industry and so on.

Biography

Yongmei Zheng (PhD) is currently serving as a Professor at School of Chemistry, Beihang University. Her research interests are focused on bioinspired surfaces with gradient micro- and nanostructures to control dynamic wettability and develop the surfaces with characteristics of water repellency, anti-icing, anti-frosting or fog-harvesting, tiny droplet transport, water collection and so on. She has published more than 90 SCI papers in journals including Nature, *Adv Mater, Angew Chem Int Ed, ACS Nano, Adv Funct Mater*, etc., with 12 cover stories and a book entitiled as "*Bioinspired Wettability Surfaces: development in Micro- and Nanostructures*" by Pan Standard Publishing, USA. Her work as a Scientist was highlighted on News of Royal Society of Chemistry, Chemistry World in 2014. She is a Member of Chinese Society of Composite Materials (CSCM), Chinese Chemistry Society (CCS), American Chemistry Society (ACS), International Society of Bionic Engineering (ISBE), and International Association of Advanced Materials (IAAM). She won an ISBE outstanding contribution award in 2016, by ISBE and an IAAM Medal in 2016, by IAAM in Sweden.

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