Bioinspired Surfaces with Special Wettability

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The wettability of solid surfaces is a very important property, and is governed by both the chemical composition and geometrical microstructure of the surface. Currently, super-hydrophobic surfaces with water CA higher than 150° are arousing much interest because they will bring great convenience in daily life as well as in many industrial processes. Various phenomena, such as snow sticking, contamination or oxidation, and current conduction, are expected to be inhibited on such a surface. Conventionally, super-hydrophobic surfaces have been produced mainly in two ways. One is to create a rough structure on a hydrophobic surface, and the other is to modify a rough surface by materials with low surface free energy. While the water CA has commonly been used as a criterion for the evaluation of hydrophobicity of a solid surface, this alone is insufficient to assess the sliding properties of water droplets on the surface. A fully super-hydrophobic surface should exhibit both high CA and low sliding angle.

Our recent studies on lotus and rice leaves reveal that a super-hydrophobic surface with both a large CA and small sliding angle needs the cooperation of micro- and nanostructures, and the arrangement of the microstructures on this surface can influence the way a water droplet tends to move. These results from the natural world provide a guide for constructing artificial super-hydrophobic surfaces and designing surfaces with controllable wettability. Accordingly, super-hydrophobic surfaces of aligned carbon nanotube films, aligned polymer nanofibers and differently patterned aligned carbon nanotube films have been fabricated. The large scale fabrications of super-hydrophobic polymer surfaces have been developed by modification of the traditional template method, the adoption of one-step coatings and electrohydrodynamics, respectively. The super-hydrophobic surface is also realized in all pH range, which extends its applications not only to pure water, but to acid and base solution as well. By combining the two factors of super-hydrophobic and super-oleoliphilic, the water-oil separation mesh has been built successfully. Considering the arrangement of the micro- and nanostructures, the surface structures of the water-strider's legs were studied in detail, indicating the relationships between super-hydrophobicity and orientation of the micro- and nano-scale composite structures, which will guide us to fabricate micro-fluid devices artificially in the near future. In further, the cooperation between surface micro- and nanostructures and surface modification of poly (*N*-isopropylacrylamide) gave reversible switching between superhydrophilicity and superhydrophobicity in a narrow temperature range of about 10 °C. The transition can be enhanced by depositing the polymer onto patterned silicon substrates. Additionally, UV light stimulated switcher of superhydrophobic and superhydrophilic transition by aligned ZnO film are successfully obtained. These two kinds of switcher materials are intrigue great interest in the world and were reported as *Nature News* and *Science Editor Choice*.

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