Session 4

Design and Creation of Bioinspired Surfaces with Special Wettability

Lei Jiang Professor
Center of Molecular Sciences, Institute of Chemistry, Chinese Academy of Sciences
Beijing 100080, P.R. China
Tel: 010-82621396 Fax: 010-82627566
e-mail: jianglei@iccas.ac.cn

Bio-inspired smart materials should be a "live" material with various functions like organism in nature, they must have three essential elements as sense, drive and control. The putting forward of bio-inspired smart interfacial materials just bases on the above mentioned elements, while the design principle can be divided into five levels: (1) bio-mimetic and intelligently design of the materials; (2) cooperate of multi-scale structure effects; (3) design for the heterogeneous interfaces; (4) cooperate with various physical properties of different materials; and (5) bi-steady state effect. Our recent studies are focused on the design and fabrication of bio-inspired surfaces with special wettability based on these ideas. The 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. 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*.

Selected Publications:

1. Lin Feng, Shuhong Li, Yingshun Li, Huanjun Li, Lingjuan Zhang, Jin Zhai, Yanlin Song, Biqian Liu, Lei Jiang*, Daoben Zhu. "Super-hydrophobic Surfaces: From Natural to Artificial" Advanced Materials, 2002, 14(24), 1857.

2. Taolei Sun, Lin Feng, Xuefeng Gao, and Lei Jiang*. "Bioinspired Surfaces with Special Wettability" *Accounts of Chemical Research*, 2005,38,644.
3. Xinjian. Feng, Lei. Jiang*. "Design and Creation of Super-Wetting/Dewetting Surfaces" Advanced Materials, 2006, Review Article, In press.