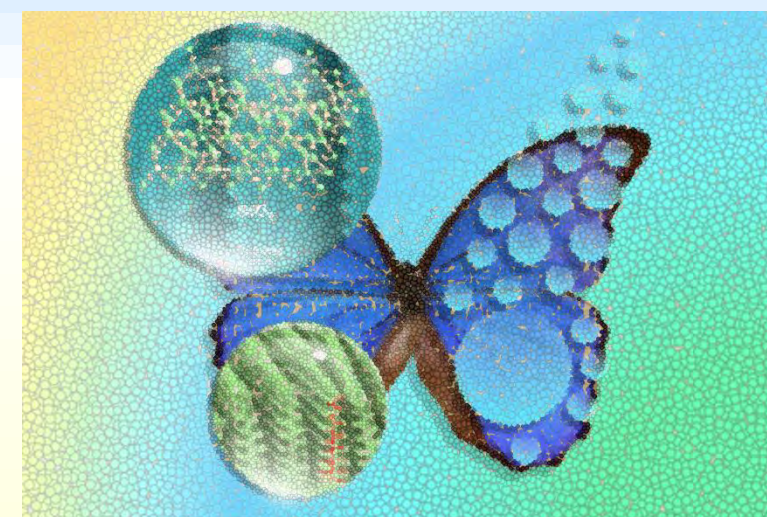


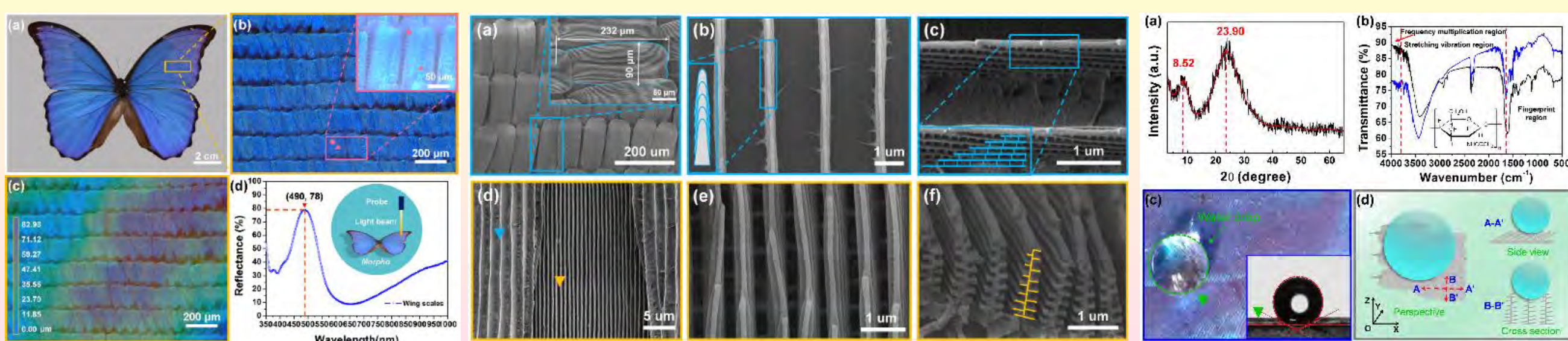
Active Antifogging Property of Monolayer SiO₂ Film with Bioinspired Multiscale Hierarchical Pagoda Structures

Antifogging surfaces with hydrophilic or even superhydrophilic wetting behavior have received significant attention due to their ability to reduce light scattering by film-like condensation. However, major challenges still remain in achieving high-speed antifogging performance and revealing the hydrophilic-based antifogging mechanism of transparent materials under aggressive fogging conditions. Herein, with inspiration from the fog-free properties of the typical *Morpho* butterfly wing scales, a monolayer SiO₂ film with multiscale hierarchical pagoda structures (MHPs) was designed and fabricated using a bio-template method. The biomimetic monolayer film (BMF) composed of nanoscale SiO₂ displays excellent antifogging properties. The MHPS-based BMF keeps high transmittance (~95%) under aggressive fog conditions. Moreover, it instantaneously recovered to a fog-free state (<5 s). Moreover, the underlying active antifogging strategy gathering initial fog capture and final antifog together was revealed. Such novel properties mainly benefit from the synergistic effect of both hydrophilic chemical compositions (nanoscale SiO₂) and physical structures (biomimetic MHPs) of the BMF. High-speed active antifogging performance of the biomimetic materials enables the retention of a high transmittance property even in humid conditions, heralding reliable optical performance in outdoor practical applications, especially in aggressive foggy environments.



Antifogging butterfly

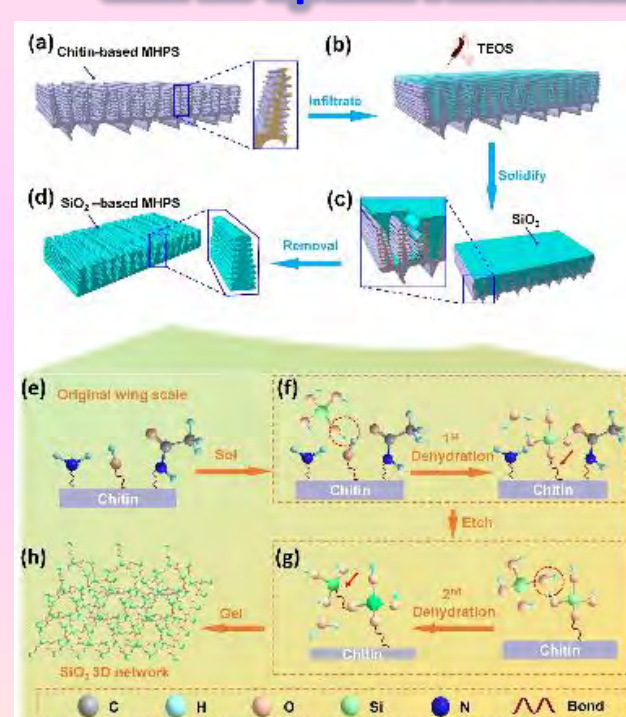
Results & Discussion



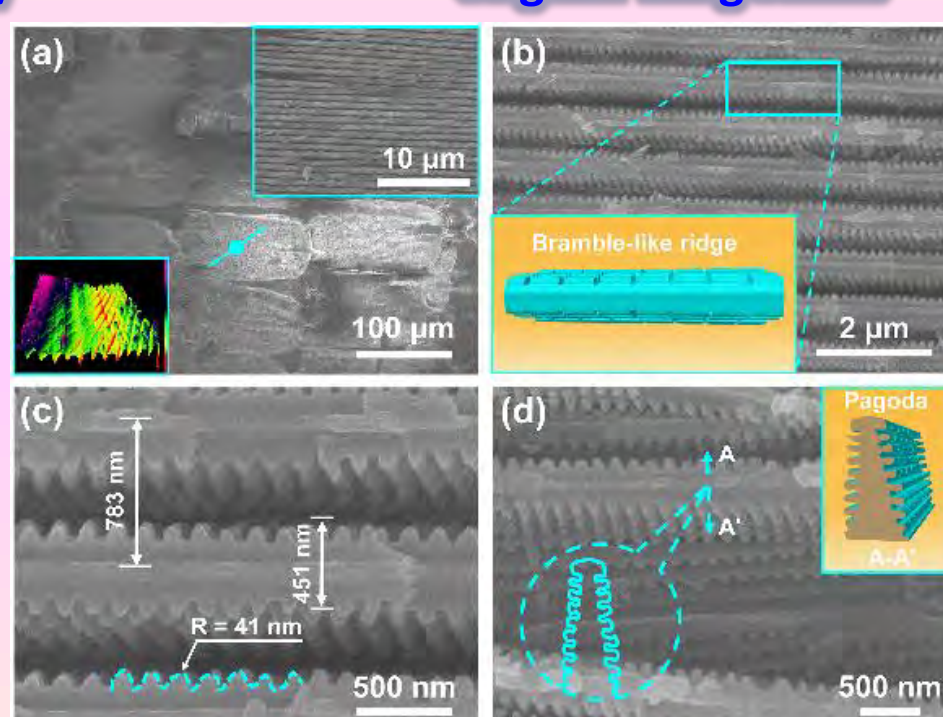
Wing surface of *Morpho* butterfly and its optical reflectivity

Multiscale hierarchical structures of original wing scales

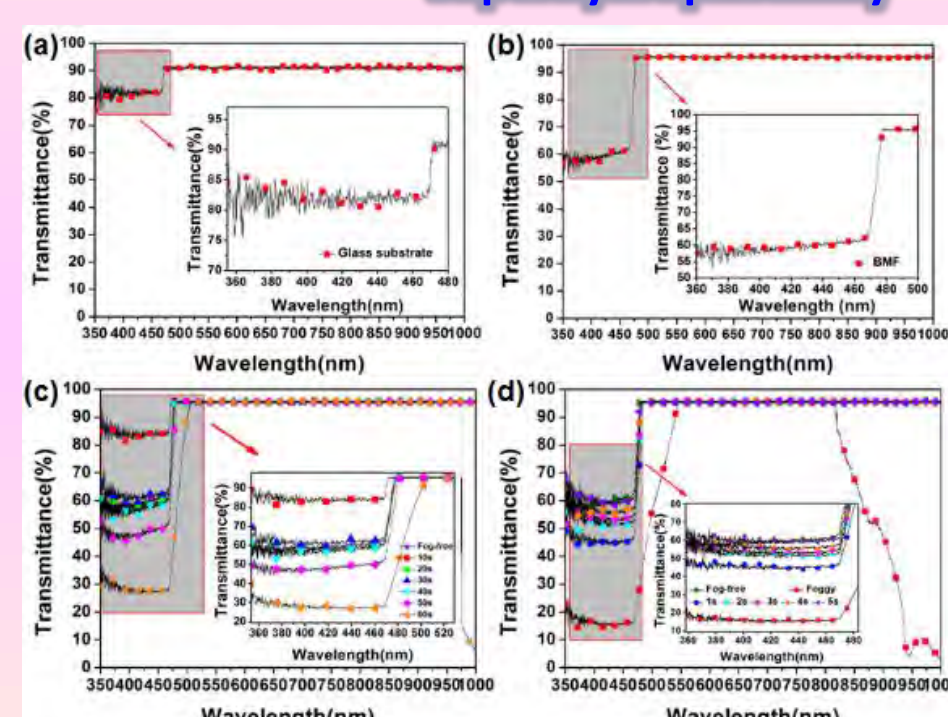
Composition analysis and superhydrophobicity



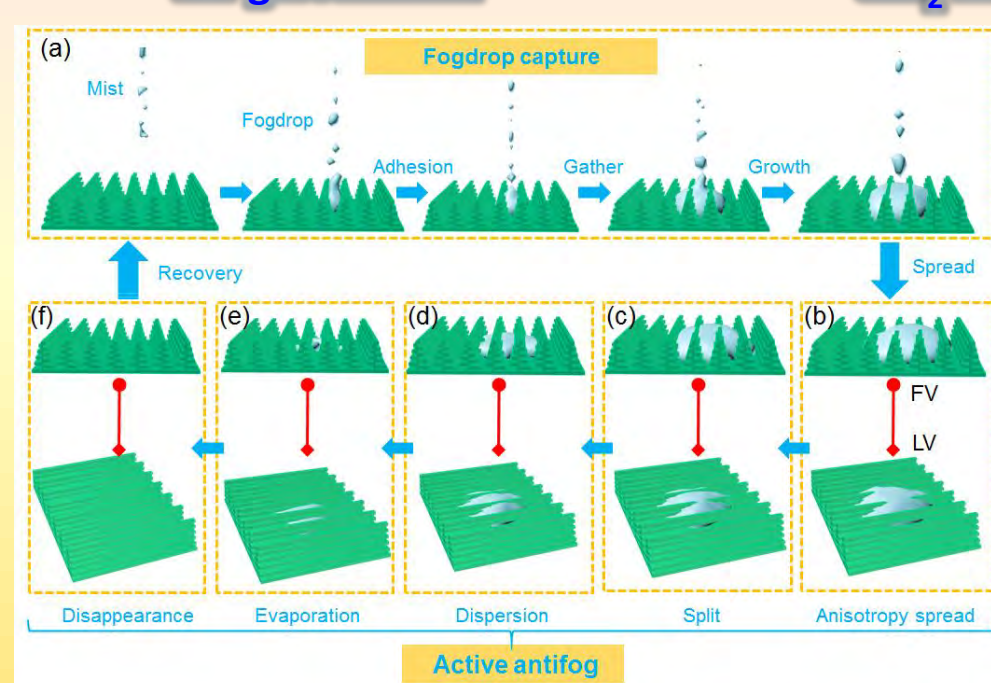
Biomimetic fabrication and sol-gel reaction



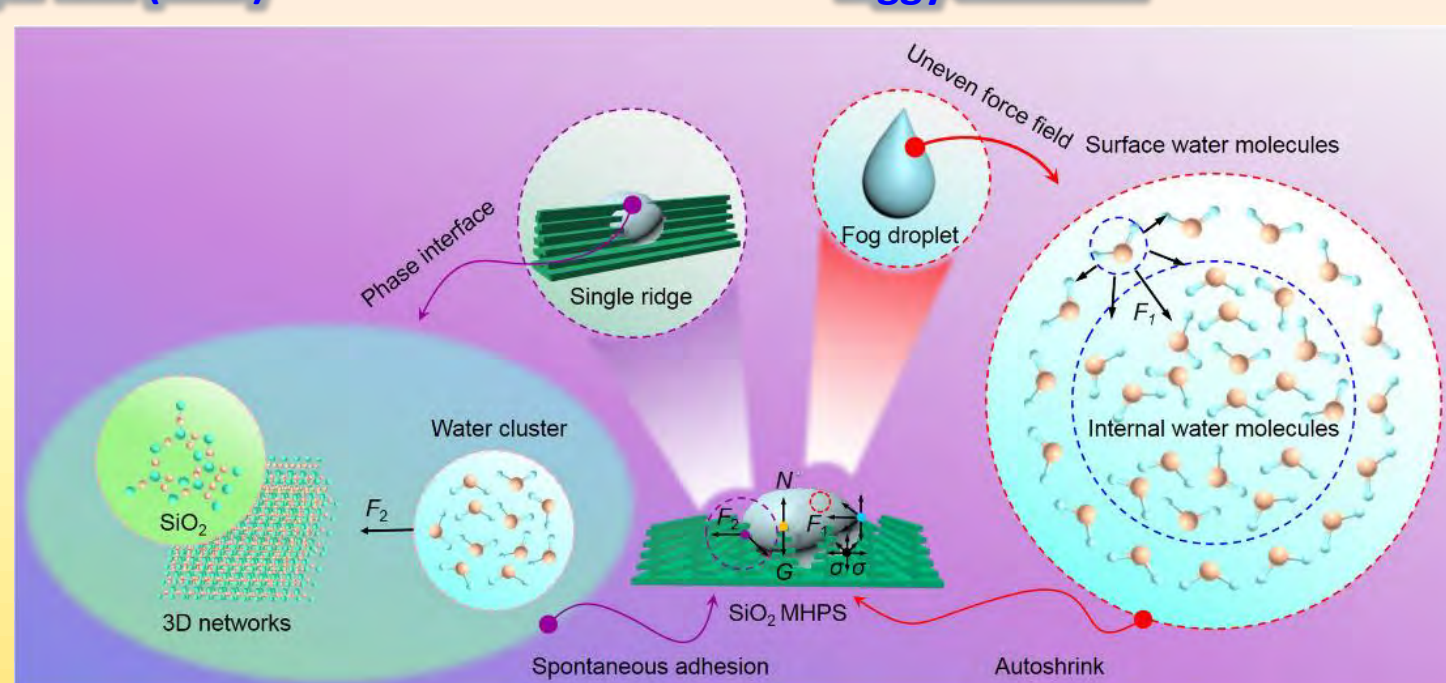
Morphology characterization of biomimetic SiO₂ monolayer film (BMF)



Transmittance of the BMF under aggressive foggy condition



Active antifogging behavior analysis



Active antifogging mechanism

Publication & Rewards

- ◆ Published in *ACS Nano*, 2016, 10(9): 8591-8602. (IF: 13.942, Highlighted by *Design for Science*)
- ◆ Grand Prize of "Elite Cup" Academic Competition in Jilin University
- ◆ First Prize of 2nd Bionic Research Exhibition in Key Laboratory of Bionic Engineering of Ministry of Education