

Controllable manipulation of bubbles in water by using underwater superaerophobic graphene-oxide/gold-nanoparticle composite surfaces

Ruixin Xu,^a Xiangyang Xu,^a Minghui He,^{*b} Bin Su^{*c}

^aSchool of Media and Communication, Shenzhen Polytechnic, Shenzhen, 518055, China

^bState Key Laboratory of Pulp & Paper Engineering, South China University of Technology, Guangzhou 510640, China. E-mail: heminghui_2008@163.com

^cDepartment of Chemical Engineering, Clayton, Vic 3800, Australia. E-mail: subin0000@iccas.ac.cn

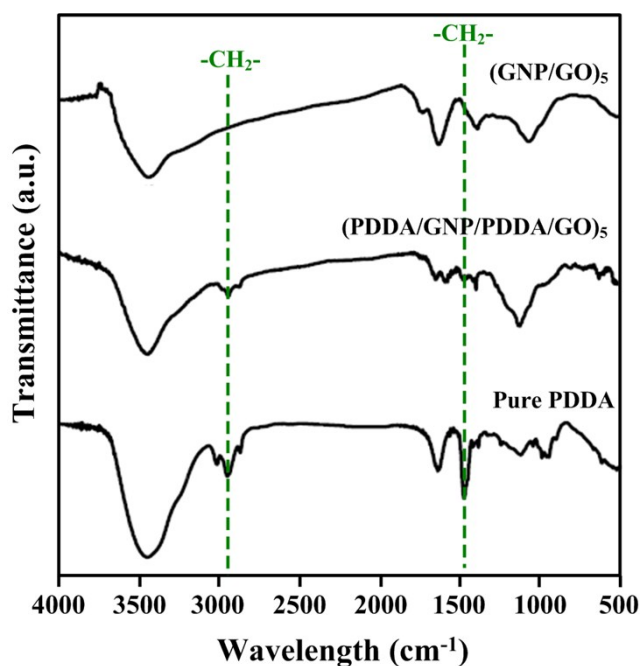


Fig. S1 Fourier transform infrared spectroscopy (FTIR) spectrum of (GNP/GO)₅, (PDDA/GNP/PDDA/GO)₅ hybrid films and pure polydiallyldimethylammonium chloride (PDDA). In the case of the (PDDA/GNP/PDDA/GO)₅ hybrid film (before the heating treatment) or pure PDDA, both spectra showed the characteristic absorption bands in 2929 cm⁻¹ (-CH₂- symmetrical stretching frequency) and 1469 cm⁻¹ (-CH₂- stretching vibration). However, these two peaks disappeared in the (GNP/GO)₅ curve (after the heating treatment), indicating the removing of organic PDDA from the hybrid film.

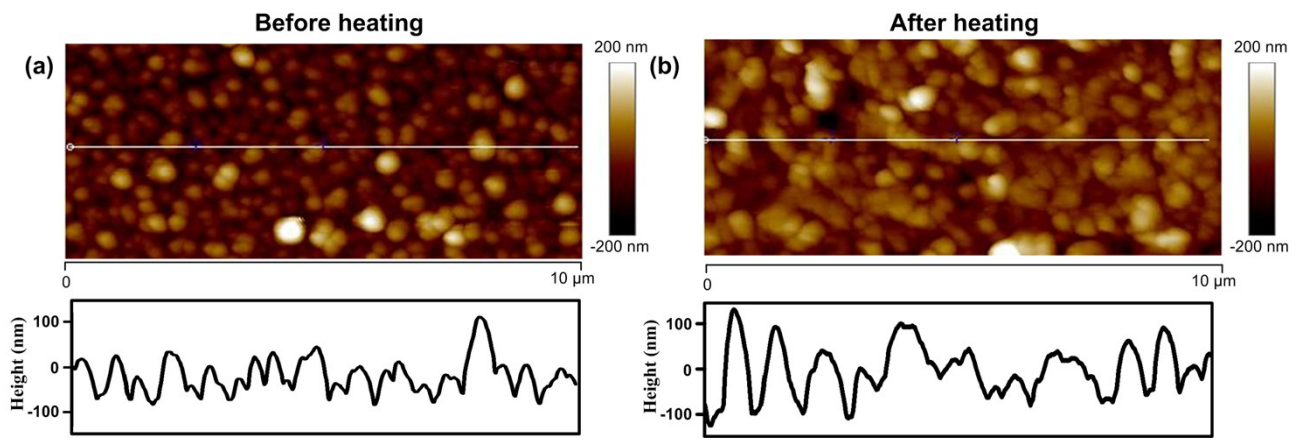


Fig. S2 The heating treatment facilitated the construction of considerable surface roughness through partly aggregation/ merging of GNPs. Atom force microscope (AFM) investigation of the (GNP/GO)₅ hybrid film (a) before and (b) after the heating treatment.

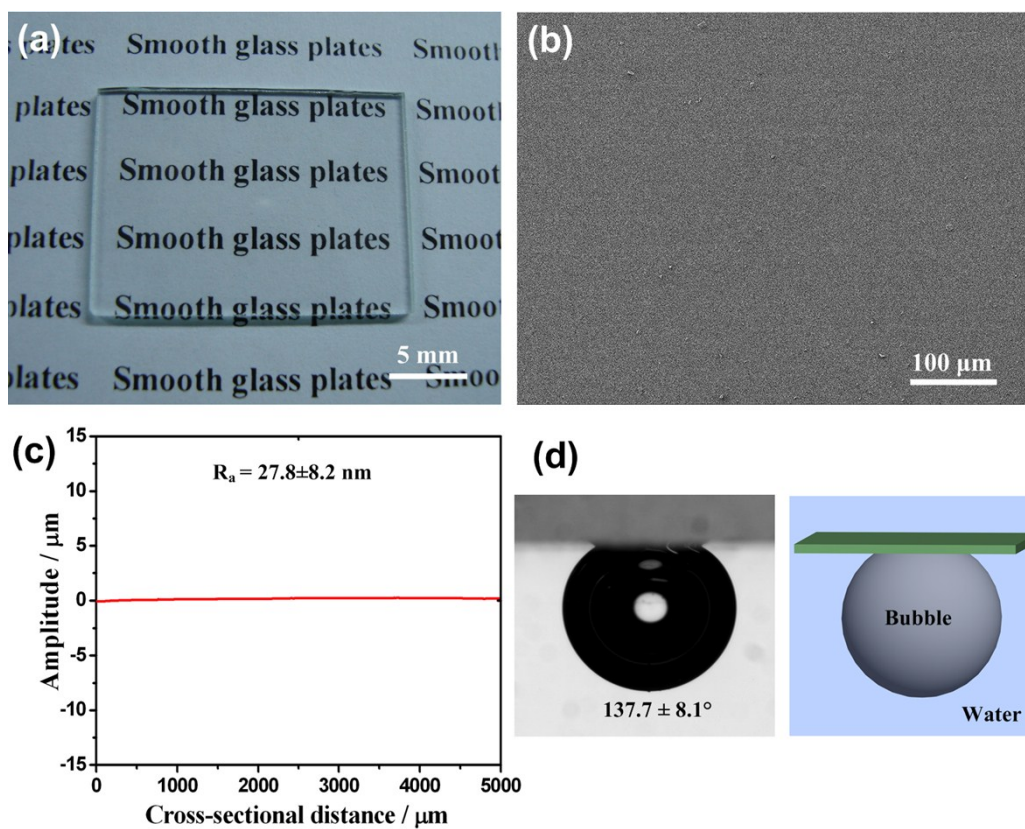


Fig. S3 Underwater aerophobicity of a bare glass plate. (a) Photograph and (b) top-view scanning electron microscope (SEM) image of a bare glass plate. (c) Cross-sectional profile of the glass plate. (d) Photograph of a bubble placed below the downward glass plate under the water surface. Right is the schematic illustration.

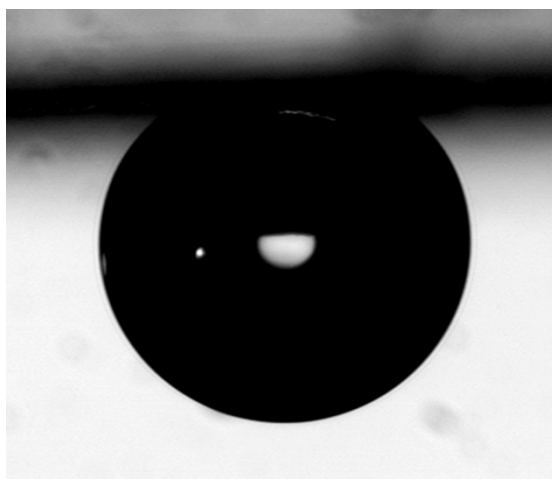


Fig. S4 Photograph of a bubble placed below the downward (PDDA/GO)₅ hybrid films under the water surface.

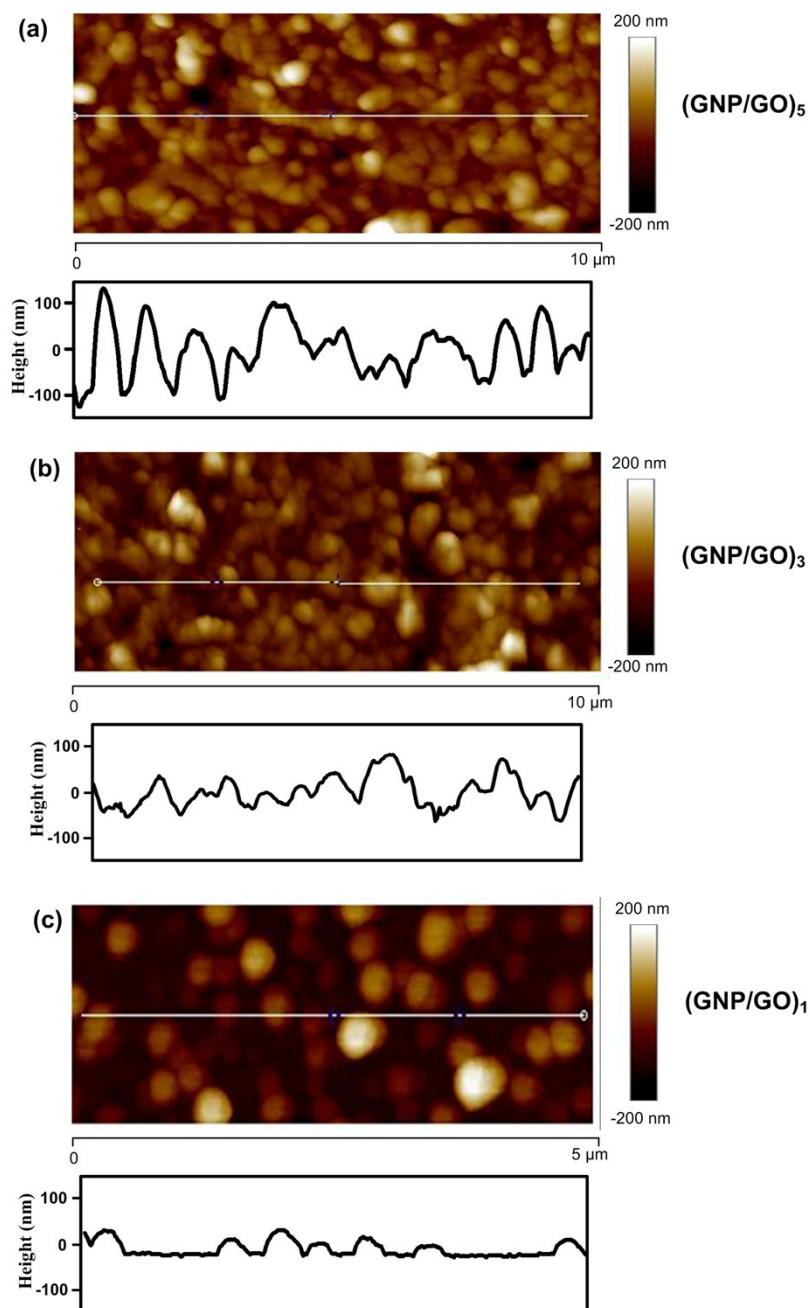


Fig. S5 AFM investigation of (a) $(\text{GNP}/\text{GO})_5$, (b) $(\text{GNP}/\text{GO})_3$, (c) $(\text{GNP}/\text{GO})_1$ hybrid films. The bottom parts are the cross-sectional profile of the rough surfaces.