

Supporting information

Highly compressible and stretchable superhydrophobic coating inspired by bio-adhesion of marine mussels

Fatang Liu, Fenghe Sun, Qinmin Pan*

(School of Chemical Engineering and Technology, Harbin Institute of Technology, Harbin, 150001, *P. R.* China)

Corresponding author:

Qinmin Pan

E-mail: panqm@hit.edu.cn

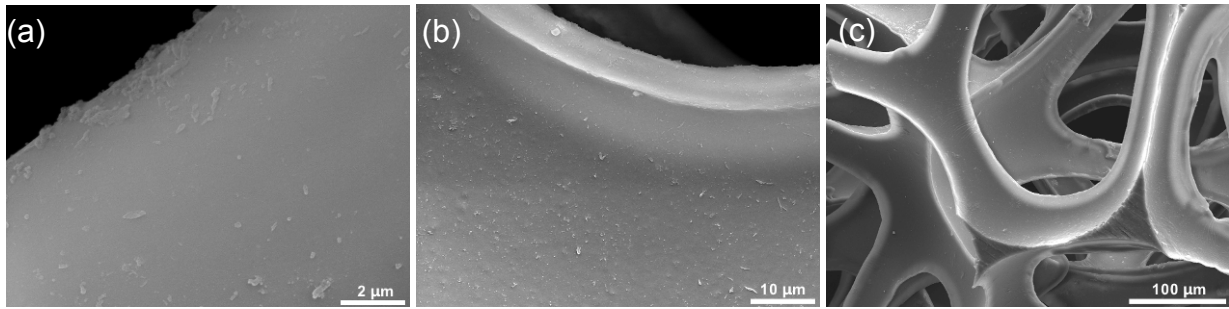


Fig. S1. SEM images of the PDA modified sponge.

The PDA-modified sponges showed a rough appearance containing nanoparticles. The nanoparticles results from the self-assembly of dopamine in the polymerization process.^[1]

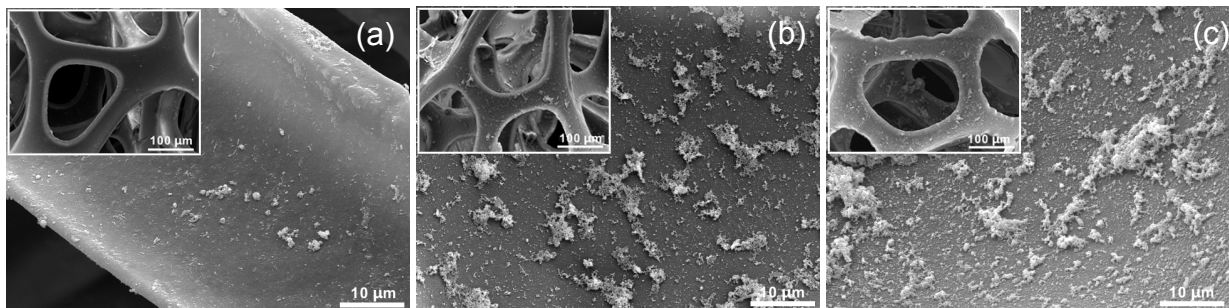


Fig. S2. SEM images of superhydrophobic sponges with (a) one, (b) three, and (c) five PDA/Ag bilayers.

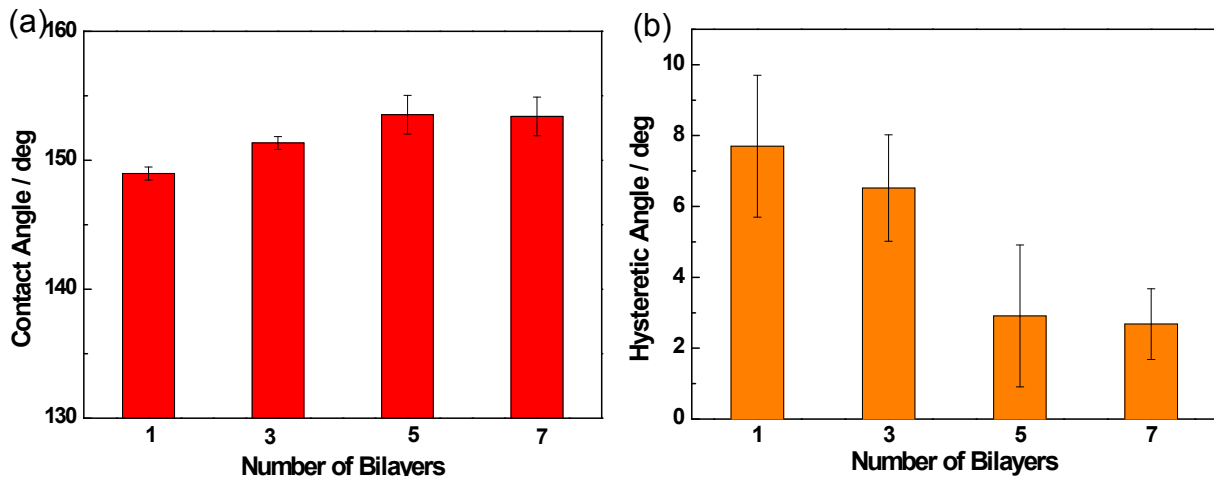


Fig. S3. Variation of water contact angle (a) and hysteric angle of (b) the as-prepared sponges with the number of PDA/Ag bilayers.

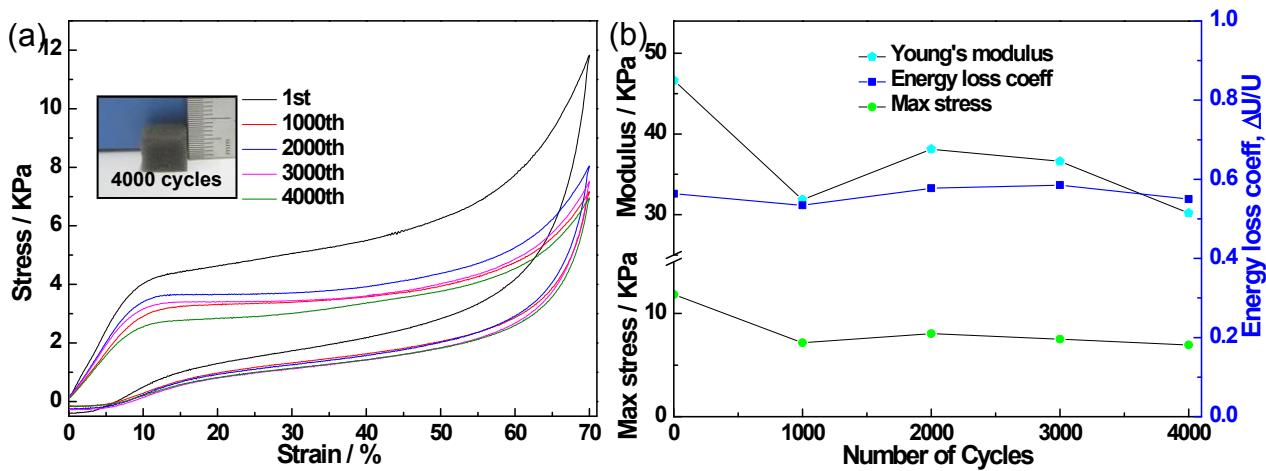


Fig. S4. (a) Stress-strain curves of a pristine sponge in the process of 4000-cycle compression. (b) Variation of the maximum stress, Young's modulus and energy loss coefficient with compression cycles. Inset is the optical image of the pristine sponge after 4000-cycle compression.

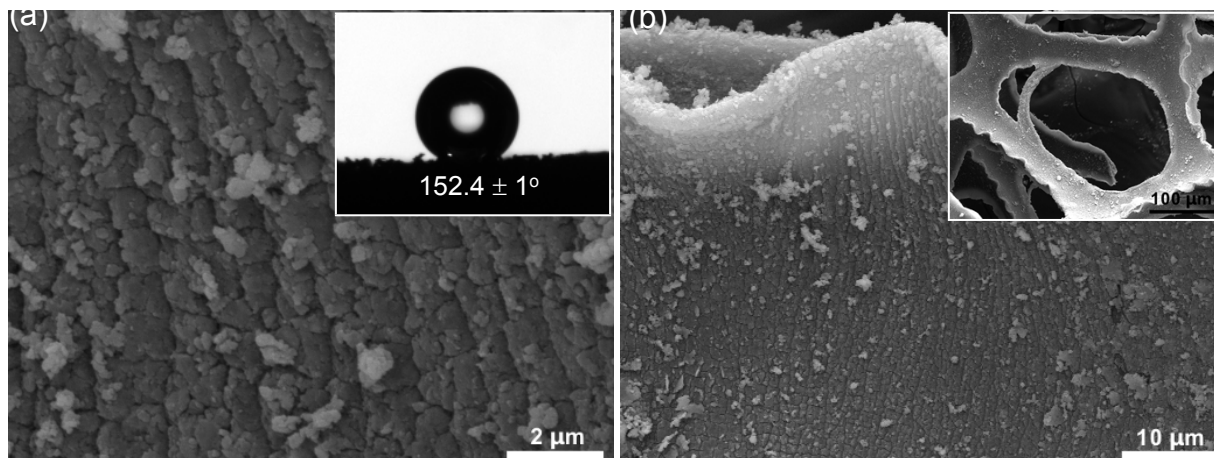


Fig. S5. SEM images of the superhydrophobic coating with seven PDA/Ag bilayers after compression for 6000 cycles. Insets are the water contact angle and low magnified SEM image of the corresponding sponge.

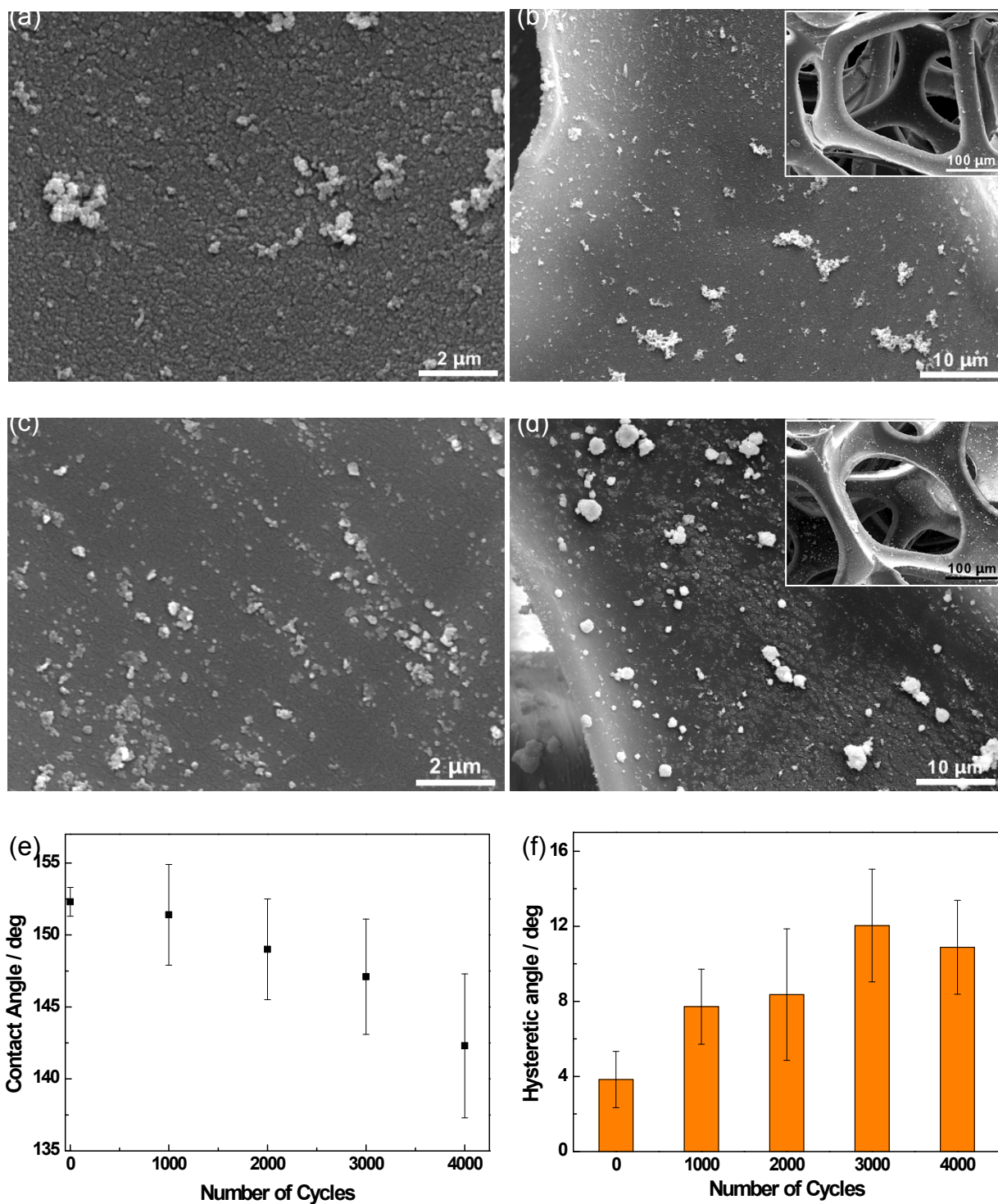


Fig. S6. SEM images of the superhydrophobic sponge prepared by electroless deposition before (a, b) and after (c, d) 4000-cycle compression. Variation of the contact angle (e) and hysteric angle (f) of the sponge with compression cycle.

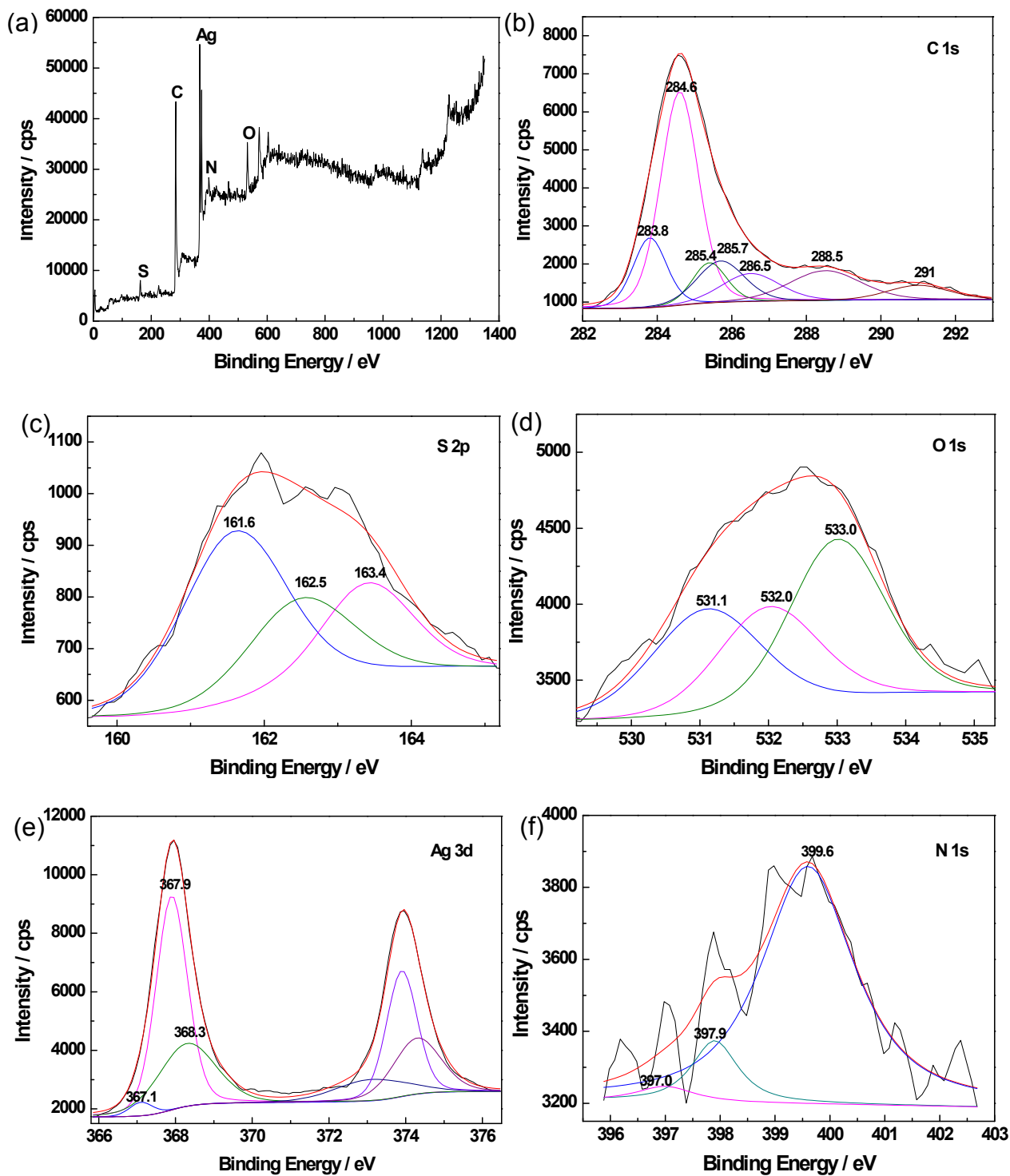


Fig. S7. XPS spectra of the superhydrophobic coating coated with 7 bilayers of PDA/Ag; (a) survey scan, (b) C 1s, (c) S 2p, (d) O 1s, (e) Ag 3d, (f) N 1s.

XPS measurements were performed to investigate the chemical interactions between Ag nanoparticles and PDA interlayers (Fig. S7). Fig. S7a shows the elements of C, S, N, O and Ag. The C 1s core spectrum (Fig. S7b) can be

deconvoluted into seven components assigned to the carbon of C=C (283.8 eV), aliphatic C-C (284.6 eV), C-N (285.4 eV), C-O (286.5 eV), C=O (288.5 eV), C-S (285.7 eV) and O-C=O (291.0 eV).^[2-4] The C-S and O-C=O components originate from *n*-dodecanethiol and PU sponge, respectively, while the C-N, C-O and C=O are attributed to polydopamine layers. In S 2p spectrum (Fig. S7c), peaks ascribed to the sulfur of Ag-S, Ag-S-R (*i.e.*, AgSC₁₂H₂₅), and free *n*-dodecanethiol (R-SH) are located at 161.6, 162.5 and 163.4 eV, respectively. The appearance of Ag-S-R bond indicates the reaction between *n*-dodecanethiol and silver nanoparticles.^[5] For O 1s spectrum (Fig. S7d), there is a peak at 532.0 and 533.0 eV, which is assigned to C-O and C=O bonds, respectively. Notably, a peak is also observed at 531.1 eV, which might relate to the interaction of silver with carbonyl group of polydopamine.^[6] The reason for this assignment is that the interaction between Ag and carbonyl exhibits a significant degree of covalent characteristic, and has a binding energy of ~531.3 eV.^[7,8] This assignment is also supported by the N 1s and Ag 3d spectra. In Ag 3d spectrum (Fig. S7e), the peaks attributed to Ag (0) and Ag-S bond locate at 367.9 and 367.1 eV, respectively. A new peak at 368.3 eV is ascribed to the Ag atom bound to oxygen-containing group.^[7,8] Here, we attribute this peak to the chemical interaction of Ag nanoparticles with carbonyl group. The N 1s spectrum has three components at 399.6 eV (R-NH-R or indole groups), 397.9 eV (=N-R) and 397.0 eV (Fig. S7f). The peak at 397.0 eV might associate with the chemical interaction between the N-containing group of polydopamine and Ag nanoparticles.^[9,10] The component at 399.6 eV suggests the conversion of the primary amine group into to secondary amine caused by the spontaneous polymerization of dopamine.^[4] The XPS results imply the chemical interactions between the polar functionalities of polydopamine layers and Ag nanoparticles.

Reference

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