Electronic Supplementary Material (ESI) for RSC Advances.
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Supplementary information

Improving the Anti-icing/frosting Property of Nanostructured Superhydrophobic Surface by Optimum Selection of Surface Modifier

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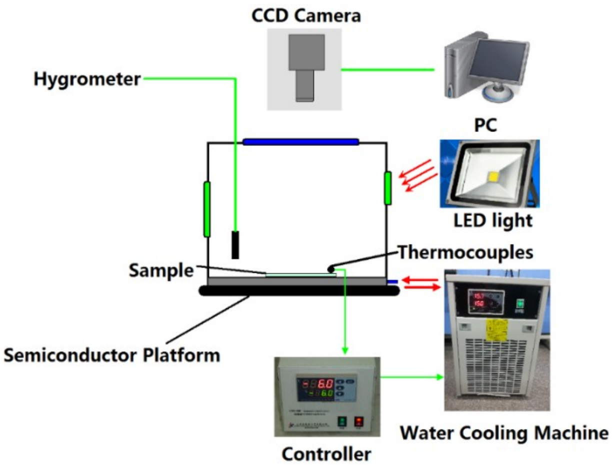


Fig. S1 The layout of the Peltier-based platform.

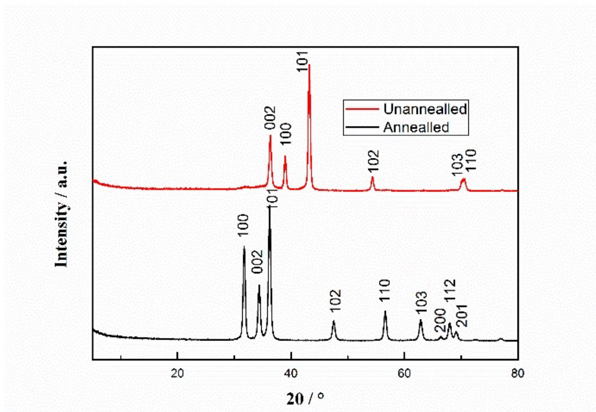


Fig. S2 XRD patterns of the as-prepared substrates before and after annealing treatment. It could be found that the peaks centered at 2θ = 36.38°, 38.96°, 43.22°, 54.42°, 70.24°, and 70.64° were assigned to (002), (100), (101), (102), (103) and (110) planes of Zn [1]. However, different peaks were found after annealing treatment in the muffle furnace. The peaks centered at 2θ = 31.70°, 34.36°, 36.24°, 47.6°, 56.58°, 62.86°, 66.42°, 67.98° and 69.10° were assigned to (100), (002), (101), (102), (110), (103), (200), (112) and (201) planes of hexagonal ZnO [2, 3].

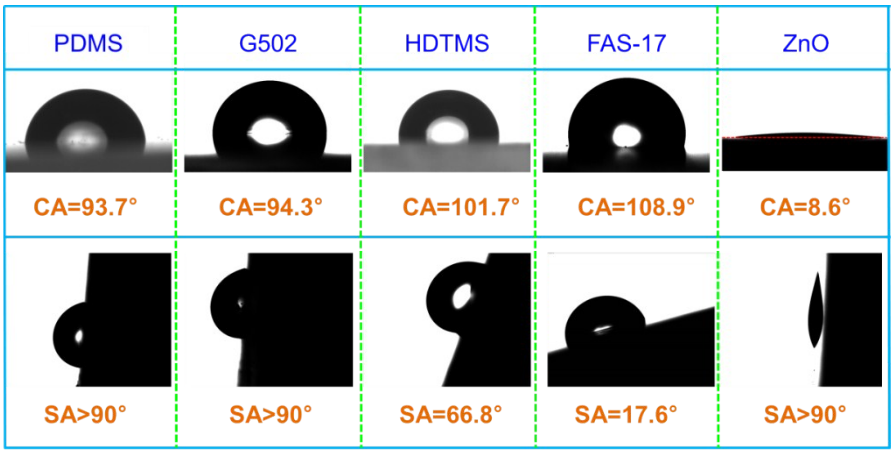


Fig. S3 CA and SA of bare glass modified with PDMS, G502, HDTMS and FAS17 and ZnO surface without modification

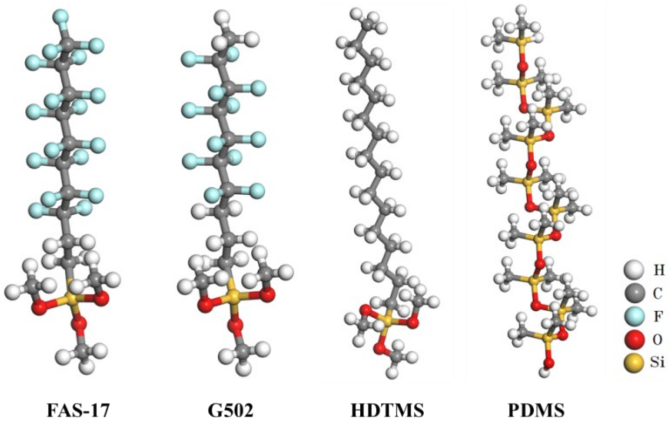
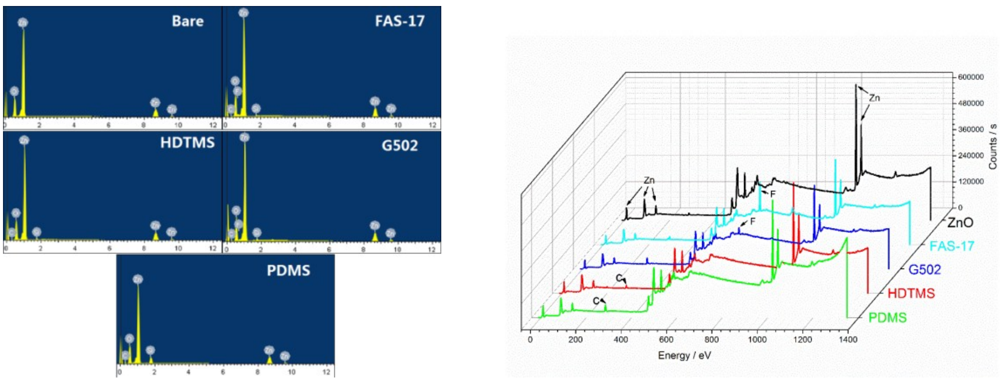


Fig. S4 Geometries of FAS-17, G502, HDTMS and PDMS



(a) (b)

Fig. S5 EDS(a) and XPS(b) spectrum of the ZnO nanostructures before and after surface modification

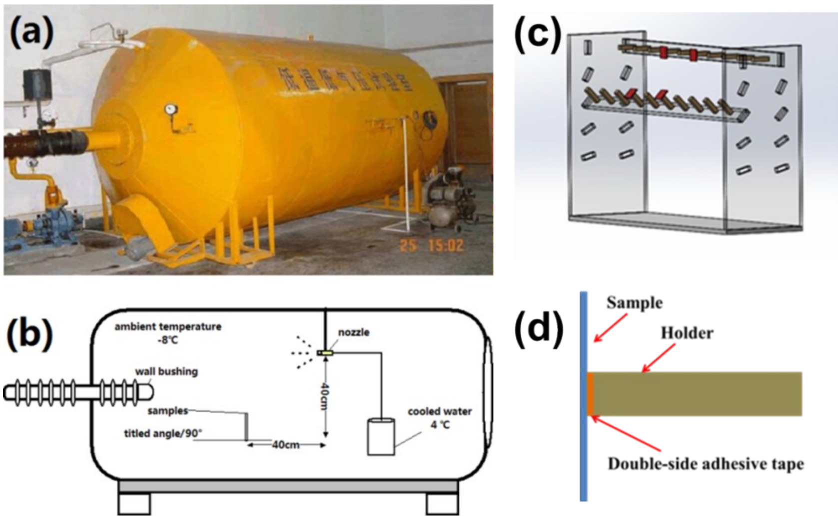


Fig. S6 The detailed description of the artificial climate laboratory: (a) the layout of the artificial climate laboratory. (b) the inner schematic of the artificial climate laboratory to simulate the snowy weather of glaze ice.(c-d) schematic of sample holder

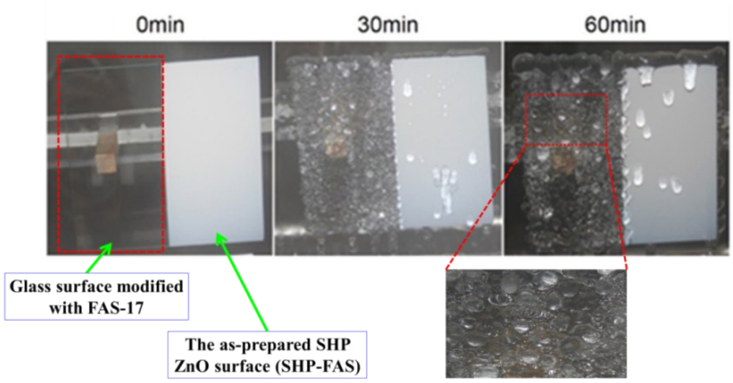


Fig. S7 Freezing process of bare glass modified with FAS-17 and SHP-FAS

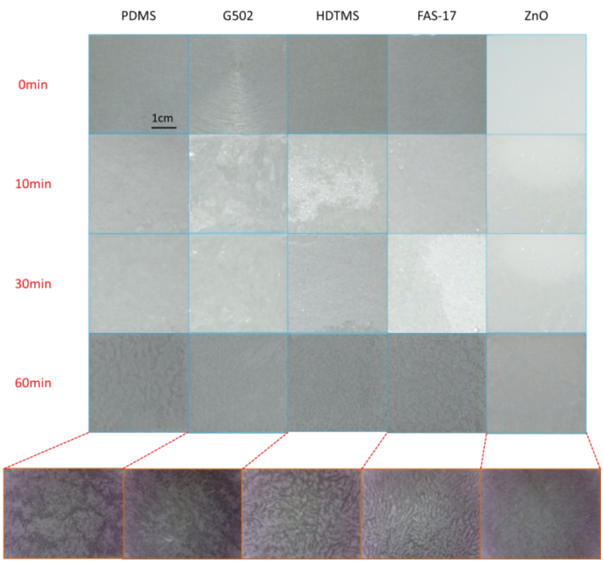


Fig. S8 Frosting process of glass modified with PDMS, G502, HDTMS, FAS-17 and the ZnO surface without modification.

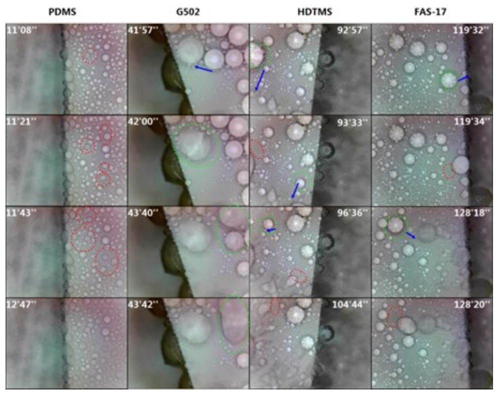


Fig. S9 Frost propagation on as-prepared SHP ZnO surfaces modified with FAS-17, G502, HDTMS and PDMS.

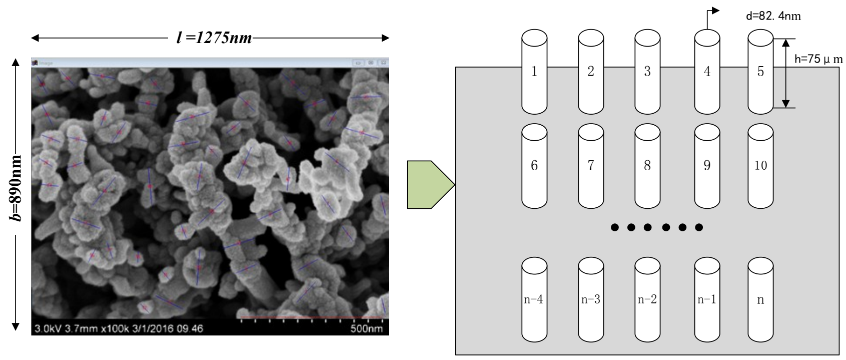


Fig. S10 Conversion diagram of the ZnO nanostructures into cylindrical structures. Given that $f_s = 0.041$ $h = 7.5\mu\text{m}$ and $d = 82.4nm$, we can calculate $n \approx 9$. Therefore, the surface roughness *r* can be calculated to be 16.39 according to $r = \dfrac{n\pi dh + lb}{lb}$.

Table. S1 Surface roughness of the FAS-17, G502, HDTMS and PDMS modified SHP surfaces

	SHP-FAS	SHP-G502	SHP-HDTMS	SHP-PDMS
*R*a (nm)	430.1 ± 80.4	455.1 ± 84.4	438.4 ± 82.7	462.4 ± 52.4
*R*q (nm)	546.8 ± 105.1	554.6 ± 97.0	560.7 ± 95.5	610.4 ± 68.8

Table. S2 CAs and SAs of the FAS-17, G502, HDTMS and PDMS modified SHP surfaces

	SHP-FAS	SHP-G502	SHP-HDTMS	SHP-PDMS
CA (°)	166.7 ± 2.2	162.1 ± 2.1	164.1 ± 1.8	162.8 ± 3.4

SA(°)	1.5	2.4	1.4	6.1

Supplementary Video. S1 recorded the self-transfer phenomenon on the SHP surface modified with FAS-17 condensing at -5^{o}C in 5min. The frame rate was 1000 frame per second. Supplementary Video.

References:

[1] Y.M. Huang, Q.-l. Ma, B.-g. Zhai, A simple method to grow one-dimensional ZnO nanostructures in air, Materials Letters, 93 (2013) 266-268.

[2] G.J. Fang, D. Li, B.-L. Yao, Influence of post-deposition annealing on the properties of transparent conductive nanocrystalline ZAO thin films prepared by RF magnetron sputtering with highly conductive ceramic target, Thin Solid Films, 418 (2002) 156-162.

[3] S. Cho, J. Ma, Y. Kim, Y. Sun, G.K.L. Wong, J.B. Ketterson, Photoluminescence and ultraviolet lasing of polycrystalline ZnO thin films prepared by the oxidation of the metallic Zn, Applied Physics Letters, 75 (1999) 2761-2763.