Supporting information

Super-wetting interfaces as multiphase composite prototype for ultra-low friction

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The prepared hydrophobic substrates with different microstructures were characterized by FE-SEM (**Fig. S1**). The characterization results showed that the aluminum sheet obtained the surface with a large number of irregular cross-arranged microsteps due treated in sodium chloride solution for 3 h (4 V) (**Fig. S1(a)**). After further oxidation, the second level of nanoscale structure were prepared on the basis of the micron-scale random step structure in the first step (**Fig. S1(b)-(c)**). Then alumina with nanopore structure (**Fig. S1(d), (f)**) and nanocluster structure (**Fig. S1(e)**) were prepared by controlling the pore reaming time.

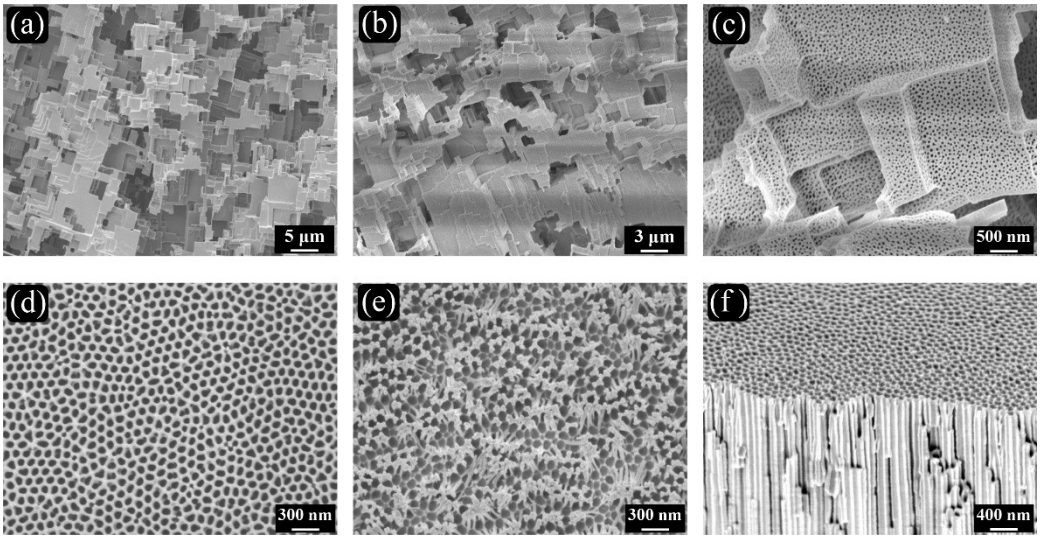

Fig. S1. (a) the surface morphology of the sample with microstructure; (b) and (c) the surface morphologies of the sample with micro-nano composite structure; (d) the surface morphology of sample with nanoporous structure; (e) the surface morphology of sample with nanocluster structures; (f) the top and cross-sectional view of sample with nanopore structure.

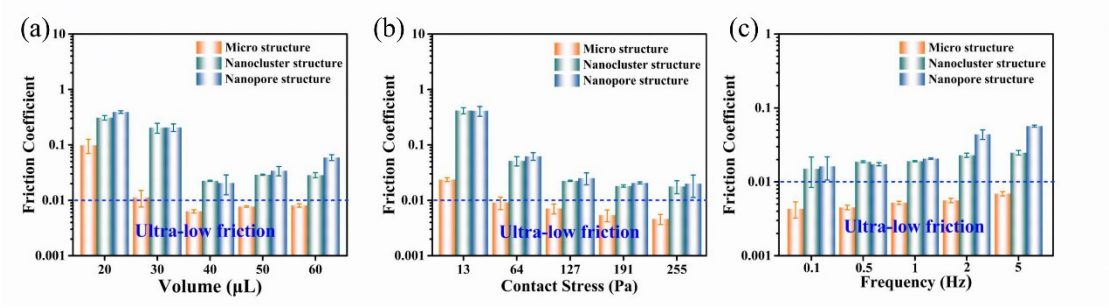

Fig. S2. The variation regular patterns of dynamic friction coefficient of constructed friction systems using different superhydrophobic substrates. (a) the variation of friction coefficient with the increasement of lubricating medium. (b) and (c) the variation of friction coefficient with contact stress and frequency.

The contact angle and adhesion force of different microstructures to water were characterized (**Fig. S3**). It was proved that the prepared alumina substrate had excellent hydrophobic effect. Moreover, the micro-nanocomposite structure had the smallest adhesion force, which might contribute to one of the main reasons for the ultra-low friction of this systems.

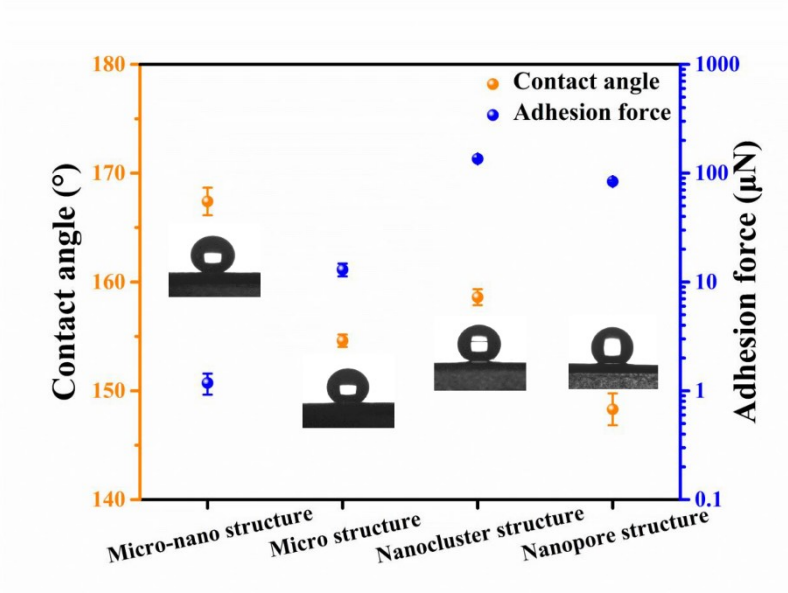

Fig. S3. Characterization of the contact angle and adhesion force of different samples to water droplet.

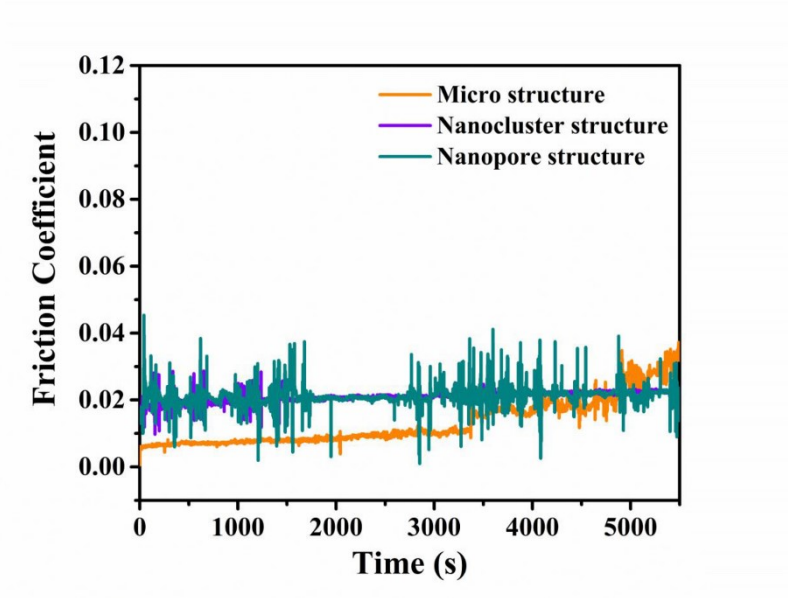

Fig. S4. Long-term application characterization of friction prototype in which water was employed to acted as lubricant.

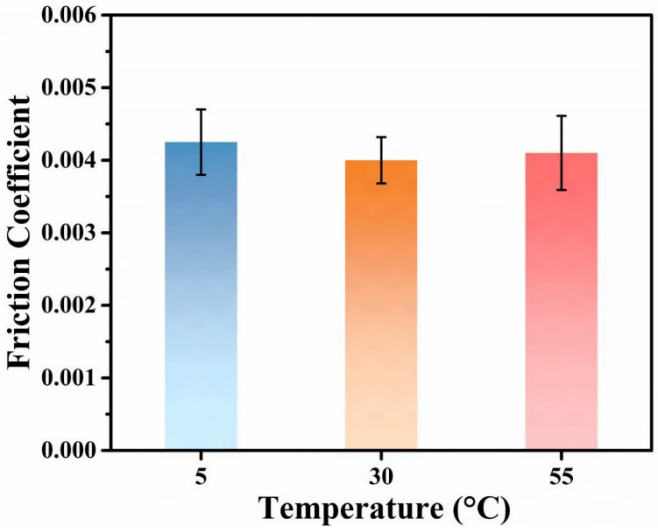

Fig. S5. The effect of water at different temperatures on friction coefficient of the micro-nano composite substrate.