Electronic Supplementary Information (ESI)

Droplet emission induced by ultrafast spreading on superhydrophilic surface

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Experimental methods

Fabrication of superhydrophilic surfaces: To get a superhydrophilic TiO_2 surface, a bare cover glass was cleaned with acetone, ethylene and deionized water, dried with nitrogen. The TiO_2 nano-particle were dispensed in solvent (ethylene: water = 1:1), and Polyvinyl Alcohol (PVA, Mw=15 000) were added to increase the viscosity. The turbid liquid was spin-coated onto the cleaned glass surface and calcinated (450 ℃, 2.5 h) after dried. The silicon surface with nanowire were etched by acid (sulfuric acid: hydrogen nitrate =1:1); the filter paper was bought in market; the PVA film was electro-spun with PVA solution (10 %wt).

Characterization of superhydrophilic surfaces: The scanning electron microscopy (SEM) images were obtained by field-emission scanning electron microscopy (HITACHI-S4800, Japan /JSM-6700F,

Japan). The contact angles were obtained by an OCA40 machine (Data-Physics, Germany). The X-ray photoelectron spectroscopy data were obtained with an ESCALab220i-XL electron spectrometer (VG Scientific) using 300W AlKα radiation.

Experiments on emission of tinier droplets: The experiments were carried on high speed CCD (~10000 frame/s) at room temperature. The original droplet was generated by an injector vertically placed above the superhydrophilic surface. The syringe needle (radius 19 nm) was in place where the droplet injected from the needle would touch the surface in no time.

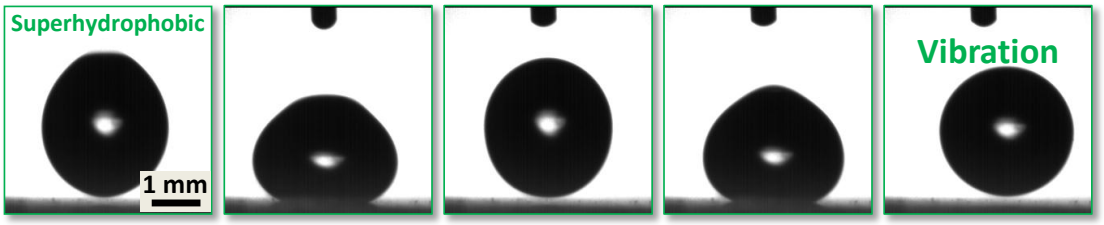

Fig. S1 Typical process of a water droplet collides on a superhydrophobic surface. Vibration appeared without tinier droplet emission when a water droplet contacted a superhydrophobic surface.

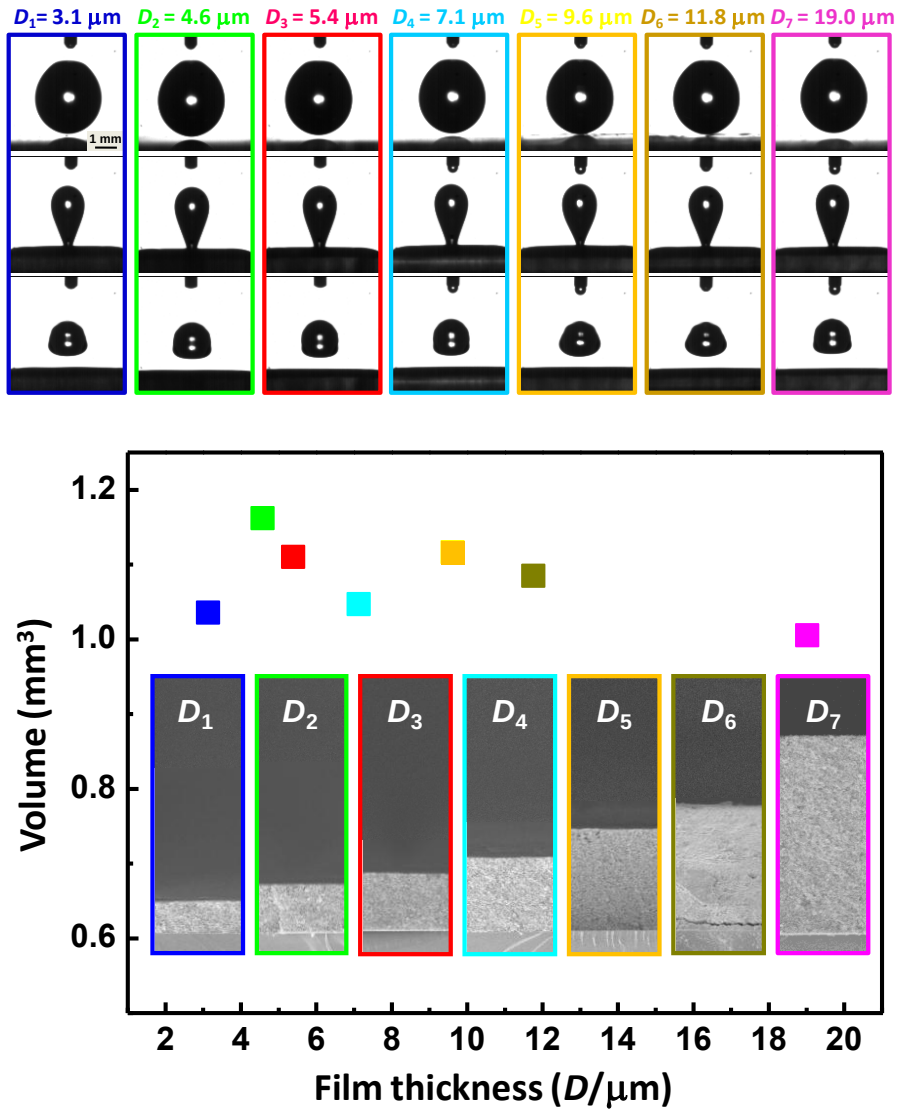

Fig. S2 SEM images of surfaces with different thickness and emission process records. The thickness of the TiO_2 surfaces varies from~3.1 μm to ~19.0 μm, and the surfaces have similar porous nano-structure. On each surface the emission occurs, and the volumes of the tinier droplets produced were calculated, which found no sharp difference.

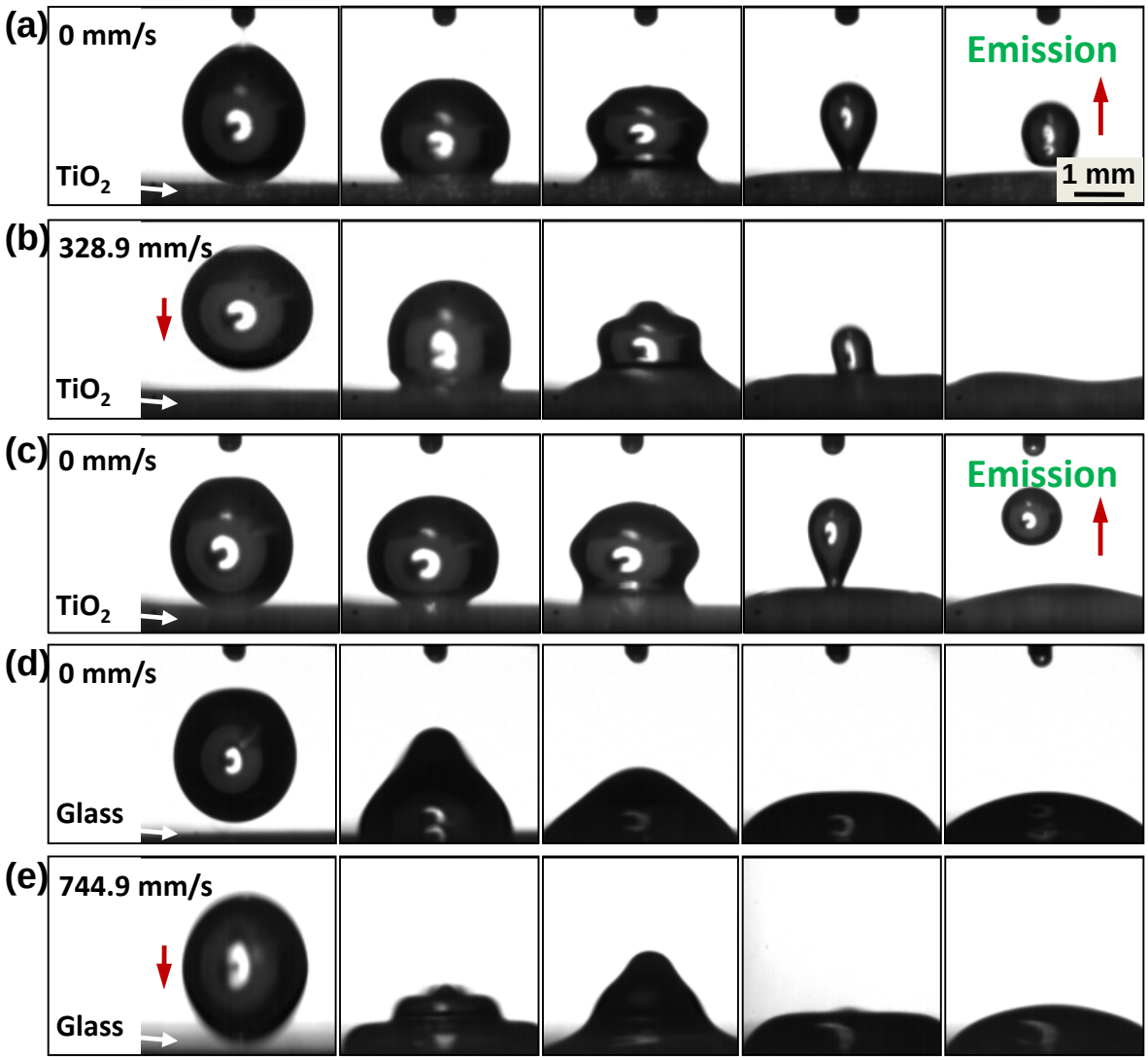

Fig. S3 Impacting process of water droplet with different initial speed. (a) Typical emission process. (b) The initial speed added, the emission disappeared. (c) The initial speed removed in situ, the emission reappeared. (d)~(e) Impacting process on bare glass surface with (d) and without (e) initial speed.

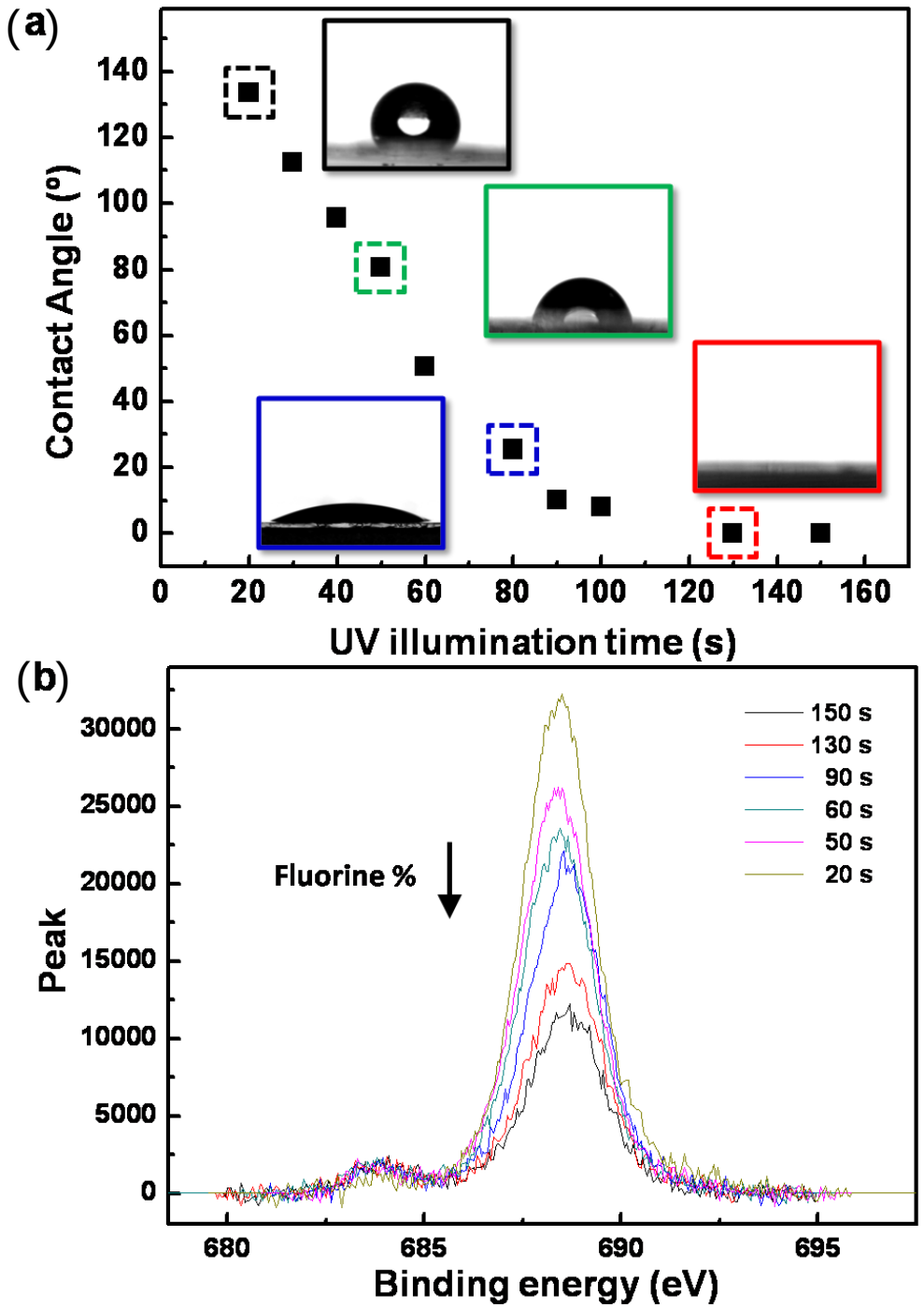

Fig. S4 Contact angles and XPS data of series of surfaces with different illuminating time. (a) The contact angles of the series of TiO2 surfaces we prepared change with the extension of UV light illuminating time. Clearly, the contact angle decreases with the illumination time increasing, and several typical contact angle images are shown. (b) The XPS data of the series of TiO2 surfaces. The content of the fluorine element on the surfaces decreases with illumination time, which supports the increase of the contact angle.

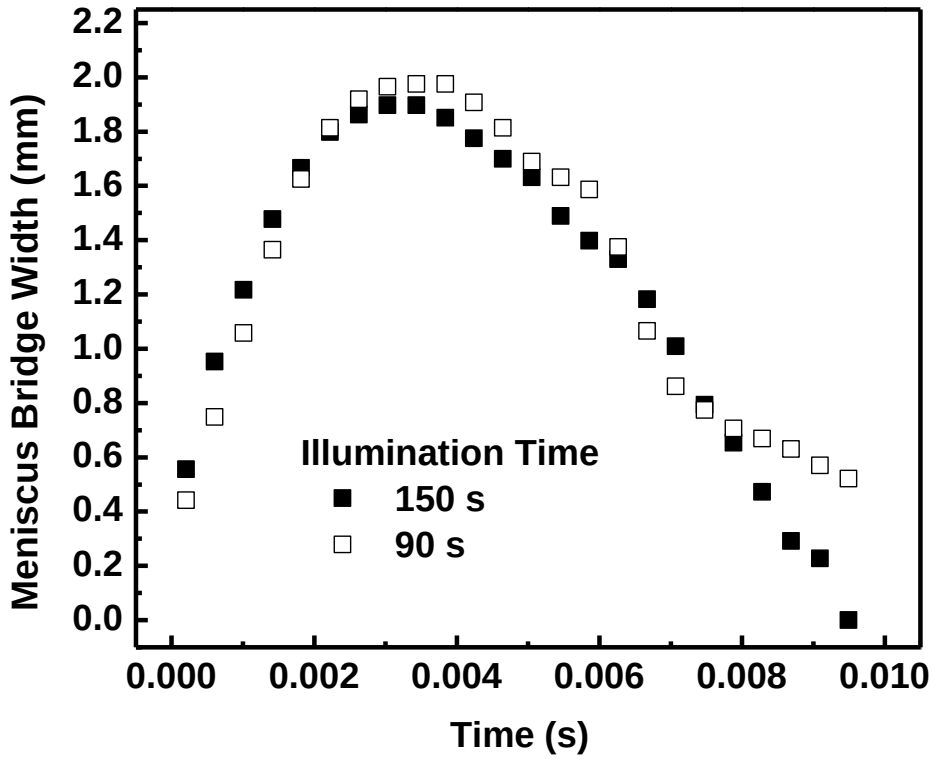

Fig. S5 The meniscus bridge width varies with time. The surface illuminated for 150 s (Black Square) stands for surfaces would emit tiny droplet, and the surface illuminated for 90 s (White Square) stands for surfaces would spread but not emit tiny droplet. On hydrophobic surfaces there would be no meniscus bridge formed, so no similar data on those surfaces are shown.

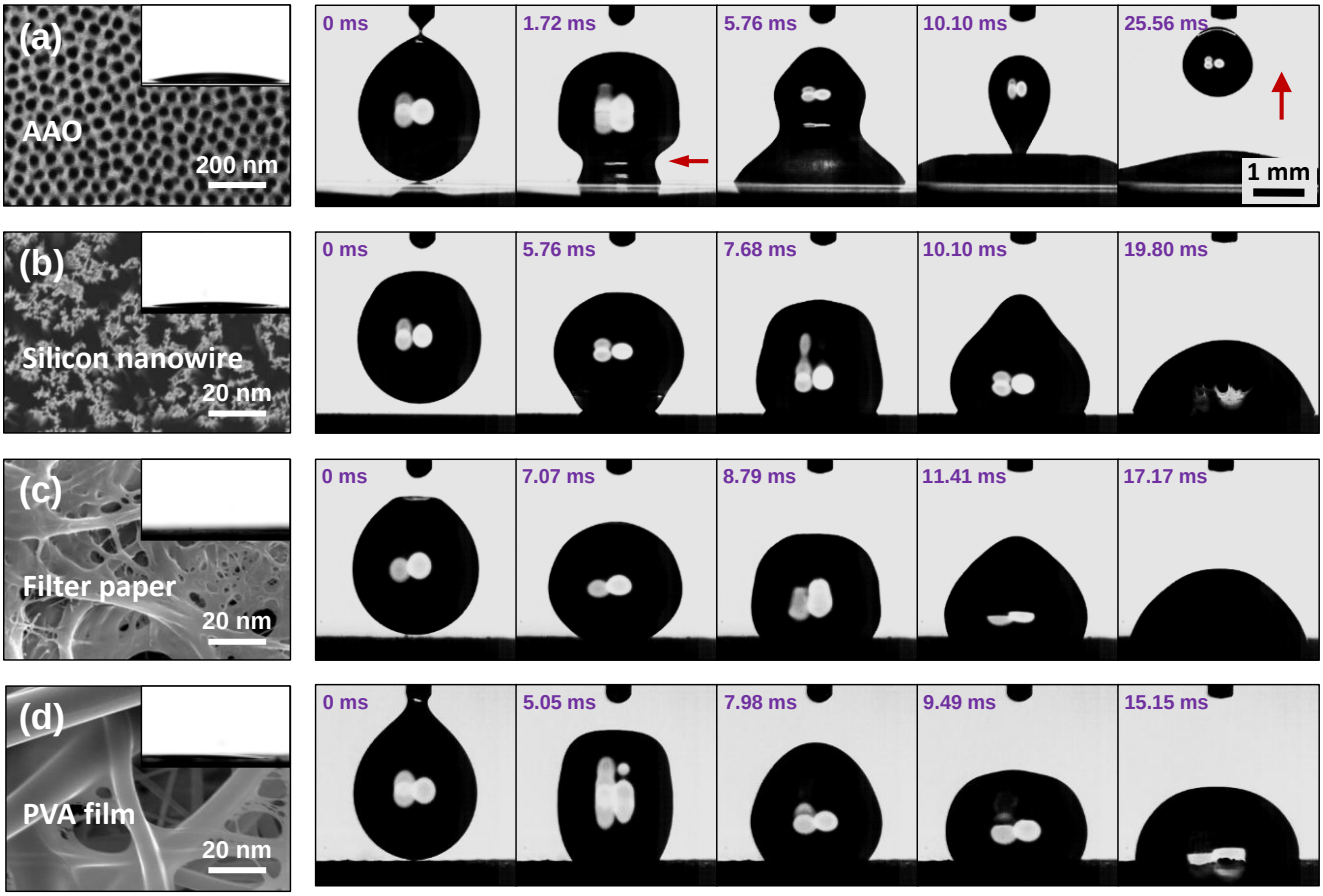

Fig. S6 The impacting experimental records on different superhydrophilic surfaces: SEM images of (a) AAO template (b) Silicon surface coated with nanowire (c) Filter paper and (d) PVA electro-spun film and the collision performance of water drops on the corresponding surfaces. The tinier droplet emission could be observed only on the AAO template.

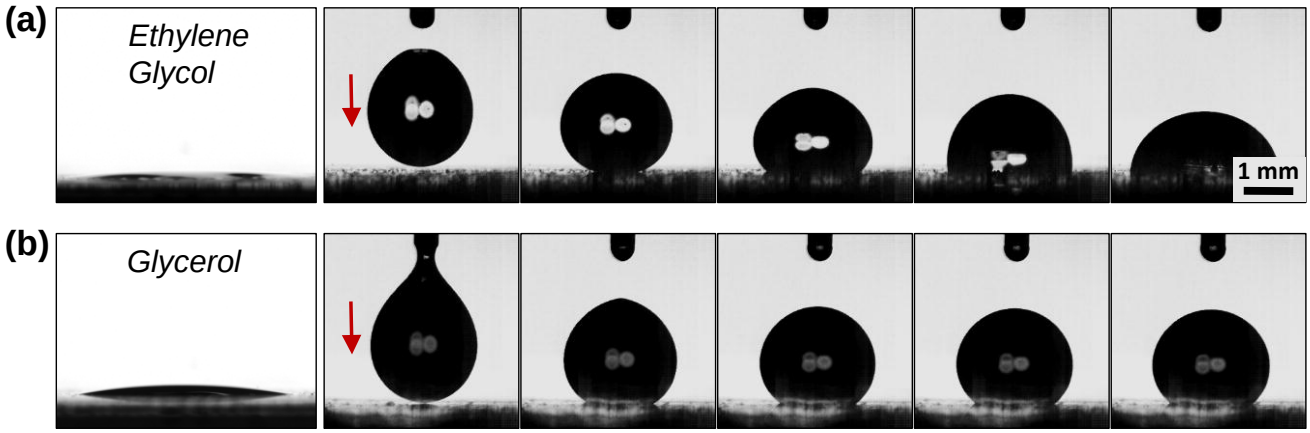

Fig. S7 Impact processes and contact angle data of different liquid collides on the same kind of TiO_2 surfaces. (a) Ethylene glycol. (b) glycerol. Both organic liquids have a static contact angle near 0°, however, the spreading speeds of these two liquids are extremely slow .Therefore, the tinier droplet processes are vanished.