Electronic Supplementary Information of Submission:

Unidirectional Water Delivery on a Superhydrophilic Surface with Two-dimensional Asymmetrical Wettability Barriers

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The Electronic Supplementary Information contains:

Experiment Section:

Preparation of unidirectional water delivering surface: Titanium dioxide micro-particle (MP) with an average diameter of 2-3 μm (Macklin) is used to prepare superhydrophilic substrate. The aqueous solution of TiO_2 MP with a concentration of 8 wt% was uniformly coated on a hydrophilic glass slide. After drying in room temperature, the substrate was directly patterned by a waterproof marker pen with the help of a drawing robot. To further improve the hydrophobicity of the water barriers, the as-drawn surface was immersed in the powder of hydrophobic fumed silica (R-972, Evonic). Afterwards, the superhydrophilic property of the surface can be enhanced via a 5 minutes UV irradiation, and then the unidirectional water delivering surface is finally obtained.

Instrument and characterization: The surface was patterned on the basis of a drawing robot (Axidraw, Shenzhen). The morphology of the surfaces were observed by the environmental scanning electron microscope (Phenom Pro, Phenom-World), and the magnified video was recorded by an industrial microscope (GP-650S, Gaopin).

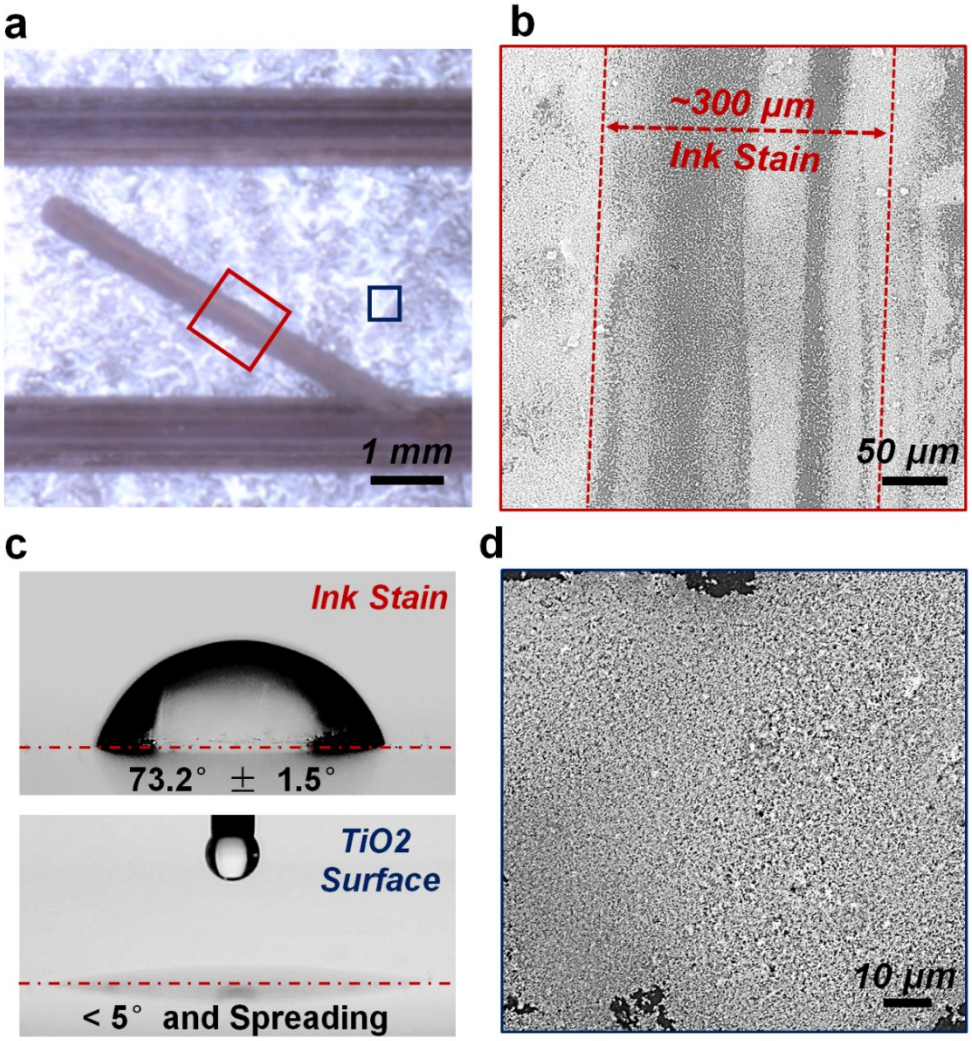

Fig. S1. (a) Optical image of unidirectional liquid spreading surface with 2D wettability patterns. The SEM image of (b) the hydrophobic marker pen strain and (d) the TiO_2 micro-particles coated surface with superhydrophilic property. (c) The contact angles of the hydrophobic ink stain and the superhydrophilic TiO_2 surface.

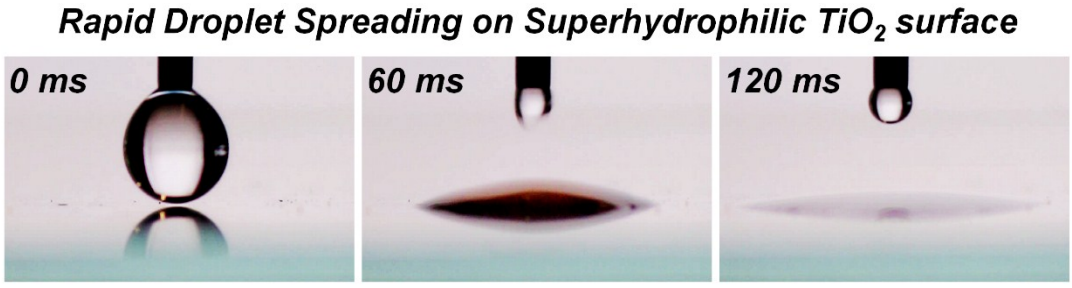

Fig. S2. The rapid droplet spreading on the superhydrophilic TiO2 based surface.

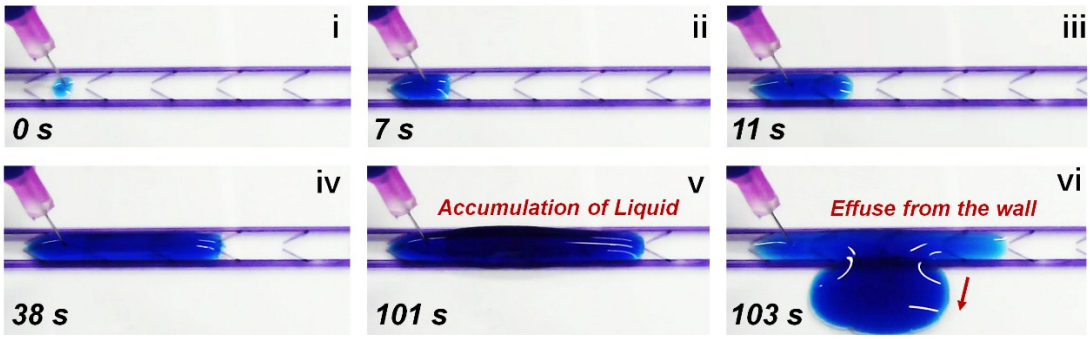

Fig. S3. The unidirectional liquid spreading on a patterned glass slide without superhydrophilic titania coating. The directionality is effective in one or more joint; however, the long-ranged delivery is not available due to the overlarge motion resistance. The massively accumulated liquid should effuse from the channel walls, resulting in the failure of delivery.

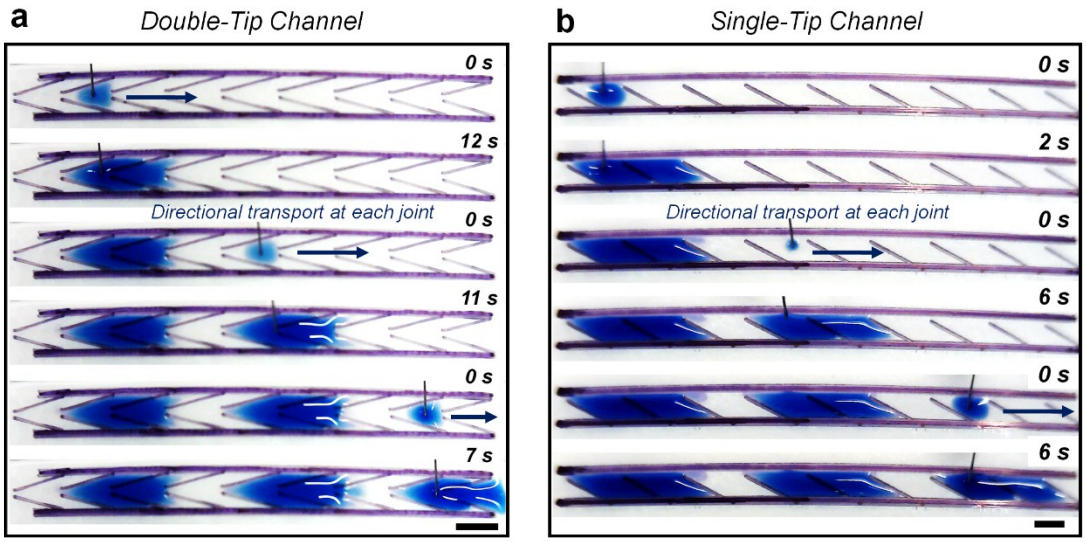

Fig. S4. The discontinuous water charging process clearly demonstrates the consistency of the directionality of water spreading in each joint of channel.

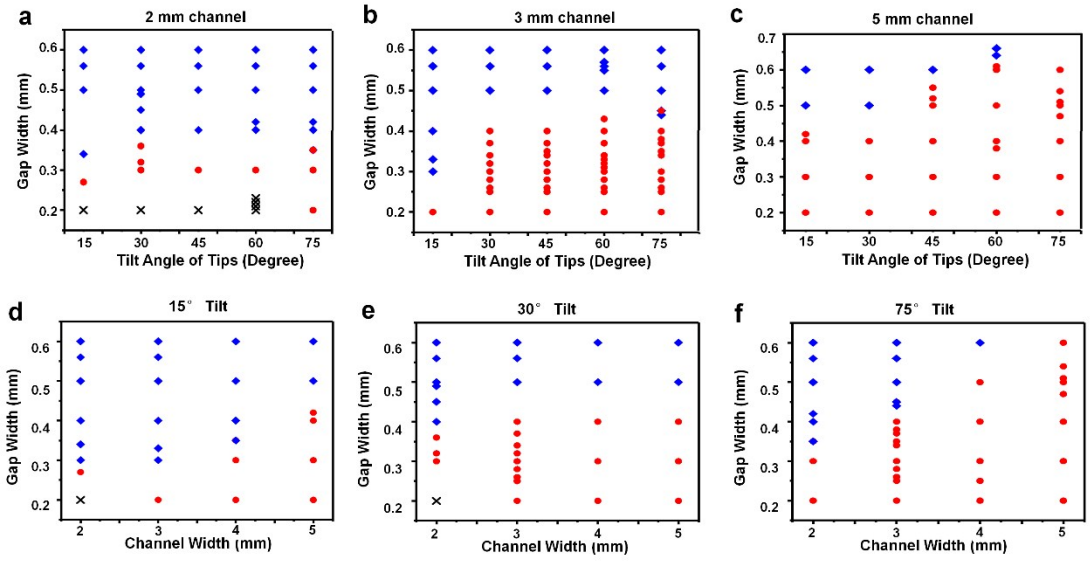

Fig. S5. The additional phase diagram of the directionality of double-spine channel. (a) 2 mm, (b) 3 mm, and (c) 5 mm channels. The spine with a tilt angle of (d) 15°, (e) 30°, and (f) 75°.

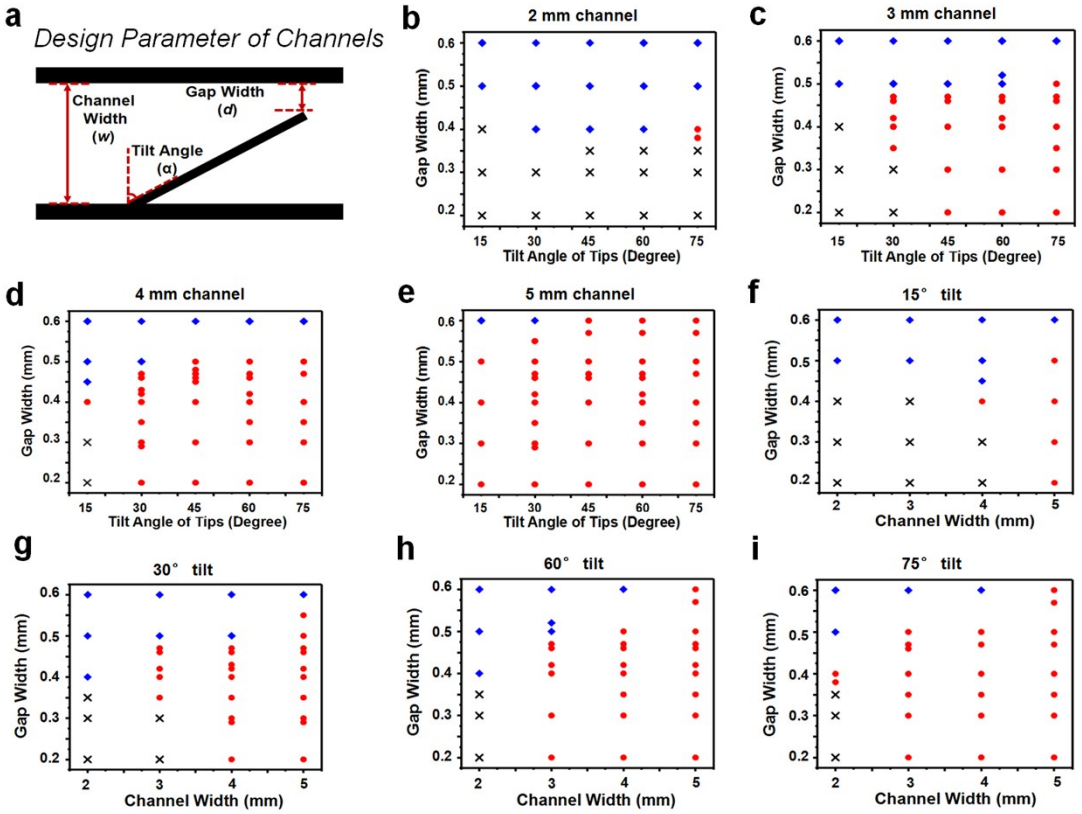

Fig. S6. The phase diagram of the directionality of single-spine channel. (a) The design parameters of the channel. (b) to (e) for the channel width from 2 to 5 mm, and (f) to (i) for the spine with a tilt angle from 15° to 75°. The similar trend was noticed as well as that of the double-spine channels.

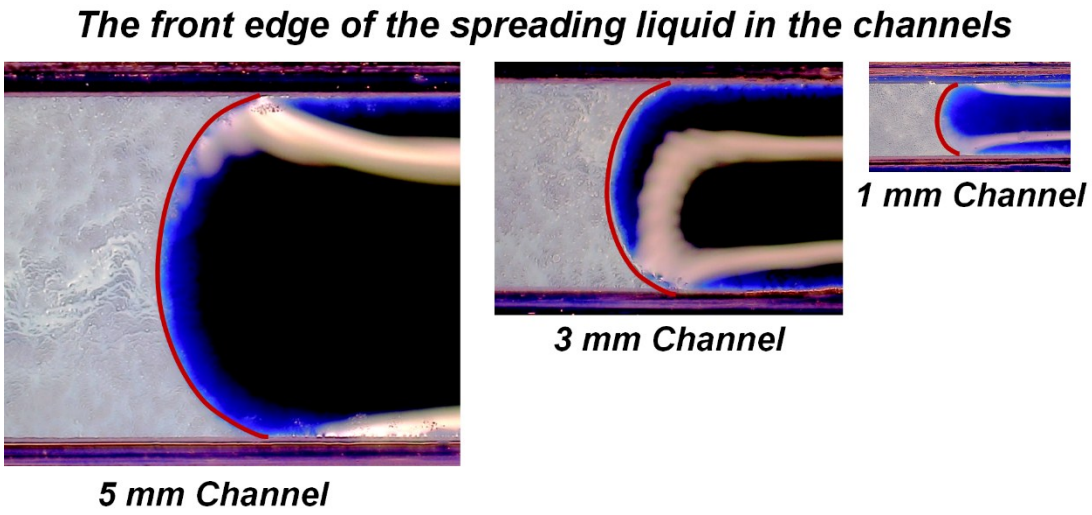

Fig. S7. The front surface of liquid flow keeps semi-circular during the liquid spreading.

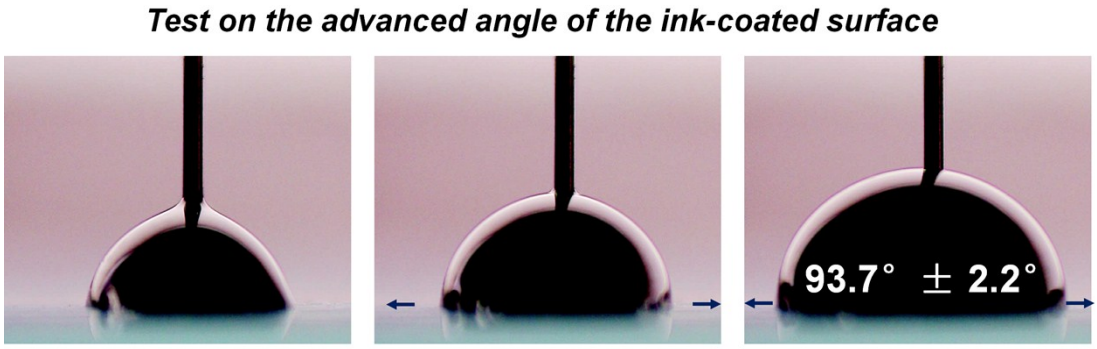

Fig. S8. The advancing angle measurement of hydrophobic ink coated surface.