Supporting Information

Power-Free Water Pump Based on Superhydrophobic Surface: Generation of Mushroom-Like Jet and Anti-Gravity Long-Distance Transport

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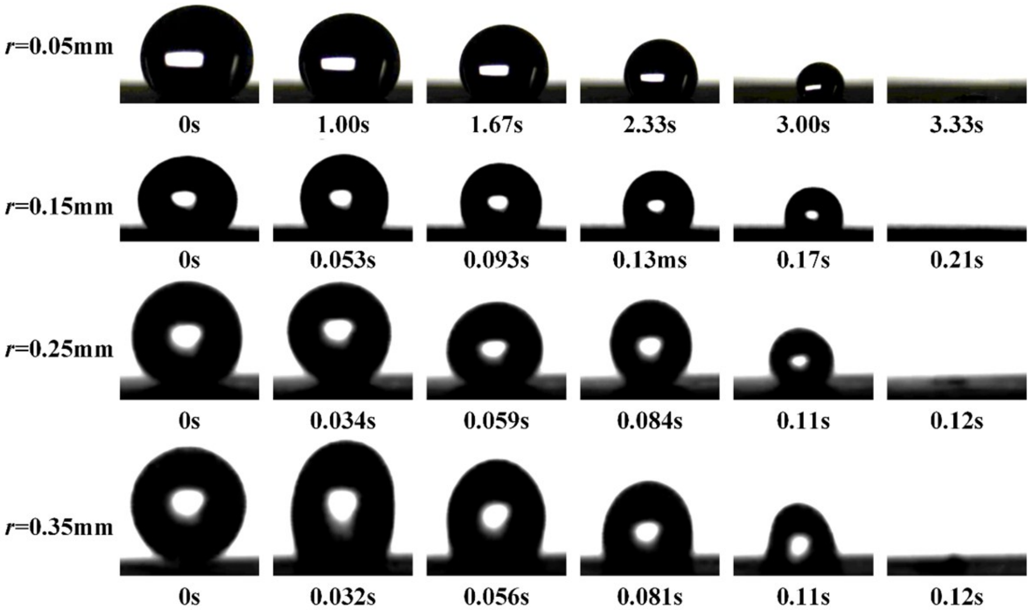

Fig. S1 Variation of contact angles with time at different pores' diameter. The water droplet with an initial volume 5 μL was in an instable state with a gradually reduced contact angle, which as a function of the time exhibited a similar trend. The self-capturing time was decreasing with the increasing pore's diameter.

Table S1 The critical volume V_{cri} of water droplets on the superhydrophobic plate with different diameter of pore. V_{cri} refers to the critical volume when the contact line just reduced to the pore's diameter ($R_{cri} = r / \sin \theta_0$), and the critical volume V_{cri} is given by Equation (S1).

Pore's radius r / mm	Critical volume V_{cri} / μL	Critical radius R_{cri} / mm	Critical CA θ_0 / °
0.05	0.01	0.13	158°± 2°
0.15	0.27	0.40	158°± 2°
0.25	1.25	0.67	158°± 2°
0.35	3.42	0.93	158°± 2°

$$V_{\text{cri}} = \frac{1}{3}\pi\left(\frac{r}{\sin\theta_0}\right)^3(2-3\cos\theta_0+\cos^3\theta_0)$$ (S1)

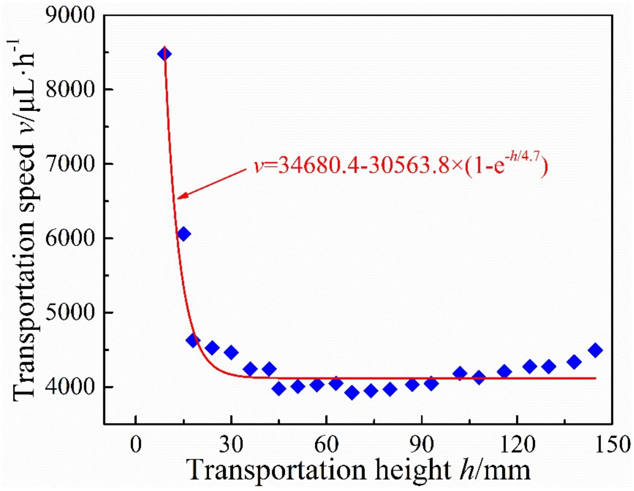

Fig. S2 Transportation speed as a function of the transportation height. Results indicated that the increase of transportation height *h* resulted in a dramatic decreased and was followed by a decrease gradually because the driving pressure was changed. As shown in Fig.S3, the total driving pressure P_{in} can be calculated as Equation (S2).

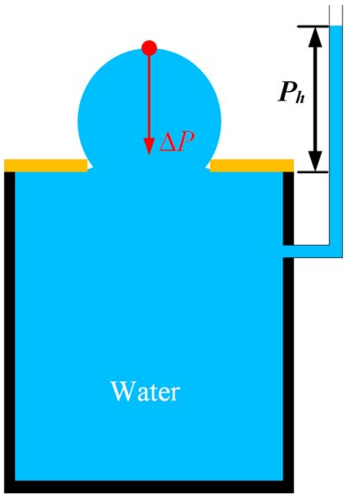

Fig. S3 Pressure analysis in the transportation process

$$P_{\text{in}} = \Delta P - P_h$$ (S2)

Where $P_h = \rho gh$, the increase of *h* resulted in an increased P_h and was followed by a decrease of P_{in}. The self-capturing time of water droplet increases with the decreasing of driving force, resulting in a decreased transportation speed.

List of supplementary movies:

Movie S1: Generation processes of the mushroom-like jets under different working conditions and wettabilities. (pore diameter, 0.1mm; droplet volume, ~ 6.4 μL).

Movie S2: A time-lapsed video clip observed by a high-speed camera of the penetrating process of 5 μL water droplets on the superhydrophobic plate under different pore diameter and playing speed (d=0.1 mm, ×0.3 speed; d=0.3 mm, ×0.025 speed; d=0.5 mm, ×0.0083 speed; d=0.7 mm, ×0.0083 speed; Δt is the capturing time).

Movie S3: Generation process of the multiple mushroom-like jets (pore diameter, 0.3mm; droplet volume, ~ 6.4 μL).

Movie S4: The experiment process of measuring sliding angles on the superhydrophobic surface and ordinary surface.

Movie S5: The antigravity transport process of the water pump (pore diameter, 0.1 mm; tube diameter, 1 mm; transport height, 144.6 mm).

Movie S6: Long distance transport process of the water pump (pore diameter, 0.3 mm; tube length, 1 m; tube diameter, 1 mm).