Supplementary Information

Uni-directional Liquid Spreading Control on Bio-inspired Surface from the Peristome of *Nepenthes alata*

Huawei Chen,a Liwen Zhang,a Yi Zhang,a Pengfei Zhang,a Deyuan Zhang,a and Lei Jiangb

a. School of Mechanical Engineering and Automation, Beihang University, Beijing, 100191, China.
b. Laboratory of Bio-inspired Smart Interface Science, Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, Beijing, 100190, China

**Fig. S1** Water Uni-directional spreading on surface structure with different (a) surface wettability and (b) viscosity. Time needed for liquid spreading pass structural periods with different surface contact angle.

**Fig. S2** Two main structural features. (a) curvature of arc edge includes straight (S), circle arc (C) and ellipse arc (E). (b) wedge angle of microcavity $\beta$ ranging from about 50° to 110°.
Fig. S3 The size of surface structures. (a) straight, (b) circle arc and (c) ellipse arc. The pit inclined angle $\beta$ for all types of arc edge curvature include $50^\circ$, $70^\circ$, $80^\circ$ and $110^\circ$. The width of each groove $w$ in all types of surface structures is approximately $120 \, \mu m$. The depth of overlaid grooves $h1$ and pits $h2$ are both about $30 \, \mu m$. The length of each stage $d1$ between pits is $120 \, \mu m$. The length of each pit $d2$ is $200 \, \mu m$. The radius of circle arc $r$ is $60 \, \mu m$. The semi-major axis length of ellipse arc $a$ contains $110$, $150$ and $190 \, \mu m$.

Fig. S4 The anisotropic liquid spreading factor $\xi_d$ and liquid climbing height in different surface structures. With arc edge curvature growing, liquid spreading factor $\xi_d$ increases (a), and the
climbing height of five surface structures decreases (b) with front direction vertically immersed into liquid. With microcavity wedge angle $\beta$ growing, liquid spreading factor $\xi$ reduces (c), and the climbing height of five surface structures rises (d) with front direction vertically immersed into liquid.

**Video S1.** Liquid spreading on surface structures with different arc edge curvature.

**Video S2.** Liquid spreading in surface structures with different microcavity wedge angle $\beta$.

**Video S3.** Pinning failure happened on surface structure with small arc edge curvature ($C60$, $\theta = 50^\circ$) and large wedge angle $\beta$ ($E190$, $\theta = 110^\circ$).