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Fast adaptive gating system based on reconfigurable morphology of liquid metal *via* electric field on porous surfaces

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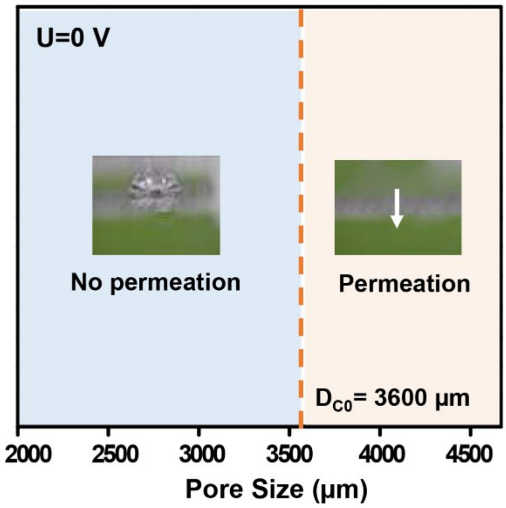

Fig. S1 The influence of mesh pore size (*D*) on LM permeation behavior on the micro/nanostructured mesh (1 mol L^{-1} NaOH solution) without applied voltage, the critical permeation pore size (D_{C0}) is 3600 μm. LM can permeate the mesh when $D>D_{C0}$, while LM cannot permeate the mesh when $D<D_{C0}$.

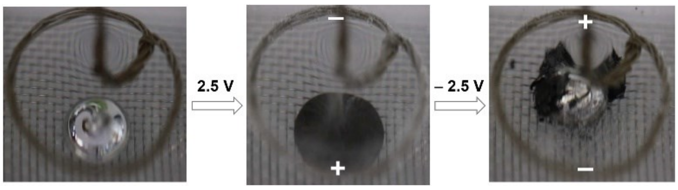

Fig. S2 Electric field adaptive wetting and dewetting of LM droplet on the micro/nanostructured mesh in 1 mol L^{-1} KCl solution. The black oxide layer is formed on LM droplet surface when it wets the mesh surface with voltage of 2.5 V. When the voltage of -2.5 V is applied, the black oxide layer will fall off from LM surface, and LM droplet restores to a spherical shape owing to increase of the surface tension.

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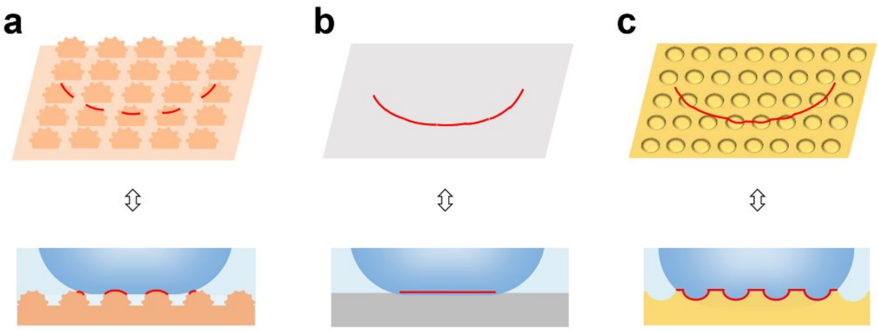

Fig. S3 Schematic illustration of the triple-phase line of LM droplet on the surface of micro/nanostructure (a), flat structure (b) and microstructure (c). The length of the contact line (L) between the LM droplet and the solid substrate is $L_a < L_b < L_c$, *i.e.*, contact area fraction of LM droplet with the micro/nanostructure, flat structure, and microstructure on the mesh satisfies $f_1^1 < f_1^2 < f_1^3$, which corresponds to equation (11).

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