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In situ adhesion switching on non-symmetrical hydrophobic-superhydrophobic patterned surfaces for droplets transfer

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Hydrophobic-superhydrophobic patterned surface was fabricated on copper surfaces by site-selectively oxidation using ink masking and subsequent surface energy reduction. Anisotropic sliding of droplets on typical non-centrosymmetrical hydrophobic-superhydrophobic patterns such as semicircle, line segment and V-shaped line patterns was observed. Pattern dimensions (semicircle diameter, line segment length and V-shape angle) were designed to control the sliding anisotropy. Experimental data on sliding adhesion was in good agreement with the calculated data using classical drag-adhesion model (Furmidge equation). Taking advantage of the anisotropic sliding adhesion, the non-centrosymmetrical pattern can be used as a "mechanical hand" to *in situ* capture and release micro droplets by simply moving the pattern in different directions. The hand can capture a droplet pinned on a dot by lifting the pattern after touching the droplet. Meanwhile, the hand can also release the droplet simply by horizontally moving the pattern in low-sliding-adhesion direction. Due to the hydrophobicity of those patterns, the droplet can be handled by this mechanical hand without mass loss. The ability of switching droplet handling functions (capture and release) using simple linear motions would facilitate the development of practical applications for droplet-based reactors in biomedical domains.

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