Supporting information

A superamphiphobic surface with orderly hexagonal microstructures inspired by springtails

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Materials. Aluminum was purchased from Guangdong Als Metal Science and Technology Co., Ltd. 1H, 1H, 2H,2H-perfluorodecyltrimethoxysilane (97%) and ethanol were purchased from Wuhan Xinshen Chemical Technology Co., Ltd. The laser marker (JN-20) used in the experiment was purchased from Zhejiang Optical Instrument Manufacturing Co., Ltd. Acetone (99.5%), and glycerol (99%) are analytical reagents (A.R.) grade, purchased from Beijing Chemical Reagent Co., Ltd. The corn oil used in the test was from Yihai Kerry Golden Dragon Fish Cereals and Oils Foodstuffs Co., Ltd. The milk used in the test came from Bright Dairy. The coffee used for the test came from Ruixing Coffee Co., Ltd. The black tea used in the test was from Xiamen Zhongmin Tea Co., Ltd. Throughout the study, deionized water was produced using the ModuPure system.

Modified aluminum surface preparation process. Firstly, the aluminum sheet was cut into 3×3 and 5×2.5 cm sizes, and then put into deionized water, ethanol, and acetone to clean for 10 minutes, respectively. The hexagonal array scheme was designed on a computer and etched on an aluminum sheet using a laser pointer (Laser model MFP-50X-NAEBA4.1, output power 50 w, beam diameter 6 mm, pulse width 90 ns, frequency 50 kHZ, operating voltage 24 V).The etched aluminum sheet was heated in boiling water for 5 minutes and then the sheet was dried. Next, a 30 ml volume 1% ethanol solution of 1H,1H,2H,2H-perfluorodecyltrimethoxysilane was configured and mixed. The mixed solution was sprayed on the surface of the aluminum sheet using a spray gun. The aluminum sheet was dried in an oven at 80°C for 1 hour to obtain the modified aluminum sheet.

Characterization. The microstructure and morphology of the samples were observed using field emission scanning electron microscopy (FE-SEM, Zeiss Sigma500), and the elemental content of the coated samples was analyzed using energy dispersive spectroscopy (EDS, JSM-5600LV). The static contact angles of the samples were measured using the JC2000D system. Tests were carried out using deionized water, glycol, glycerol, corn oil, coffee, milk, and tea, with 5 μl of test liquid, and the average of five different points on each sample was taken. The groups on the modified surfaces were characterized by Fourier transform infrared spectroscopy (FTIR, is50; Thermo Fisher China Technology). The surface composition of the samples was studied by X-ray photoelectron spectroscopy (XPS, Escalab 250Xi).

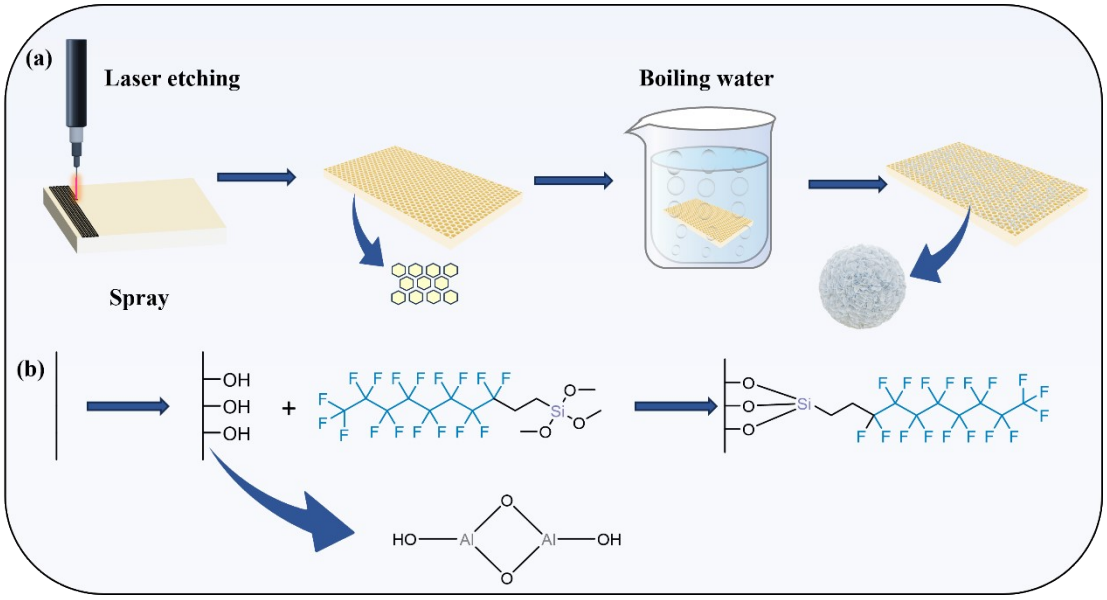

Fig. S1. Schematic diagram of the surface preparation process and reaction mechanism for the preparation of modified aluminum sheets (a) preparation of modified aluminum sheet surfaces; (b) the principle of the chemical reactions.

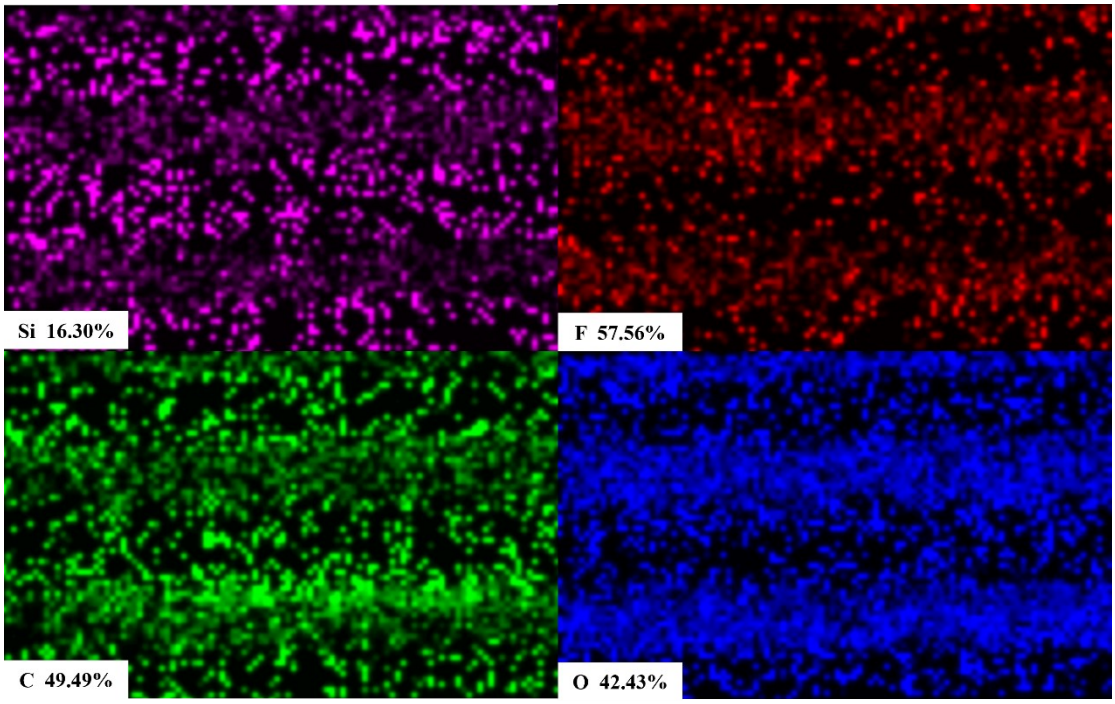

Fig. S2. EDS C, F, O and Si elemental maps of the modified aluminum surface.

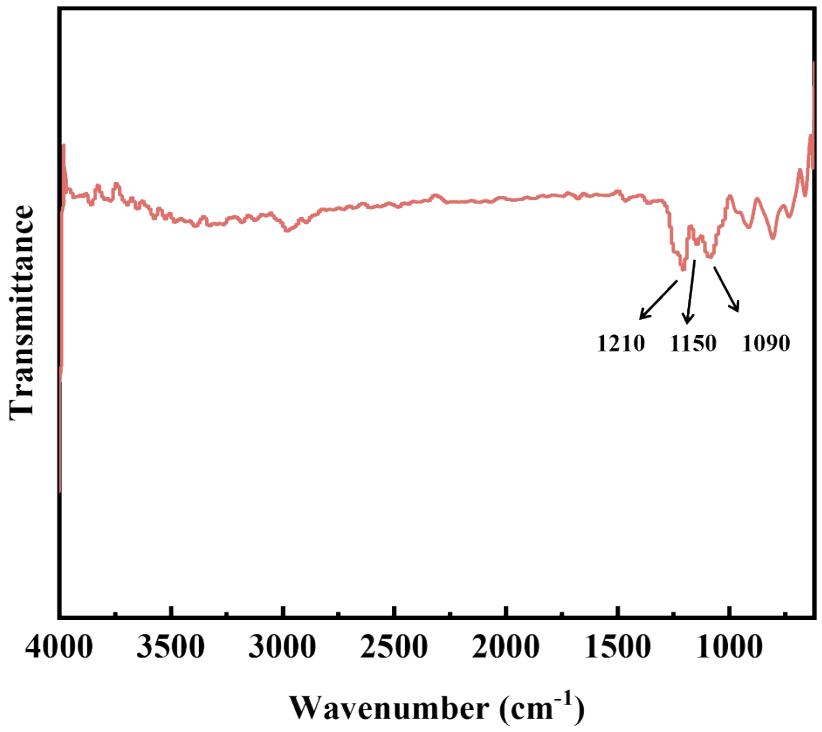

Fig.S3. FTIR diagrams of modified aluminum surface.

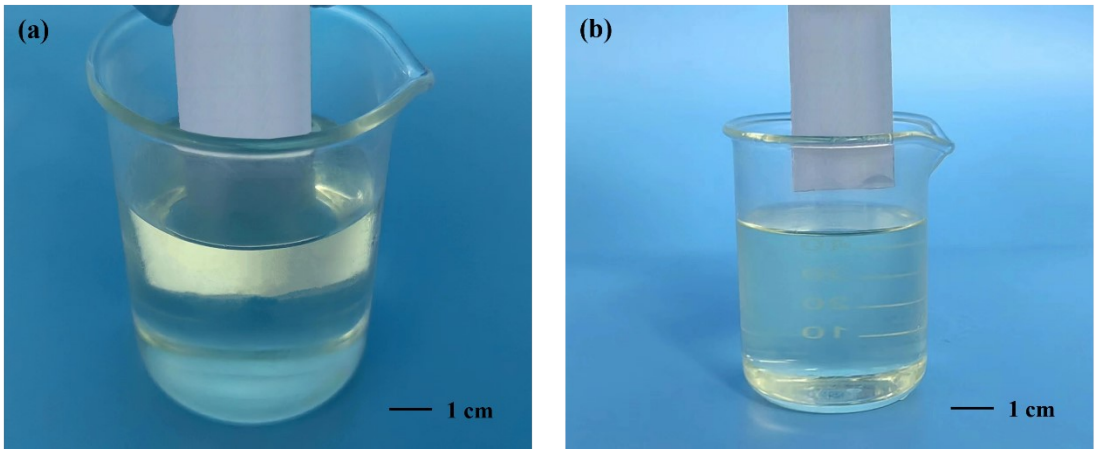

Fig. S4. Images of aluminum plates before and after immersion in edible oil.

Movie S1. Superhydrophilic aluminum surface after laser etching.
Movie S2. The water jet bounces off the aluminum surface.