Supporting information:

Anti-platelet and Thermal-responsive Poly(N-isopropylacrylamide) Surface with Nanoscale Topography

Li Chen,[†, §] *Mingjie Liu,*[‡, §] *Hao Bai,*[‡, §] *Peipei Chen,*[‡, §] *Fan Xia,*[†, §] *Dong Han*[*, ‡] *and Lei Jiang*[*, †]

Beijing National Laboratory for Molecular Sciences (BNLMS), Center for Molecular Sciences, Institute of Chemistry, Chinese Academy of Sciences, Beijing 100190, P. R. China, National Centre for NanoScience and Technology, Beijing 100190, P. R. China and Graduate University of Chinese Academy of Sciences, Beijing 100049, P. R. China.

jianglei@iccas.ac.cn, dhan@nanoctr.cn

[†] Institute of Chemistry, Chinese Academy of Sciences. [‡] National Centre for NanoScience and Technology. [§] Graduate University of Chinese Academy of Sciences.

Figure S1

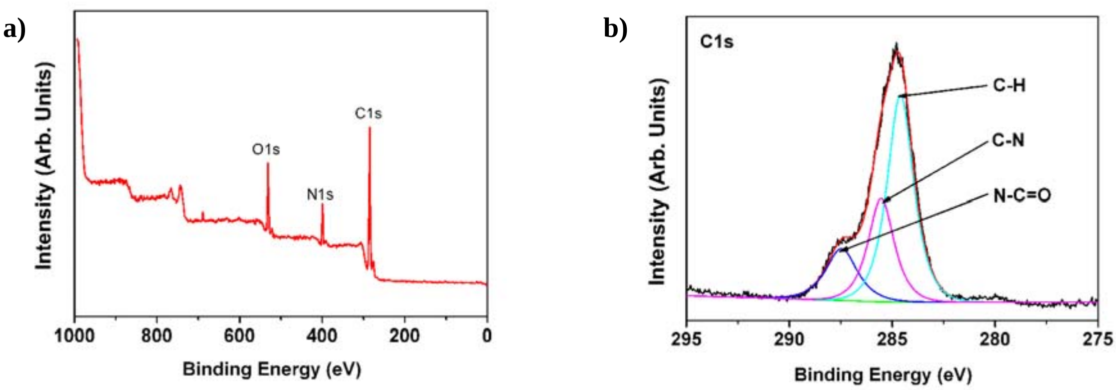
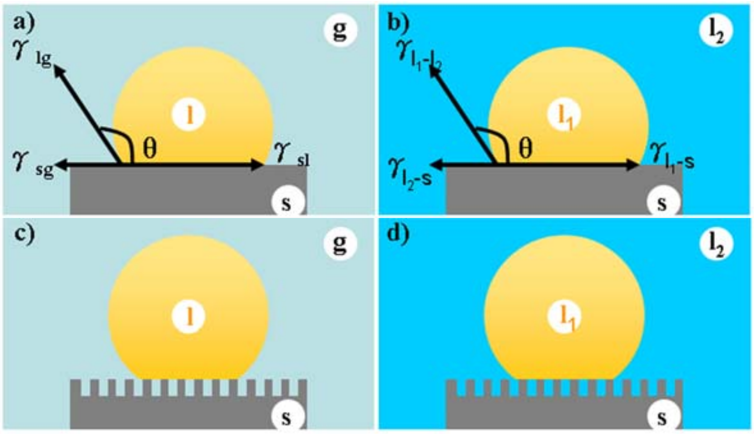


Fig. S1 a) XPS wide-scan spectra of the SiNWA-PNIPAAm's surface. b) The C1s core-level spectrum of the SiNWA-PNIPAAm's surface, which could be curve-fitted with three peak components (C-H, C-N, and N-C=O) with binding energies.

Scheme S1.



Scheme S1. Wetting behaviors of different solid substrates in air and in liquid. a) Diagram of Young's equation of a water droplet in gas-liquid-solid three phase system. b) Diagram of Young's equation at the condition of a liquid 1 droplet on smooth surface in liquid 2 phase. c) A Cassie's model describing the contact angle at a rough surface in air. d) A Cassie's model describing the contact angle at the condition of a liquid 1 droplet on rough surface in liquid 2 phase.

Note S1

Young's equation is as Eq. (1) (Scheme 1a):

$$\cos\theta = \frac{\gamma_{sg} - \gamma_{sl}}{\gamma_{lg}} \qquad (1)$$

Where θ is the contact angle of a liquid droplet on solid surface, γ_{sg} is the solid-gas interface tension, γ_{sl} is the solid-liquid interface tension and γ_{lg} is the liquid-gas interface tension.

Through Young's equation, we could get Eq. (2) in liquid phase (Scheme 1b):

$$\cos\theta_3 = \frac{\gamma_{l1-g}\cos\theta_1 - \gamma_{l2-g}\cos\theta_2}{\gamma_{l1-l2}} \qquad (2)$$

Where $\gamma_{l1\text{-}g}$ is the liquid 1-gas interface tension, θ_1 is the contact angle of liquid1 in air, $\gamma_{l2\text{-}g}$ is the liquid 2-gas interface tension, θ_2 is the contact angle of liquid 2 in air, $\gamma_{l1\text{-}l2}$ is the liquid 1-liquid 2 interface tension, and θ_3 is the contact angle of liquid 1 in liquid 2.

In solid/air/water system, Cassie proposed a model describing the contact angle at a rough surface composed of solid and air. He modified Young's equation as Eq. (3) (Scheme 1c):

$$\cos\theta' = f\cos\theta + f - 1 \qquad (3)$$

Where f is the area fraction of the solid on the surface, θ is the contact angle of a liquid droplet on a smooth surface in air, and θ' is the contact angle of a liquid droplet on a rough surface in air.

In oil/water/solid system, the rough surface is composed of solid and water, then the Cassie model is expressed as Eq. (4) (Scheme 1d):

$$\cos\theta'_3 = f\cos\theta_3 + f - 1 \qquad (4)$$

Where f is area fraction of solid, θ_3 is the contact angle of a oil droplet on a smooth surface in water, θ_3' is the contact angle of a oil droplet on a rough surface in water.

Experimental

Materials: *N*-isopropylacrylamide (Fluka, Switzerland) was recrystallized from *n*-hexane. CuBr was recrystallized before using. Silicon wafers (Grinm Semiconductor Materials Co. Ltd., China), acetone, nitric acid, methanol, sodium hydroxide, pyridine, *a*-bromoisobutyryl bromide (Fluka, Switzerland), *N,N,N',N',N''*-pentamethyl diethylenetriamine (Aldrich, Germany), and aminopropyl trimethoxysilane (Fluka, Switzerland) were used as-received. Toluene and dichloromethane were dried before use for 24 h using molecular sieves. Doubly distilled water (> 1.82 MΩ cm, MilliQ system) was used.

Instrumentation: A field-emission SEM (JSM-6700F, Japan) was used to obtain SEM images of the nanostructures, an Environmental SEM (FEI Quanta 200) was used to obtain ESEM images of the platelets, and Tecnai G2 F20 U-Twin was used to obtain TEM images.

Contact angles were measured on an OCA20 machine (DataPhysics, Germany) contact angle system. Deionized water droplets (about 3 μL) were dropped carefully onto the surface. The average contact angle value was obtained by measuring at five different positions of the same sample. The adhesive force of surfaces to oil droplet was measured using a high-sensitivity micro electro-mechanical balance system (Data-Physics DCAT 11, Germany).

X-ray photoelectron spectroscopy data were obtained with an ESCALab220i-XL electron spectrometer from VG Scientific using 300 W MgKα radiation. The base pressure was about 3×10^{-9} mbar. The binding energies were referenced to the C1s line at 284.8 eV from adventitious carbon. XPS Software used: Avantage 3.85.

The force-distance curve on the PNIPAAm-grafted surface was measured with AFM, using a Si_3N_4 probe tip (calibrated force constant≈0.121 N/m). Measurements were performed in a sample cell filled with deionized water (18 MΩ), and the temperature of the sample cell (25 or 37°C) was controlled and monitored by a thermocouple digital thermometer. The same cantilevers were used through the measurements on the PNIPAAm-grafted surface under different temperature. Force was obtained by multiplying the catilever deflection by the spring constant and plotted against the z-displacement of the catilever. Typically, 30 force-distance curves were obtained at one location through repeated tip approach/retract cycles, and the measurements were repeated at five locations on each sample. Sequential force-distance curves were collected by computer software at 0.3 s intervals.