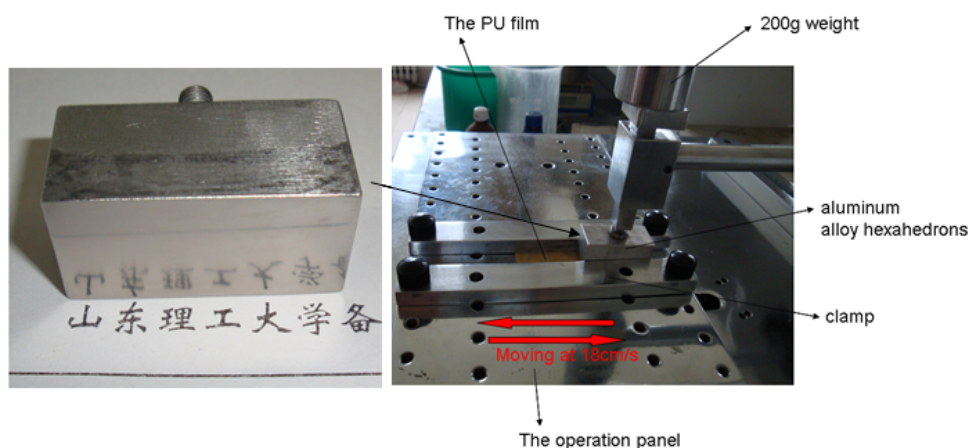




ESI. 1 The structure of the friction testing instrument.

ESI. 2: contact angles of the PU films after being loaded with friction testing and the mean square error of contact angle measurement

friction times	0	500	1000	2000	3000	4000	6000	8000	10000
contact Angle(°)	165.1	165.2	162.5	163.0	163.1	160.3	157.8	155.4	154.7
mean square error(°)	2.73	3.49	2.52	3.62	3.63	2.23	2.86	4.79	4.22



ESI. 3 The image of 20μL water droplet sticking on the tilted PU film. the title angle is 66°

ESI. 4 Experimental details

Preparation of Al negative template

The 70mm×90mm×100μm Al sheets (99.5%, Tianjing Chemical Reagent Co. China) were immersed in an etching solution (10mol/L HCl) for 60s and then oscillated in distilled water for 30 min by an ultrasonic washer at room temperature.

Preparation of NCO-terminated PB

NCO-terminated PB was prepared by blending 4.0 g Hydroxyl-terminated polybutadiene (HTPB, OH%=0.90mmol/g, provided by Zibo Qilong Chemical Industry Co.Ltd, China, dewatered under vacuum at 80°C for 4h before being used) and Toluene diisocyanate (according to the ration of NCO:OH=2.5:1) in presence of ethyl acetate as solvent and Dibutyltin dilaurate of as catalyst (0.02wt%) at 80°C for 3h under nitrogen flow. The resultant was diluted with ethyl acetate to 30 wt. % solid content before being used.

Preparation of PU precursor and EP precursor

NCO-terminated PB, HTPMS (OH%=0.59mmol/g, Jinan Guobang Chemical Co., China) as low surface energy material and MOCA (Shanghai Chemical Reagent Co., China) as chain extender (according to the ration of NCO:NH₂ = 2:1) was stirred for 10 min, the content of HTPMS is 15 wt. % in the solid content of the blend.

EP precursor was prepared by blend diglycidyl ether of bisphenol (E-44, the content of epoxy group is 0.44mol/100g), 1, 2-ethylenediamine (according to epoxy group: amine group = 2:1), and TMEDA (0.05 wt.%), the blend was diluted with ethyl acetate to 30 wt. % solid content before being used.

Casting procedure

The Al negative template was adhered on a 70mm×90mm×5mm PTFE dish by twin adhesive tapes, the template was wetted with ethyl acetate before casting. The PU precursor or EP precursor was carefully cast into the PTFE dish and then dried for 4h at room temperature, then, the sample was kept at 50°C for 24h for solidification. After immersing the sample in 1mol/L HCl solution to remove the Al negative template via corrosion, the films were oscillated in distilled water by an ultrasonic washer for 10 min at room temperature and then dried at 50°C for 1 h for contact angle and SEM measurement.

Friction testing

The PU film was cut to 35mm×90mm and then fixed on the operation panel of the friction testing instrument (A20-399, Dongguang Chuangyu Instrument Co. Ltd, China, shown in Figure 1)

by a clamp. the friction performance of the films were tested using a polished surface (40mm×30mm, $R_a \leq 0.5 \mu\text{m}$, shown in ESI. 1) of an aluminum alloy hexahedron, the aluminum alloy hexahedron was loaded with 200g weight, and then the operation panel was kept reciprocating motion at the average rate of 18 cm/s at the room temperature, the weight of the aluminum alloy hexahedron and the attachment is 160.7g, so the films was loaded with 2945.7 Pa and rubbed at 18 cm/s during the friction testing, the films were milled twice during one friction cycle,

After friction testing, a 10mm×35mm flim was cut across friction direction from the film and then was oscillated in distilled water by an ultrasonic washer for 10 min at room temperature and then dried at 50°C for 1 h for contact angle and SEM measurement. The remnant was used for the next friction testing.

Measurement

Contact angles of 4 μL water droplet and sliding angles of 20 μL water droplet on films were measured with an optical contact angle meter (CAM200, KSV Instruments Ltd, Finland). Contact angle on eight different points of films were measured and the average value of measurements was adopted. The morphology of the films was measured using a scanning electron microscopy (SEM, FEL Sirion 200 Netherlands). The FTIR spectra of the films were measured on a Fourier Transform Infrared Spectrometer (Nicolet 5700, USA).