

Facile Transformation of Hydrophilic Cellulose into Superhydrophobic One

Shenghai Li, Haibo Xie, Suobo Zhang, and Xianhong Wang*

State Key Laboratory of Polymer Physics and Chemistry Changchun Institute of
Applied Chemistry Chinese Academy of Sciences Changchun 130022 (P. R. China)

E-mail: sbzhang@ciac.jl.cn

Experimental Section

Trichloromethylsilane (TCMS) was obtained from Aldrich, and used without further purification. Cotton fabric was purchased from a general store.

The method employed is described as follow: first, a sheet of cotton fabric is cleaned by ultrasonic washing in ethanol and water, respectively, and then dried at 120 °C in a vacuum oven for 1h. Second, the cotton fabric is placed in a sealed chamber for designed time, into which a saturated atmosphere of trichloromethylsilane (TCMS) at 50 °C is introduced. The vapor of TCMS is absorbed onto the cotton fibres' surface and penetrated into the fabric, due to the porous property of the fibers and a reaction between the halide and hydroxyl group. The efficient reaction will enhance the content of covalently silicone to the fibres' surfaces. Next, the cotton fabric is withdrawn from the chamber and immersed into an aqueous solution of pyridine (1 M) at room temperature to hydrolyze the remaining Si-Cl bonds. The cotton fabric is carefully washed with water to remove the excess reagents. At last, the cotton fabric is treated in a vacuum oven at 150 °C for 10

minutes, subsequent polymerization results in nano-scaled silicone coating attached to the surface tightly.

Hollow silica replicas of as-prepared superhydrophobic cotton fabric were obtained by heat treatment at 500 °C for 6 h (heating rate 10 K/min).

FT-IR spectra were recorded in the range 500-4000 cm⁻¹ with a Bruker Vertex-70 instrument with 128 scans per sample. Surface chemical characterization was carried out by X-ray photoelectron spectra (XPS), with a Thermo ESCALAB 280 system with Al/K α radiation as the X-ray source. The morphology of the sample was characterized by an XL30 ESEM FEG field emission scanning electron microscope (FE-SEM, FEI Company with 20 kV operating voltage) and an atomic force microscope (AFM, Seiko Instruments Industry, Co. Ltd. SPA300HV with an SPI 3800 controller). The contact angles was estimated by Drop Shape Analysis DSA10 (Krüss GmbH, Germany) at the ambient temperature. The average WCA value was obtained by measuring more than five different positions for the same sample.