# One-step Coating of Fluoro-containing Silica Nanoparticles for Universal Generation of Surface Superhydrophobicity

**Hongxia Wang[a], Jian Fang[a], Tong Cheng[a], Jie Ding[b], Liangti Qu[b], Liming Dai[c], Xungai Wang[a] and Tong Lin[a]**

**DOI: 10.1039/b714352d**

## ELECTRONIC SUPPLEMENTARY INFORMATION

[a] *Centre for Material and Fibre Innovation, Deakin University, Geelong, VIC 3217, Australia Fax: 61-3-52272539; Tel: 61-3-52271245; E-mail: tong.lin@deakin.edu.au*
*b Human Protection and Performance Division,Defence Science & Technology Organisation (DSTO), VIC 3207, Australia*
*c Department of Chemical and Materials Engineering, The University of Dayton, Dayton, OH 45469, USA*

## Experimental Section

Ethanol, tetraethylorthosilicate (TEOS), and ammonium hydroxide (28% in water) were obtained from Aldrich. Tridecafluorooctyl triethoxysilane (FAS, Dynasylan F 8261) was supplied by Degussa.

Electron microscopic images and EDX mapping were taken on a scanning electron microscope (SEM) Leo 1530 and JSM-5910, respectively. Transmission electron microscope (TEM, JEM-200 CX JEOL) was used to observe the silica particles. FTIR (Fourier Transform Infrared) spectra were measured on a FTIR spectrophotometer (Bruker Optics) in ATR mode. Water contact angles were measured using a contact angle meter (KSV CAM200 Instruments Ltd). X-ray photoelectron spectra (XPS) were collected on a VG ESCALAB 220-iXL spectrometer with a monochromated Al Kα source (1486.6 eV) using samples of *ca.* 3 $mm^2$ in size. The X-ray beam incidence angle is 0º with respect to the surface normal, which corresponds to a sampling depth of *ca.* 10 nm. The obtained XPS spectra were analysed by the XPSPEAK41 software.

Typical sol preparation and coating procedure: TEOS (5ml), together with an appropriate amount of FAS, was dissolved in 25 ml ethanol. The solution was mixed with ammonium hydroxide/ethanol solution (6ml 28% $NH_3 \cdot H_2O$ in 25 ml ethanol), and stirred intensively at room temperature for 12 hr. The milky mixture solution was then ultrasonicated (VCX750 Sonics & Materials Inc.) for 30 min to produce a homogeneous suspension piror to the coating onto substrates. Upon drying at room temperature, the treated substrate was further cured at 110ºC for 1hr.

A large variety of different substrates: glass slide, polyester fabric (plain weave, 168 $g/m^2$), wool fabric (plain weave, 196 $g/m^2$), cotton fabric (plain weave, 160 $g/m^2$), electrospun polyacrylonitrile (PAN) nanofibre mat (average fibre diameter 226 ± 21 nm, thickness 0.29 ± 0.03 mm), filter paper (Advantec. Tokyo Roshi Kaisha, Ltd), and silicon wafer (Si-Mat Silicon Materials) were used in the present work.

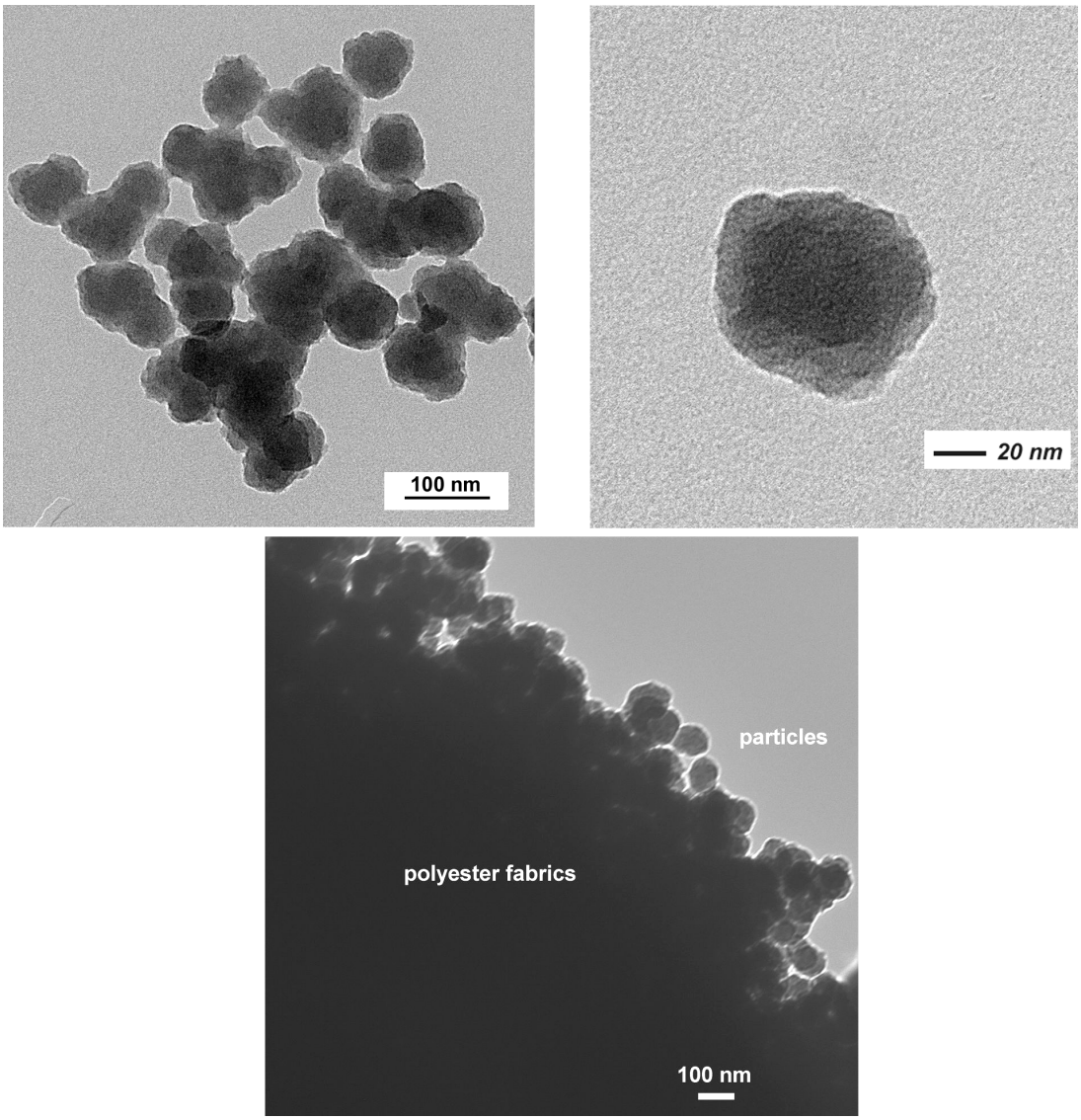


**Fig. S1.** Typical TEM images for the particles and the particle-coated polyester fabric

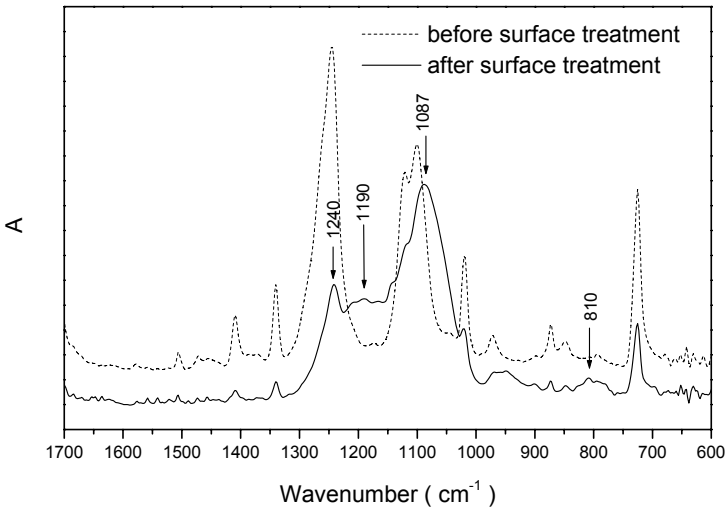


**Fig. S2.** FTIR spectra of polyester fabric before and after the silica coating (FAS/TEOS=1:10 mol/mol)

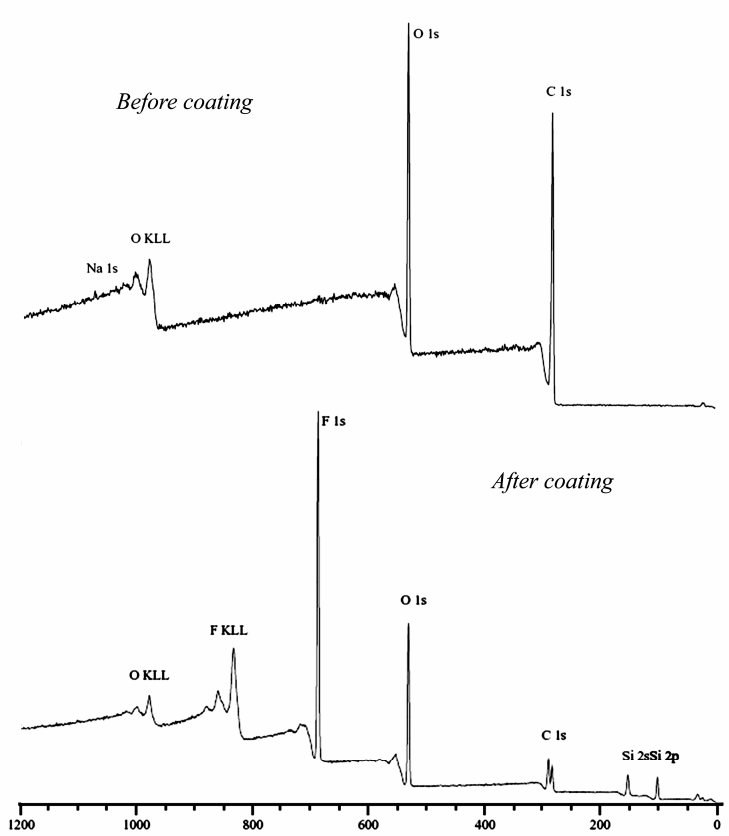


**Fig. S3.** XPS survey spectra of the polyester fabric before and after the superhydrophobic treatment (FAS/TEOS=1:10 mol/mol)

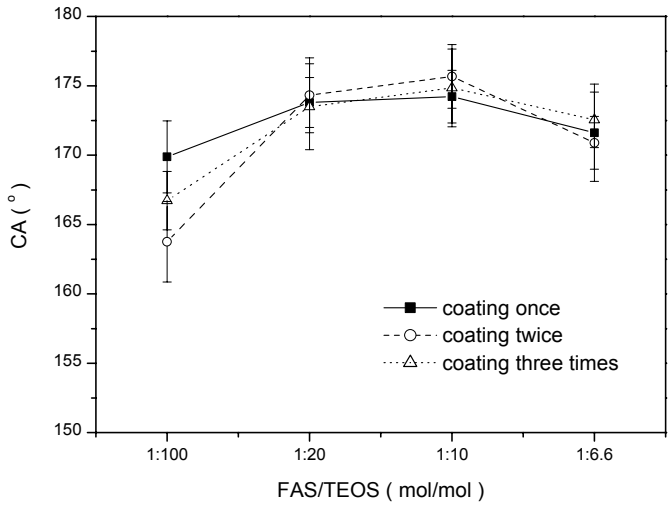


**Fig. S4.** The effect of FAS/TEOS ratios and treatment times on the water contact angles of the silica-coated polyester fabric