Electronic Supplementary Material (ESI) for Green Chemistry.

Supporting Information:

Hydrophobic Nanocoating of Cellulose by Solventless Mechanical milling

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1. Acid hydrolysis

Acid hydrolysis of PTFE-milled cellulose: 1 g of 28-h PTFE-milled cellulose was dispersed in 100 ml of 20 wt% H_2SO_4, refluxed at 80°C for 2h. The mixture was neutralized, washed with water by filtration and dried. Figure S1 is X-ray diffraction of the product. There was nearly no change in the pattern. SEM-EDS (Figure S2) also showed preservation of cellulose-PTFE composition. These results show that cellulose was protected by the PTFE layer from the harsh acid treatment.

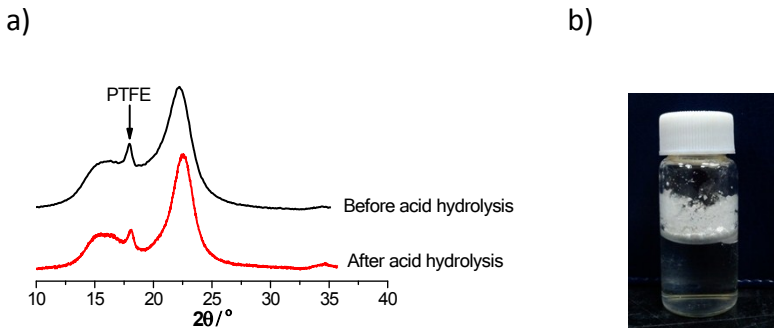

Figure S1. a) X-ray diffraction profiles of acid hydrolysis product of PTFE-milled cellulose. Arrow shows major reflection of PTFE. b) Photographs of 28-h PTFE-milled cellulose after acid treatment showing total repulsion from water.

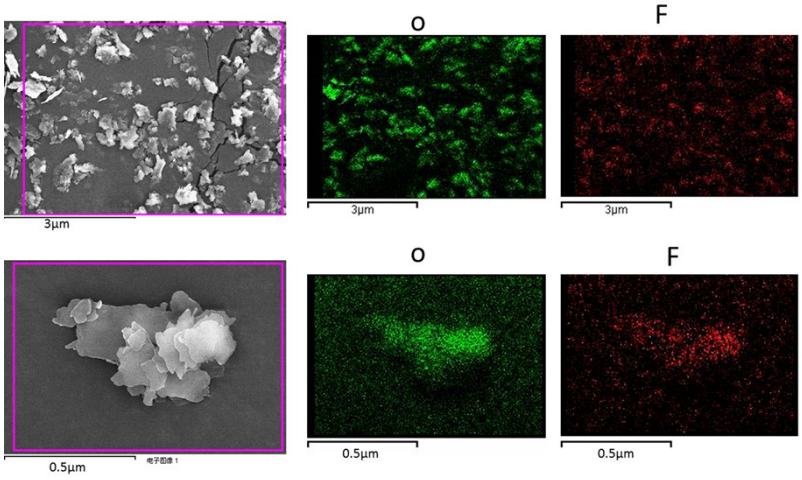

Figure S2. Elemental mapping by SEM-EDX of 28-h PTFE-milled cellulose after acid hydrolysis. The O and F signals indicate cellulose and PTFE, respectively. Distribution of O and F match well, indicating continuous PTFE coverage of cellulose remained.

2. Scherrer Equation (Supporting Information Eq. S1)

$$D_{hkl} = K\lambda / B\cos\theta \qquad (1)$$

Where D_{hkl} is the dimension of the crystal perpendicular to *hkl* plane, θ is the diffraction angle, λ is the wavelength of the X-ray radiation (Cu Kα, λ = 0.154 nm), and B is the full width at half maximum (fwhm) of the diffraction peak.

3. Supplementary figures

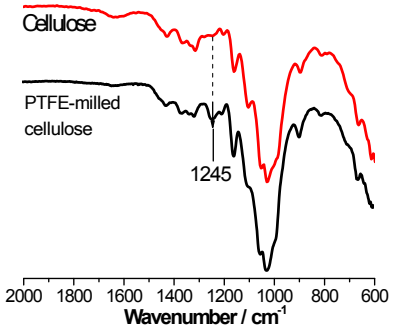

Figure S3. ATR-FTIR spectra of cellulose and PTFE-milled cellulose. Note a new peak at 1245 cm^{-1} of PTFE-milled cellulose arising from PTFE.

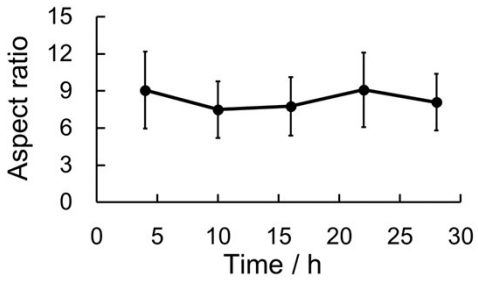

Figure S4. Aspect ratio of PTFE-milled cellulose particle (28 h). Width from SEM; thickness from AFM.

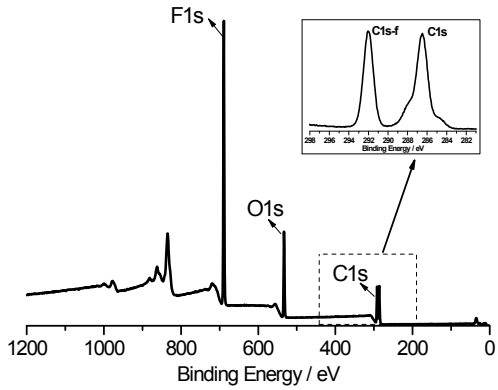

Figure S5. Wide scan XPS spectra of PTFE-milled cellulose for 28h.

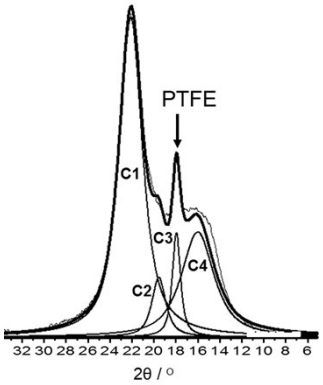

Figure S6. Peak separation of X-ray diffraction of PTFE-milled cellulose for 28 h, C3 is PTFE peak of (100) plane at 2θ=18.2°.

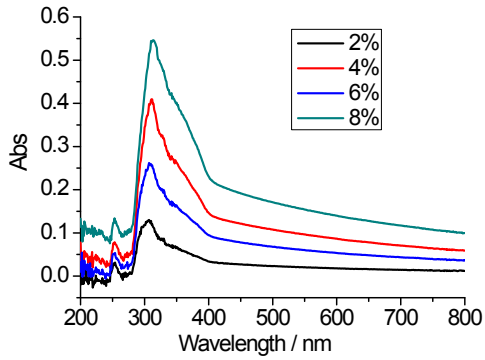

Figure S7. UV-VIS spectra of Vaseline with different content of PTFE-milled cellulose.