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% H2SO4, 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](image1.png)

**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](image2.png)

**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)**

\[
D_{hkl} = \frac{K\lambda}{B\cos \theta}
\]  

(1)

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

3. **Supplementary figures**

![ATR-FTIR spectra of cellulose and PTFE-milled cellulose. Note a new peak at 1245 cm\(^{-1}\) of PTFE-milled cellulose arising from PTFE.](image)

**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.

![Aspect ratio of PTFE-milled cellulose particle (28 h). Width from SEM; thickness from AFM.](image)

**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.