Supporting Information for Diblock-Copolymer-Coated Water and Oil Repellent Cotton Fabrics

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1. Estimation of the Specific Surface Area for the Cotton Fabrics

The warp and weft thread diameters, d_r and d_f, were (270 ± 10) and (620 ± 10) μm, respectively. Using the fiber diameter d_0 of (10.0 ± 15) μm and assuming hexagonal packing for the fiber cross sections and thus a packing density of 90%, we calculated the fiber number N_r in a warp thread to be

$$N_r = \frac{{d_r}^2}{{d_0}^2} \times 90\% = 656$$

Analogously, the number N_f of fibers per weft thread was calculated to be 3460.

Since the numbers of warp and weft threads per square inch were 47 and 41, respectively, the total number of fibers per square inch was 656×47+3460×41 $=1.72\times10^5$.

Assuming a smooth surface for the fibers, the total surface area S for fibers per in^2 of fabric is

$$S = 1.72 \times 10^5 \times \pi d_0 \times 2.54 = 1370 \quad \text{cm}^2$$

Since the weight of each square inch of fabric is ~110 mg. Thus, the specific surface area of cotton fabric was ~1.25 m^2/g.

2. Estimation of the Thickness of a Fully Grafted Polymer Layer

The density ρ of a dried grafted P1 layer should be close to 1.91 g/cm^3. A fully grafted P1 layer has a weight fraction of 3.0% in a fabric sample. This corresponds to 3.4 mg of grafted polymer per in^2 of fabric. The thickness h of this layer can be calculated from

$$h = 3.4\times10^{-3}/(1.91\times1370) = 13\times10^{-7} \quad \text{cm}$$

3. Light Scattering Study of a Sol-Gelling P1 Mixture after Ammonia Addition

We determined the sizes of the polymer chains before ammonia addition and 5 min after ammonia addition. The hydrodynamic diameters were between 2 and 7 nm initially and increased to ~20 nm 5 min after ammonia addition.

We followed the scattered intensity change of 2.0 mL of a P1 solution in THF at 1.5 mg/mL as a function of time after 0.1 mL of 14-M ammonia solution was added. The data are plotted in Figure 1S. It clearly shows that the intensity started to increase abruptly about 2 min after ammonia addition and thus cluster formation thereafter.

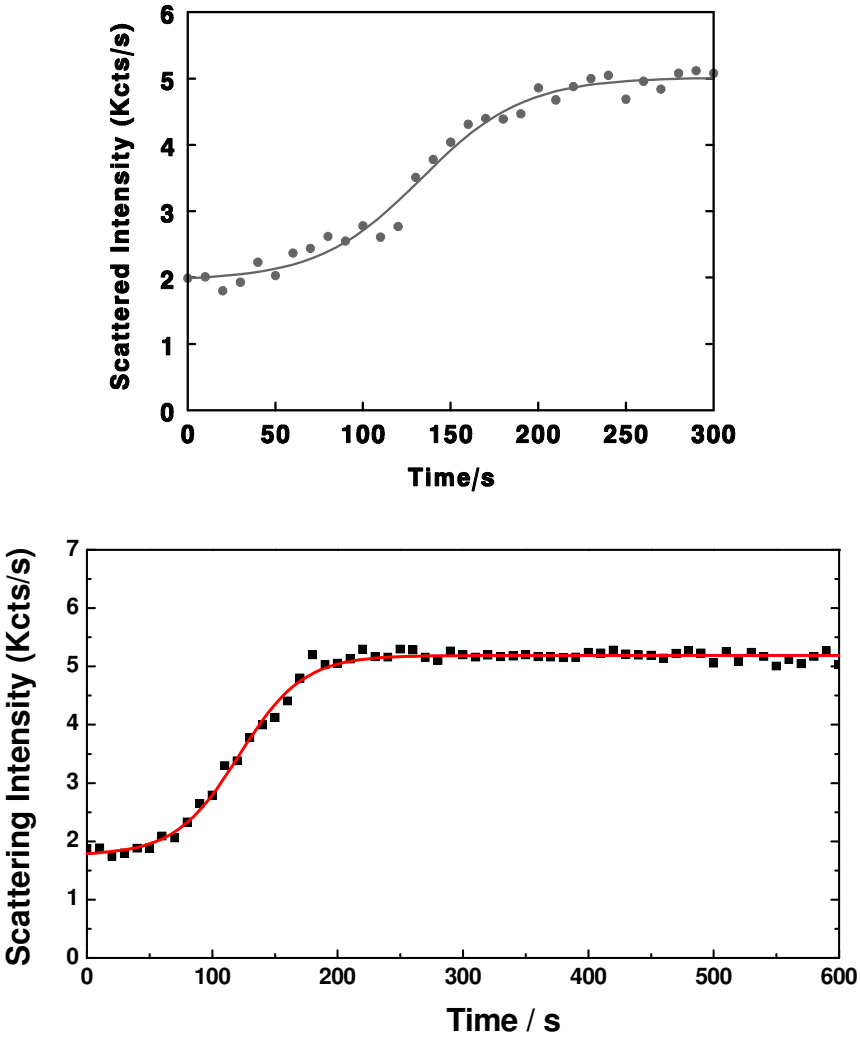

Figure 1S. Variation in the scattered intensity from 2.0 mL of a P1 solution at 1.5 mg/mL in THF after the addition of 0.1 mL of a 14.0-M ammonia solution. The two sets of data were from different runs.

We were surprised at the leveling of the scattered intensity about 3.5 min after ammonia addition. This prompted it us to repeat the experiment. The same trend was observed. This thus suggested that a saturated cluster population was reached about 3.5 min after ammonia addition. Also, the cluster size did not increase with sol-gel time because the clusters were shelled by PFOEMA.

4. FTIR Study of Grafted Cotton

In an attempt to gain insight into the grafting chemistry, diffuse reflectance Fourier-transform infrared spectra were obtained for cotton, P1-coated cotton, P1, and sol-gelled P1 and are compared in Figure 2S. The sol-gelled P1 sample was obtained from sol-gelling P1 in a standard P1 coating solution for 10 h. After P1 coating, the ester carbonyl stretching peak at 1734 cm^{-1}, the C-F stretching vibrations at 1204 and 1239 cm^{-1} (Ye, XY; Zuo B.; Deng M. et al. *J. Colloid & Interf. Sci.* **2010**, *349*, 205-214), and the rocking and wagging vibrations of CF2 groups at 660 and 703 cm^{-1} appeared, suggesting the presence of PFOEMA in the coated cotton. Unfortunately, the sol-gelled P1 and P1 samples differed insignificantly and the spectra comparison shed little light on the grafting chemistry.

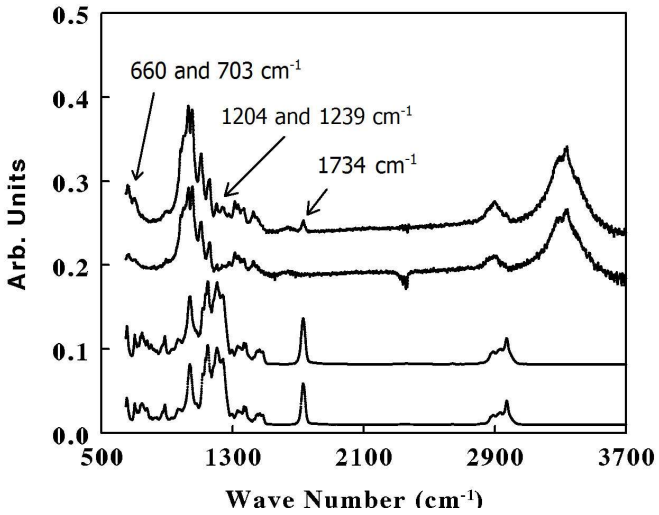

Figure 2S. Comparison of FTIR spectra of P1 (botton), sel-gelled P1 (second from the bottom), cotton (third from the bottom), and P1-coated cotton (top). The data were scaled to facilitate data comparison.