

## **Supporting Information**

# **Facile and Effective Fabrication of Highly UV-Resistant Silk Fabrics with Excellent Laundering Durability, and Thermal and Chemical Stabilities**

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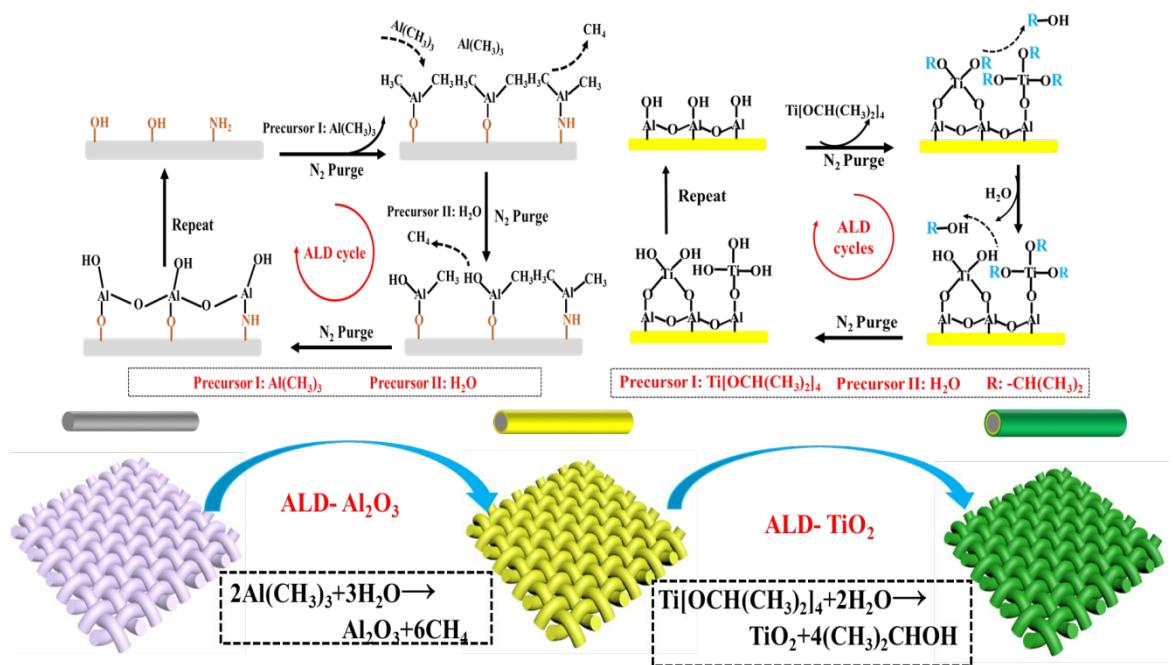


Figure S1. Schematic process of ALD  $\text{TiO}_2$  and  $\text{Al}_2\text{O}_3$  coating on silk fabric surface in sequence.

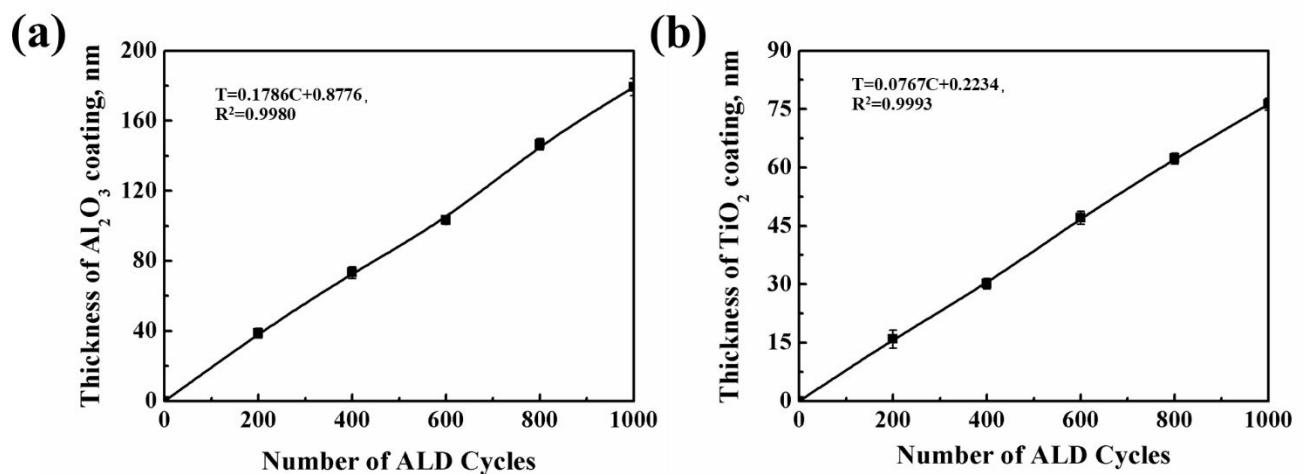


Figure S2.  $\text{Al}_2\text{O}_3(\text{TiO}_2)$  films thickness on the silk fiber/fabric as a function of the number of ALD cycles.

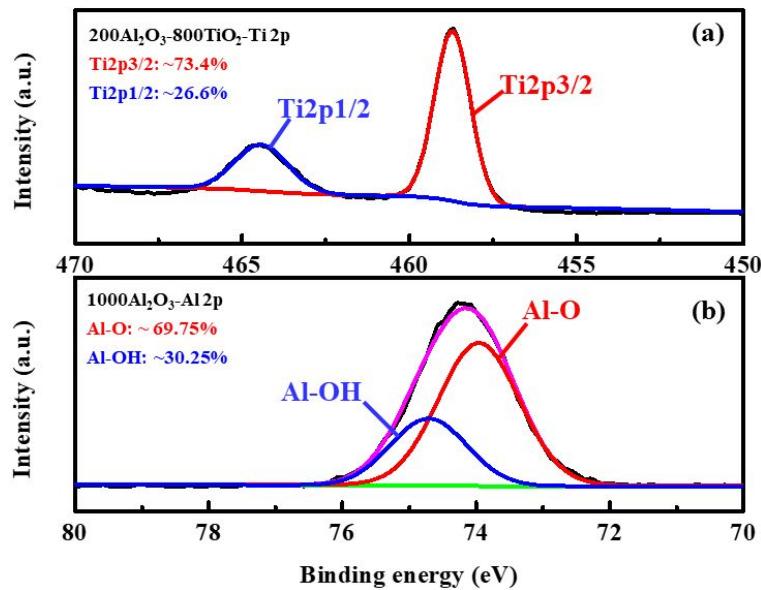


Figure S3. Detailed XPS spectra of Ti2p of SF-200Al<sub>2</sub>O<sub>3</sub>-800TiO<sub>2</sub> and Al2p of SF-1000Al<sub>2</sub>O<sub>3</sub>, respectively.

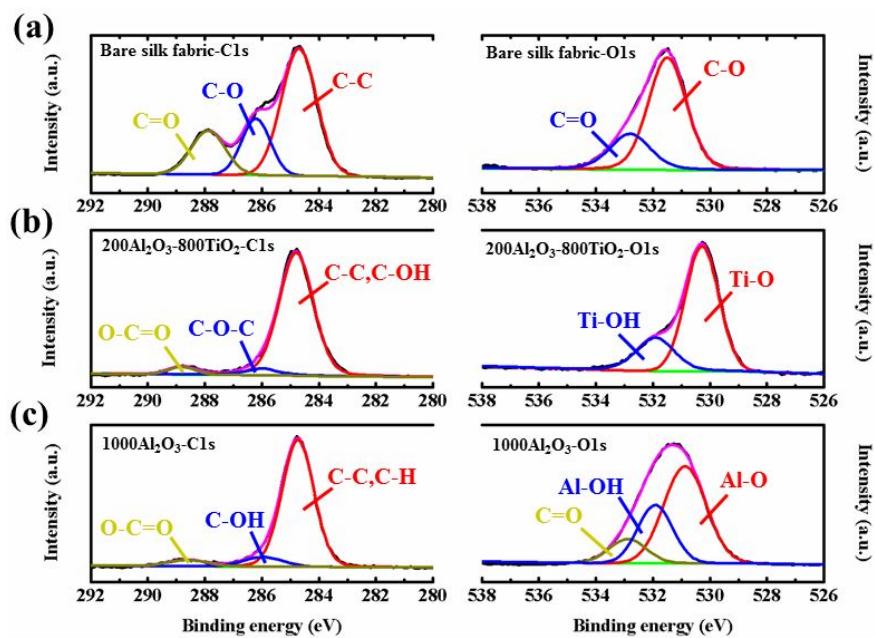


Figure S4. Detailed XPS spectra of C1s and O1s, respectively. (a) SF, (b) SF-200Al<sub>2</sub>O<sub>3</sub>-800TiO<sub>2</sub> and (c) SF-1000Al<sub>2</sub>O<sub>3</sub>

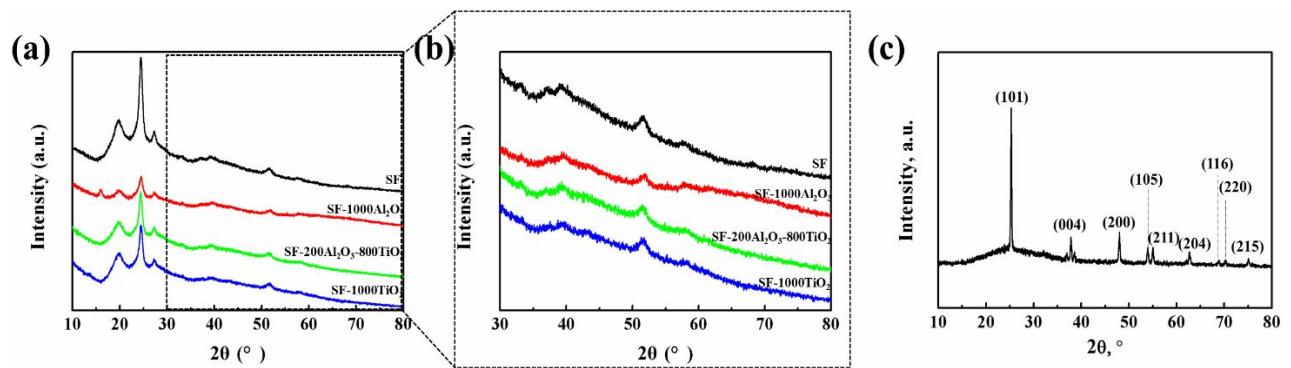


Figure S5 X-ray diffraction (XRD) spectra of SF, SF-1000Al<sub>2</sub>O<sub>3</sub>, SF-200Al<sub>2</sub>O<sub>3</sub>-800 TiO<sub>2</sub> and SF-1000 TiO<sub>2</sub> (a), the enlarge XRD spectra of SF, SF-1000Al<sub>2</sub>O<sub>3</sub>, SF-200Al<sub>2</sub>O<sub>3</sub>-800 TiO<sub>2</sub> and SF-1000 TiO<sub>2</sub> (b) and (c) XRD spectra of SF-1000 TiO<sub>2</sub>, which were treated by air-annealing at 550 °C for 240min.

Figure S6.

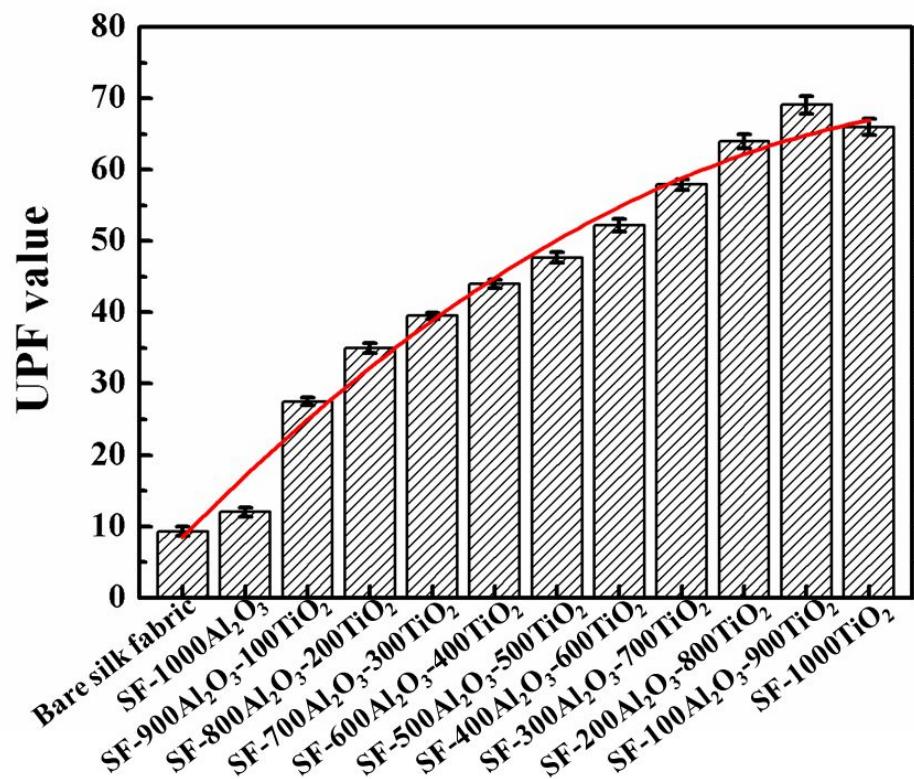


Figure S6 UPF value of bare silk fabric and ALD-coated silk fabrics

Figure S7.

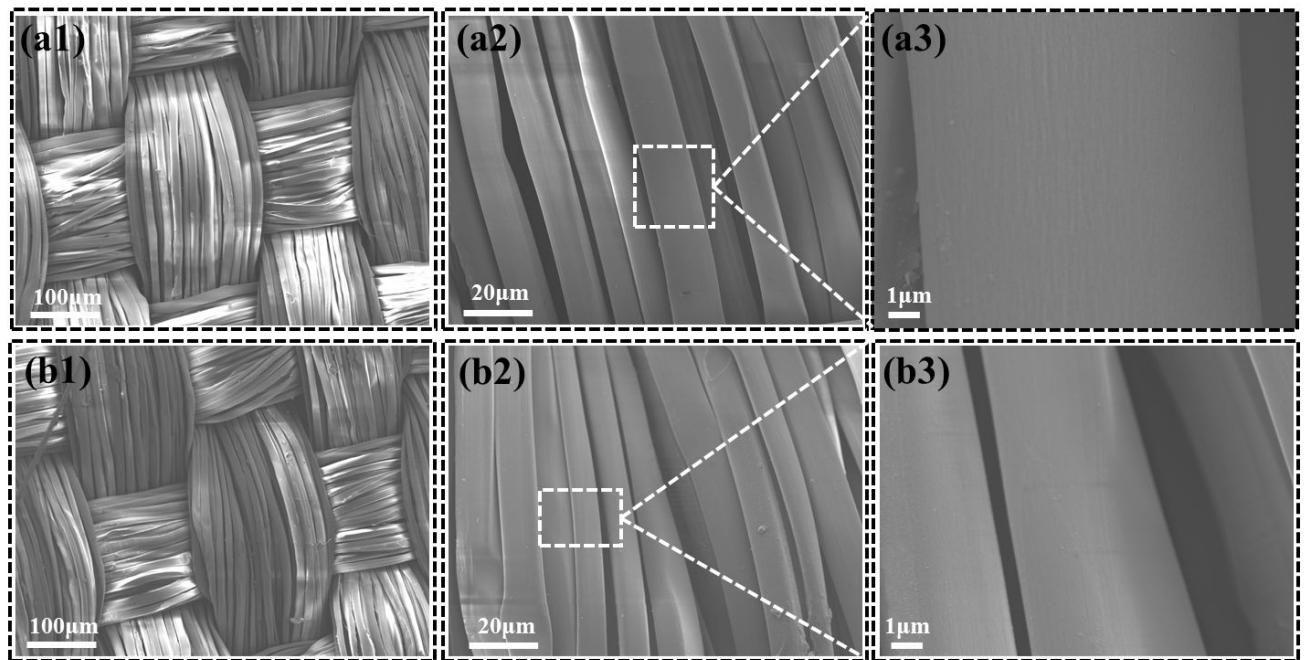


Figure S7 The SEM comparison images of SF-200Al<sub>2</sub>O<sub>3</sub>-800TiO<sub>2</sub> before and after the laundering durability

Table S1

Table S1. Maximum decomposition temperature and residual weight ratio of silk fabrics before and after ALD coating

Sample	SF	SF- 100Al <sub>2</sub> O <sub>3</sub> - 900TiO <sub>2</sub>	SF- 200Al <sub>2</sub> O <sub>3</sub> - 800TiO <sub>2</sub>	SF- 1000TiO <sub>2</sub>	SF- 1000Al <sub>2</sub> O <sub>3</sub>
$T_{\max}$ (°C)	311.5	314.0	316.5	314.5	318.0
$Y_c$ at 800°C (%)	32.4	39.1	41.5	43.1	45.1

Table S2.

Table S2. Ultraviolet (UV)-protection properties of bare silk fabric and ALD coated silk fabrics.

Sample	UPF value	UVA (%)	UVB (%)
SF	9.3±0.52	21.69±1.23	5.22±0.25
SF-1000Al <sub>2</sub> O <sub>3</sub>	12.0±0.58	17.68±1.07	4.12±0.2
SF-200Al <sub>2</sub> O <sub>3</sub> -800TiO <sub>2</sub>	64.0±0.68	5.68±0.84	1.08±0.13
SF-100Al <sub>2</sub> O <sub>3</sub> -900TiO <sub>2</sub>	69.1±0.74	6.82±0.43	0.75±0.12
1000TiO <sub>2</sub>	66.0±0.86	6.12±0.58	0.87±0.08

Table S3.

Table S3. Mechanical properties of bare silk fiber and ALD coated silk fibers before and after the UV irradiation.

Sample	Before UV radiation			After UV radiation		
	Tensile stress (cN)	Strain (%)	Breaking	Tensile stress (cN)	Strain (%)	Breaking
			strength (MPa)			strength (MPa)
SF	3.01±0.17	15.73±1.05	170.3±2.12	1.75±0.12	2.4±0.05	99.03±1.84
SF-heated	2.65±0.14	13.31±1.07	149.9±1.96	1.2±0.08	1.17±0.06	67.9±1.92
SF-1000Al <sub>2</sub> O <sub>3</sub>	3.96±0.13	22.62±1.23	224.1±1.94	3.05±0.08	5.31±0.07	172.6±1.93
SF-200Al <sub>2</sub> O <sub>3</sub> - 800TiO <sub>2</sub>	4.94±0.12	24.36±0.88	279.5±2.23	3.55±0.13	7.62±0.08	200.9±2.02
SF-100Al <sub>2</sub> O <sub>3</sub> - 900TiO <sub>2</sub>	6.06±0.12	26.82±1.12	342.9±2.58	4.16±0.11	8.75±0.07	235.4±1.96
SF-1000TiO <sub>2</sub>	8.45±0.15	29.47±1.32	478.2±2.34	3.17±0.12	5.91±0.08	179.4±2.05