

Supporting information

Enhancing the durability of Pt nanoparticles for water electrolysis using ultrathin SiO₂ layers

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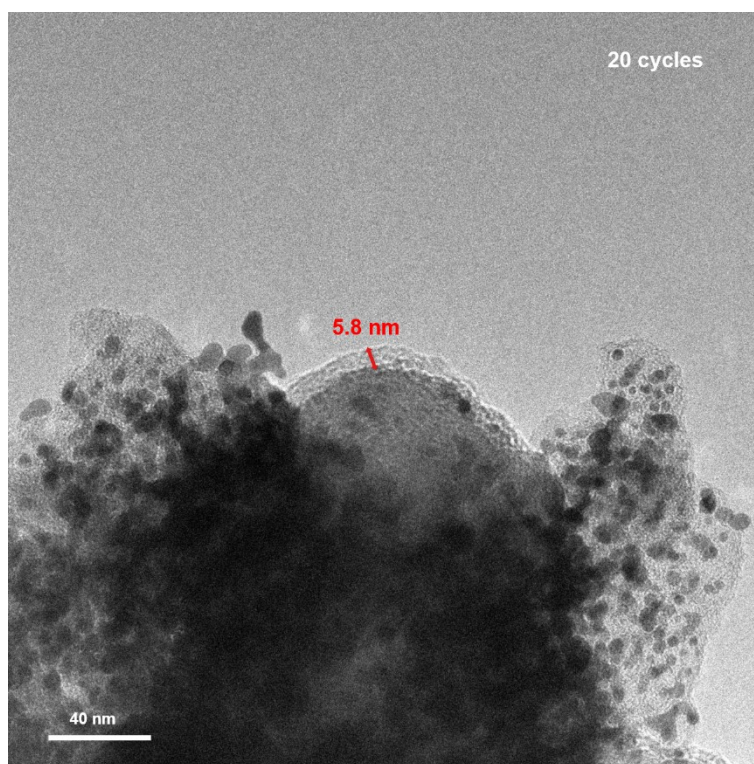


Figure S1. Film thickness determination, TEM image of the Pt/CB catalyst after 20 ALD cycles. Sampling from the outermost surface of the catalyst ink spot.

Table S1: ALD experimental conditions. (RT indicates room temperature)

Material	Precursor (T, °C)	Co-reactant (T, °C)	T _{reaction} (°C)	Pulse Time (s) (Precursor-N ₂ -Co- reactant-N ₂)	Flow rate(L/min)
SiO ₂	SiCl ₄ (RT)	H ₂ O vapor (RT)	100	15-60-30-60	0,5-0,5-0,5- 0,5

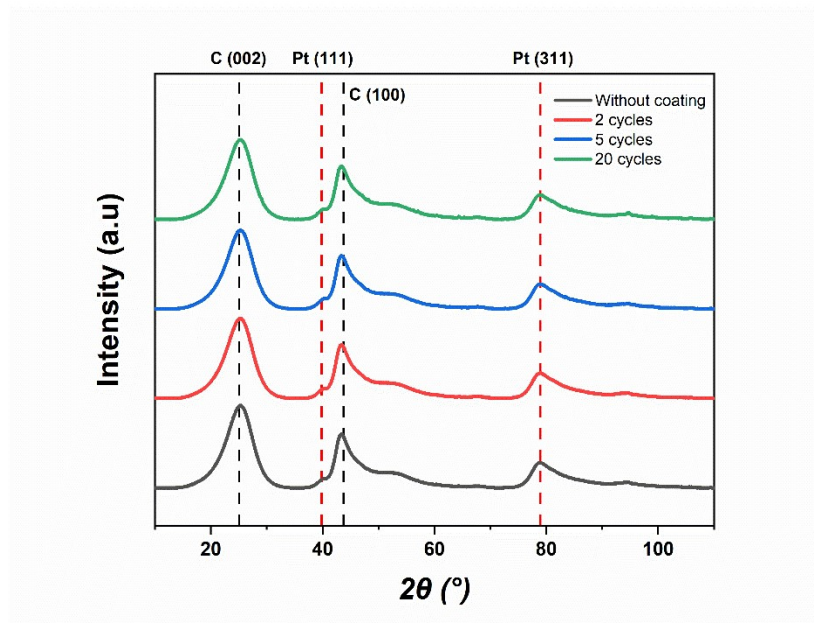


Figure S2. X-ray diffraction patterns of the original Pt/CB catalyst and the Pt/CB catalyst after applying variant numbers of ALD cycles.

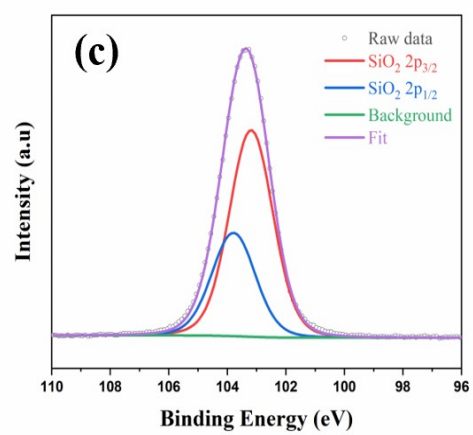
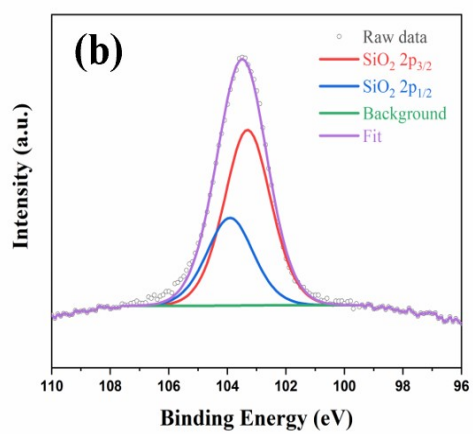
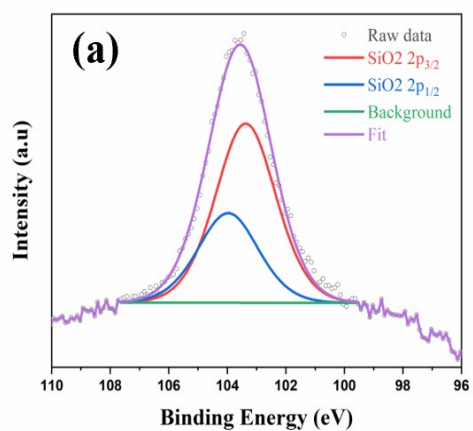


Figure S3. The Si 2p XPS spectra of the Pt/CB catalyst with SiO₂ coating: (a) 2 ALD cycles, (b) 5 ALD cycles, and (c) 20 ALD cycles of SiO₂ ALD coating.

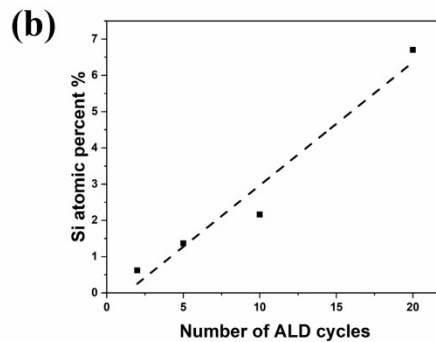
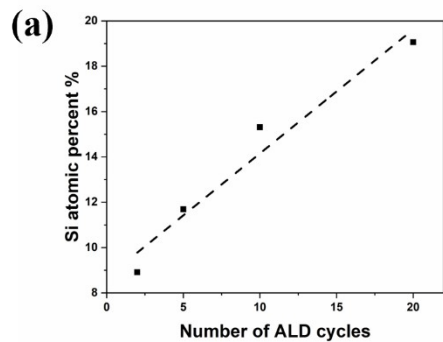


Figure S4. Growth per ALD cycle of SiO_2 deposition on the surface of Pt/CB catalyst, based on (a) XPS and (b) EDS characterization, respectively.

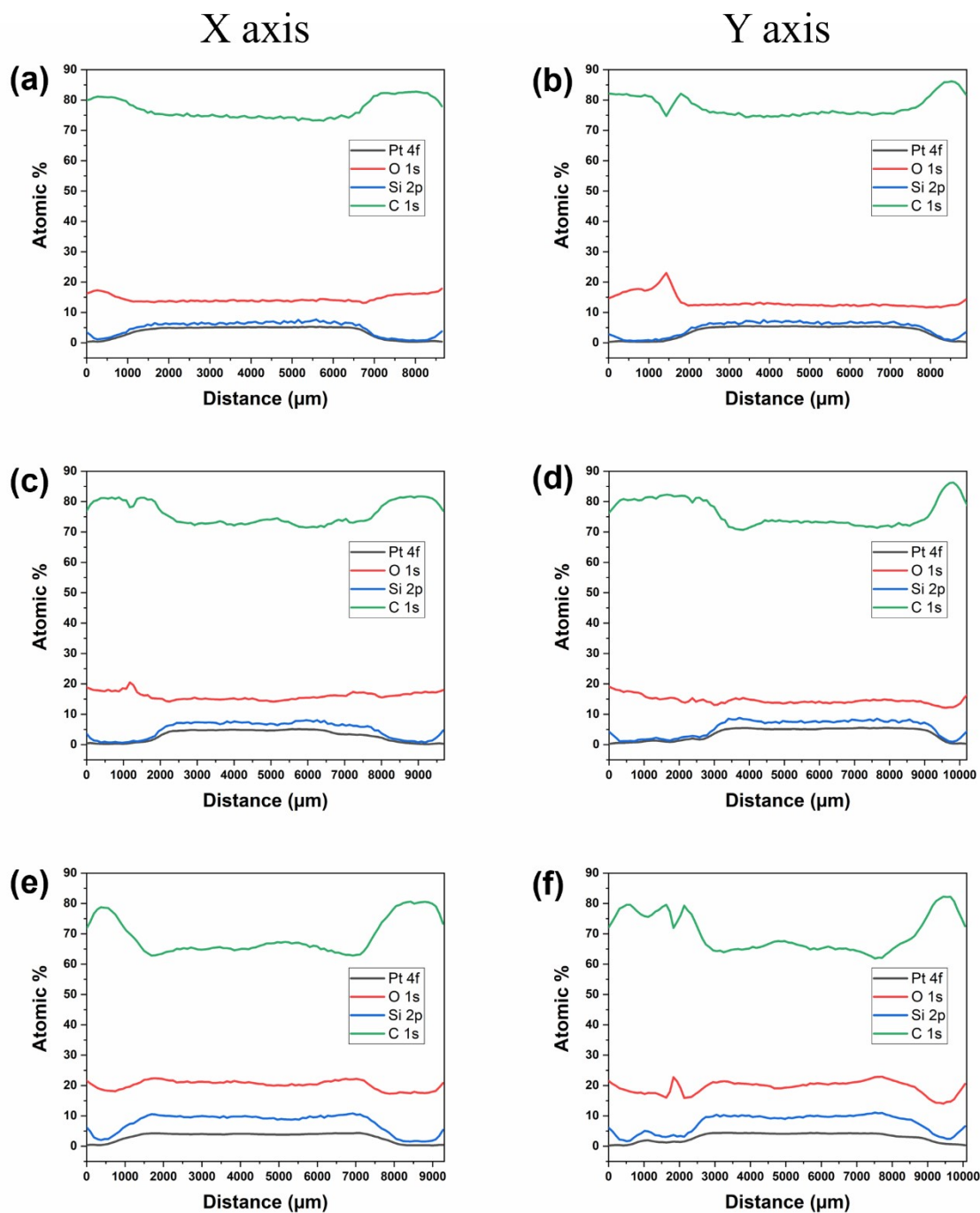


Figure S5. Crossover XPS line scan of the Pt/CB catalyst drop casted on the glassy carbon substrate after applying variant numbers of SiO₂ ALD cycles: (a, b) 2 ALD cycles, (c, d) 5 ALD cycles, and (e, f) 20 ALD cycles scanning from X and Y axis.

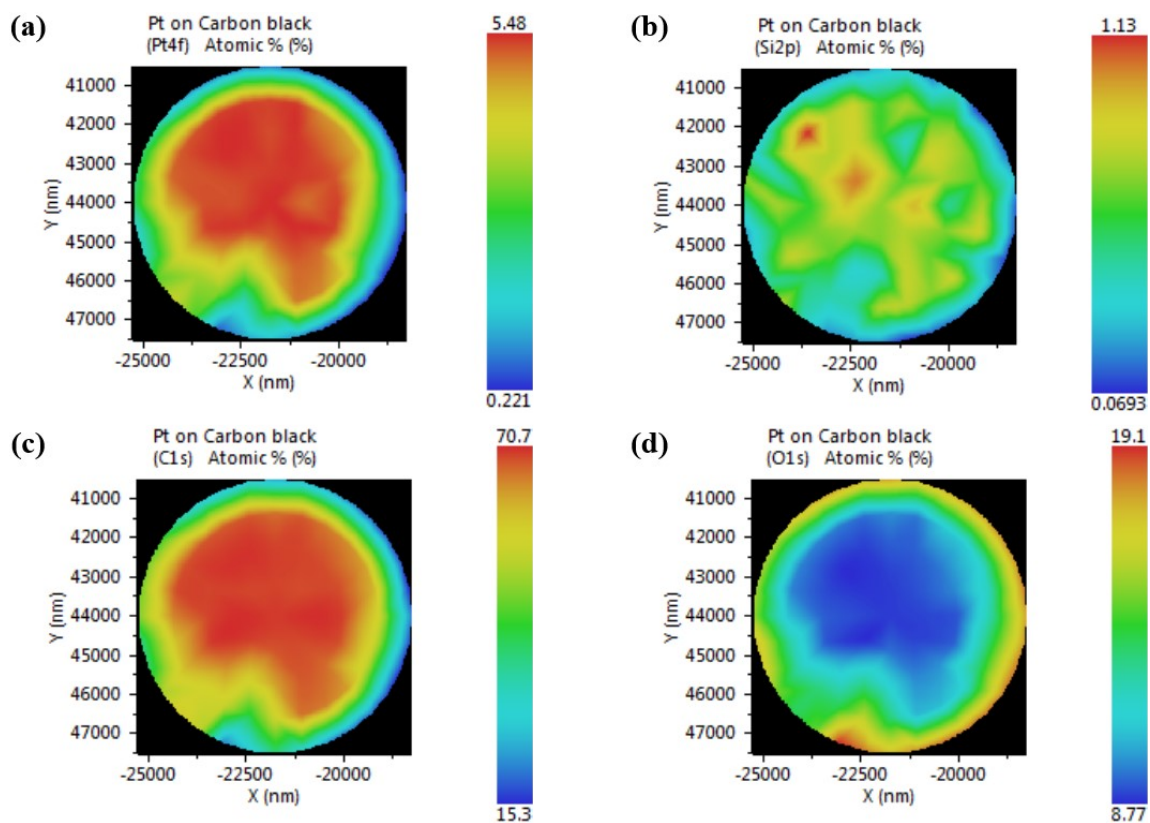


Figure S6. XPS area scans of the original Pt/CB catalyst on glassy carbon electrode; (a) Pt 4f signal; (b) Si 2p signal; (c) C 1s signal; (d) O 1s signal scanned from the catalyst spot and its margin region.

Two red spots shown in Figure S5b represent one atomic percent of Si on the surface of the sample and this might come from contamination from the lab environment, like small flakes of glass wool.

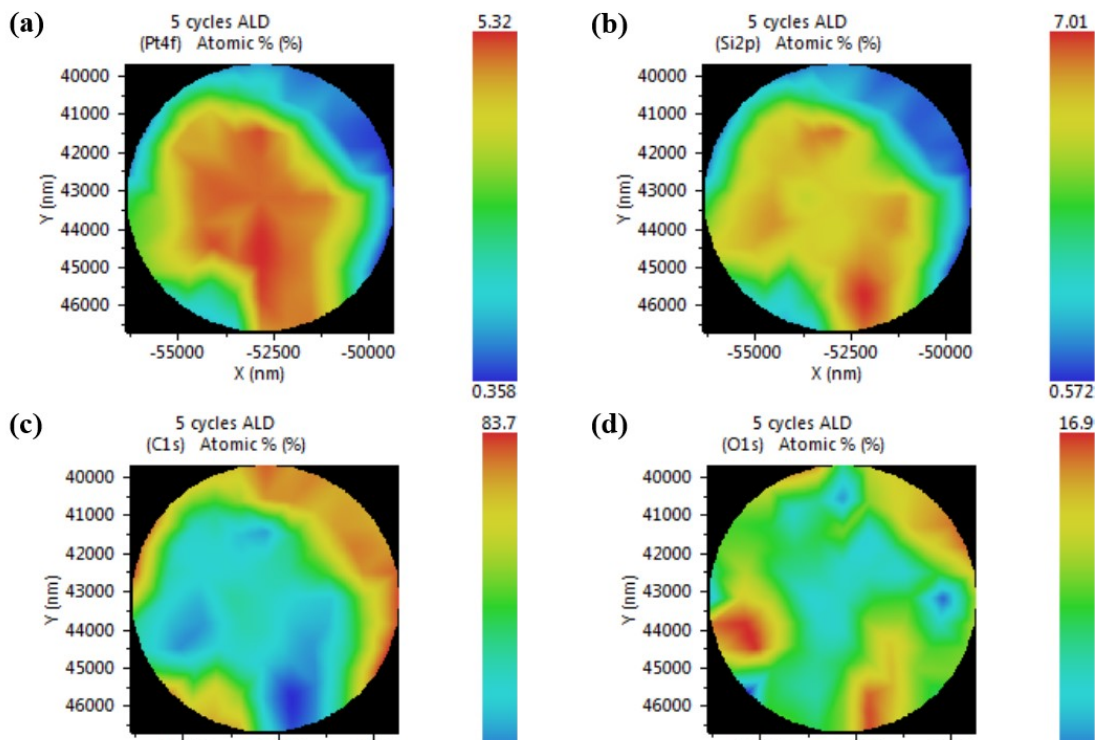


Figure S7. XPS area scans of the Pt/CB catalyst after 5 cycles of SiO_2 ALD on glassy carbon electrode; (a) Pt 4f signal; (b) Si 2p signal; (c) C 1s signal; (d) O 1s signal scanned from the catalyst spot and its margin region.

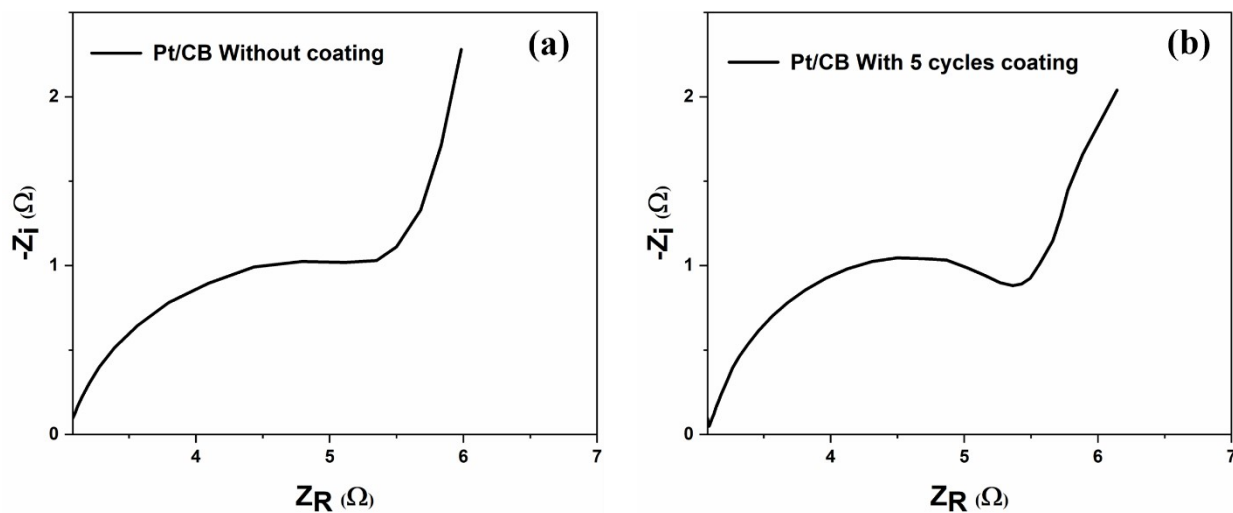


Figure S8. The Nyquist plots of Pt/CB catalyst with and without 5 cycles ALD coating.

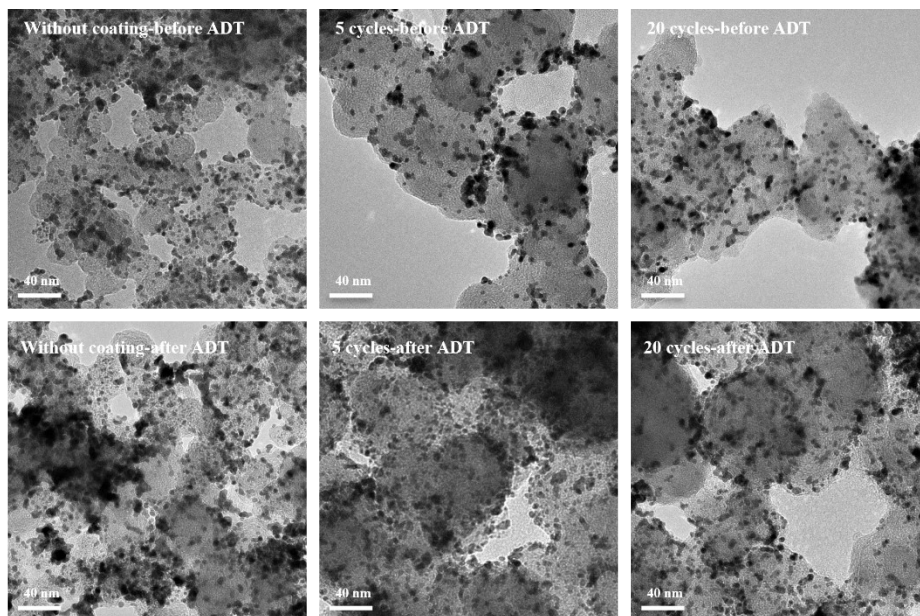


Figure S9. TEM images of the Pt/CB catalyst before (top row) and after (bottom row) accelerated durability tests.

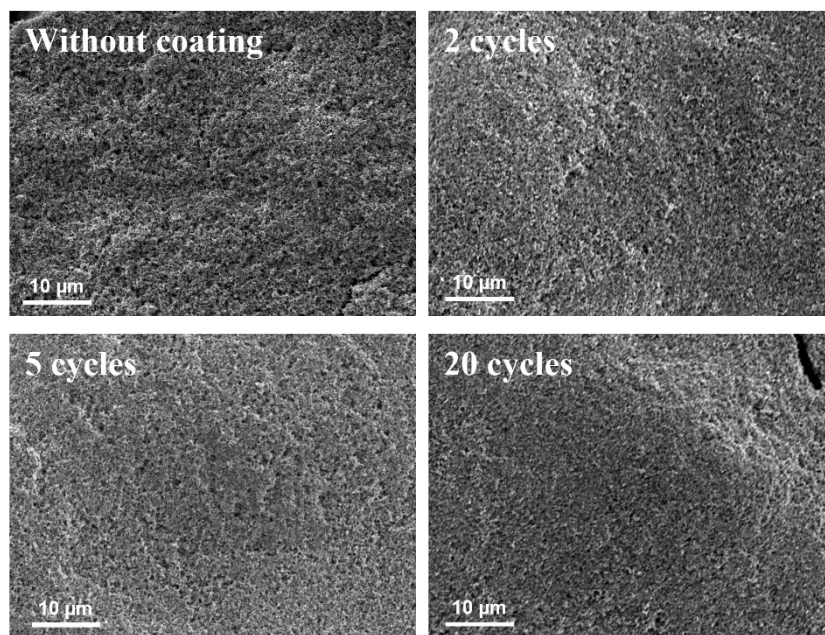


Figure S10. SEM images of the Pt/CB catalyst before accelerated durability tests.

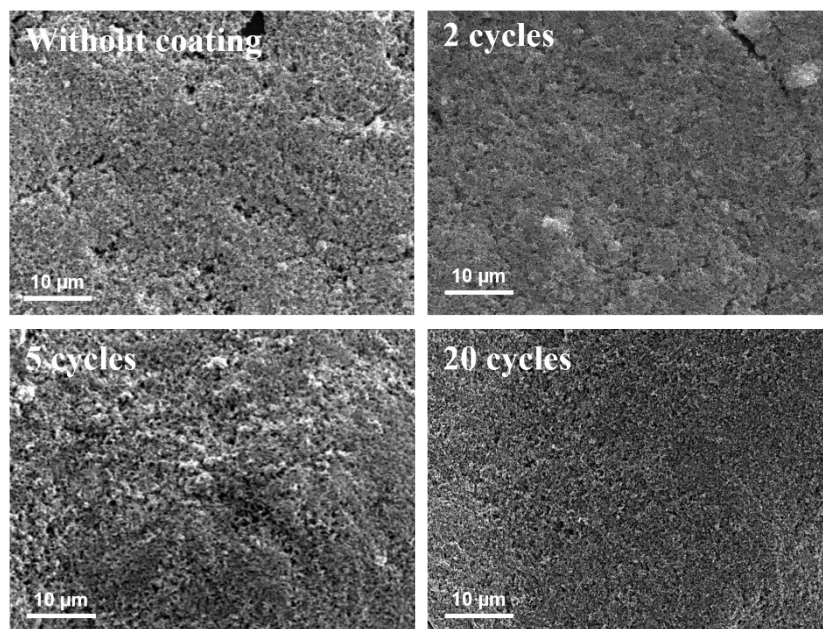


Figure S11. SEM images of the Pt/CB catalyst after accelerated durability tests.