Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary Information

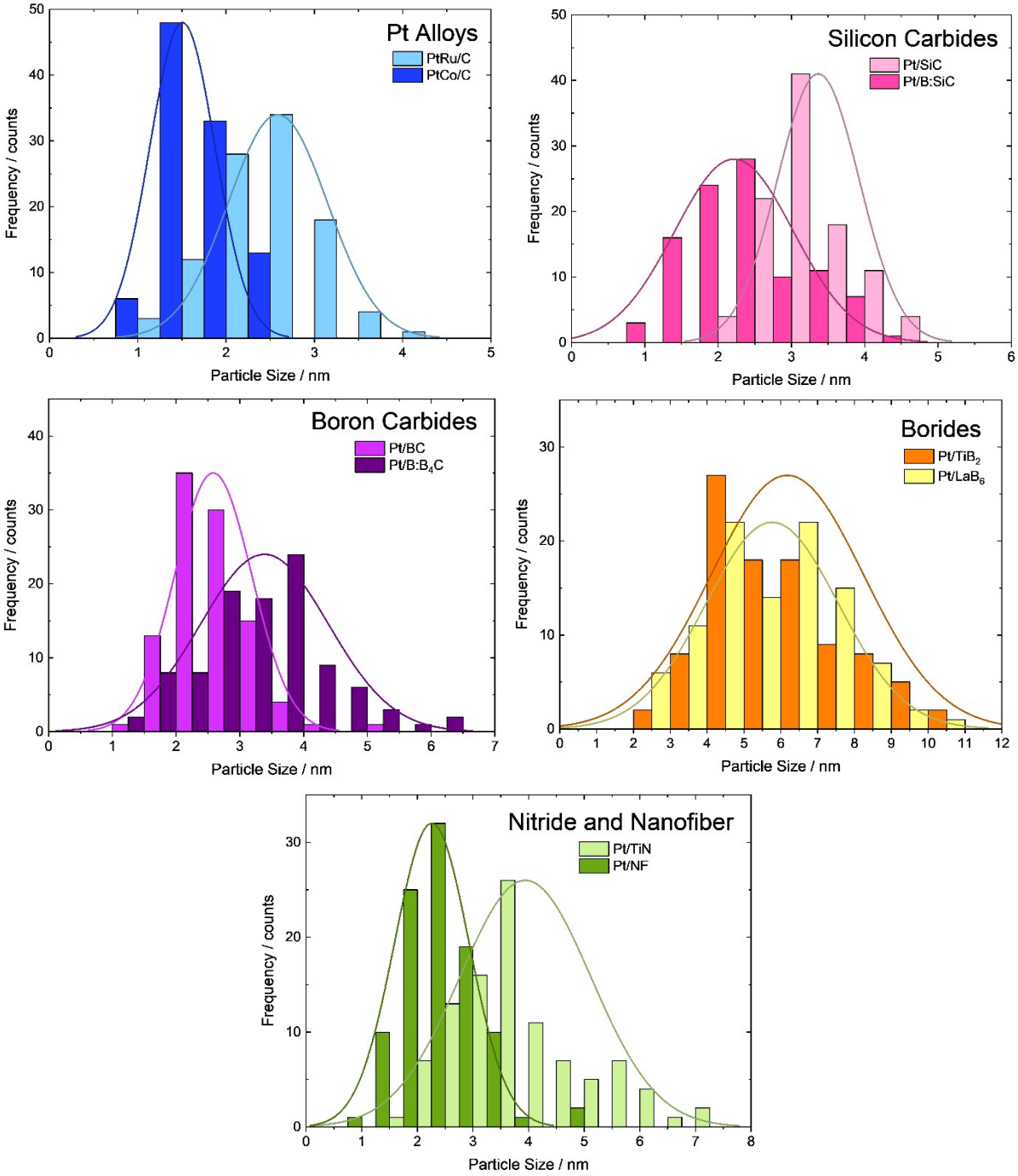
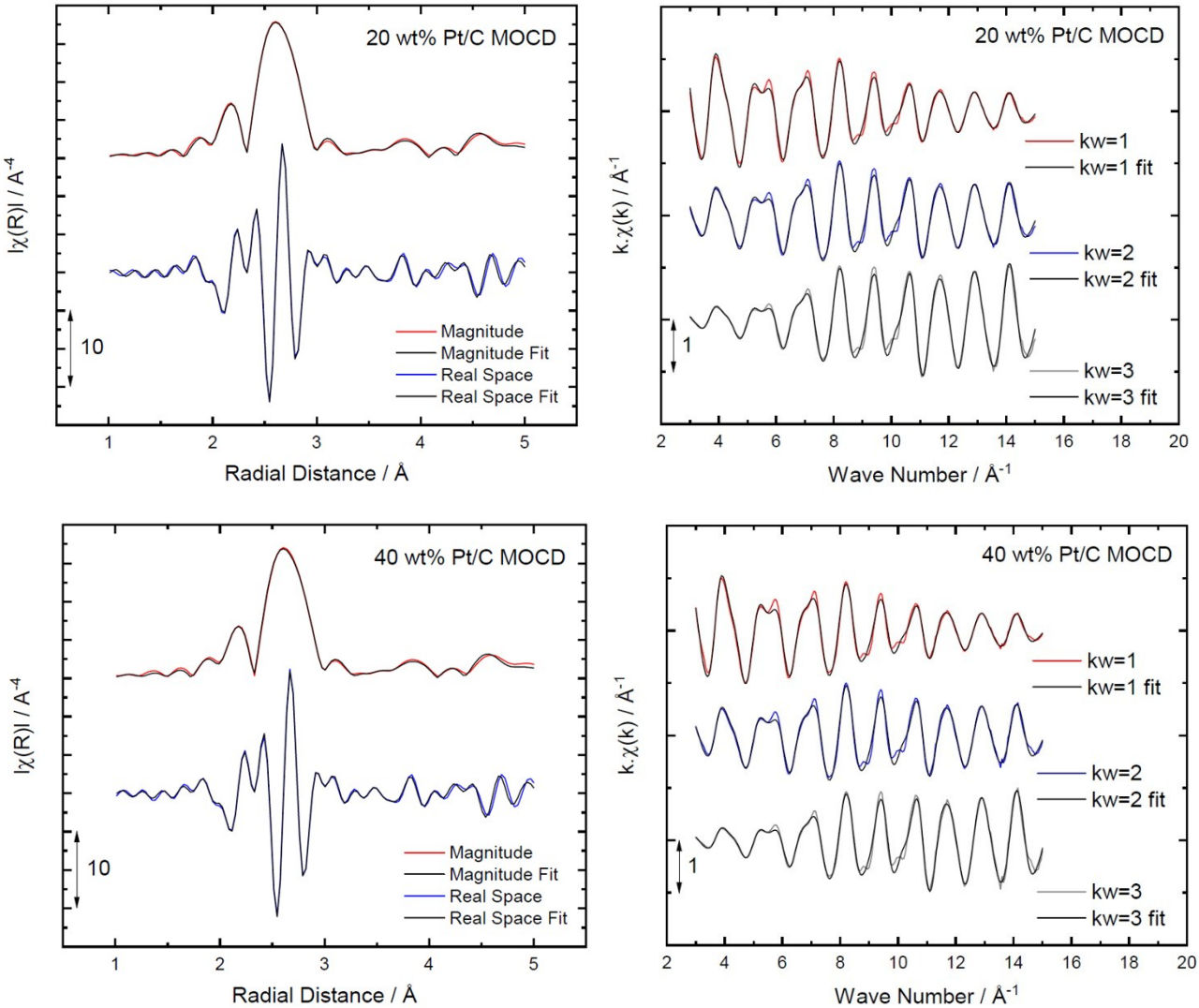
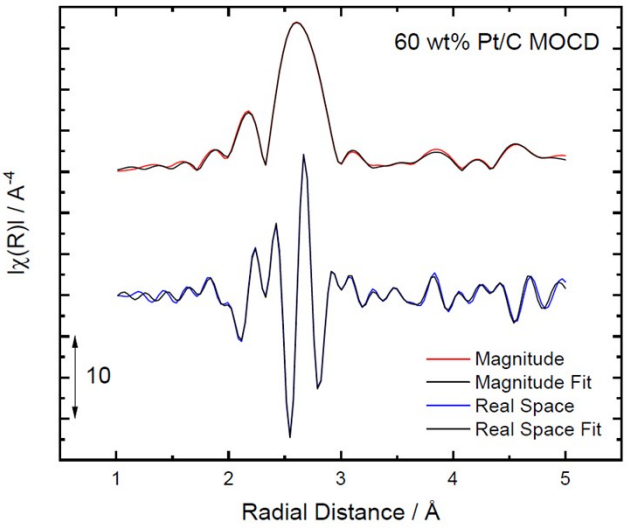


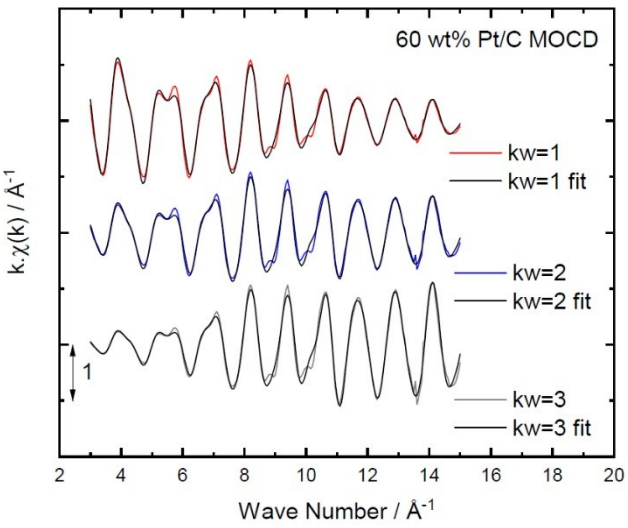
Figure S1: *TEM particle size distribution for each of the Pt/Pt Alloy and support materials investigated.*

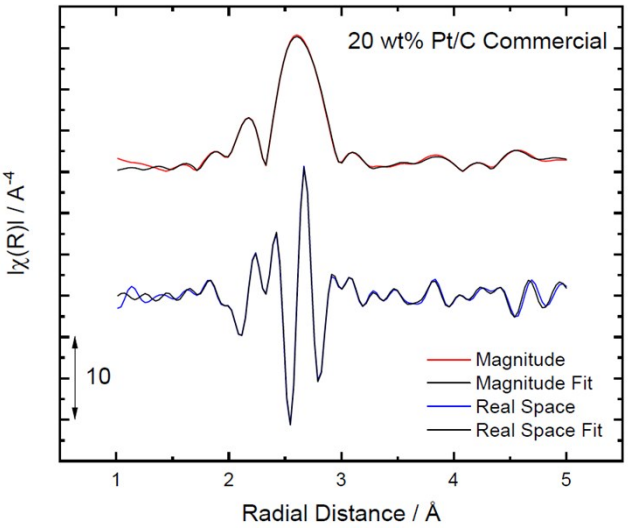
Table S1: *XRD d-spacing determined from Pt(311) peak for each of the MOCD prepared and commercial Pt/C catalysts.*

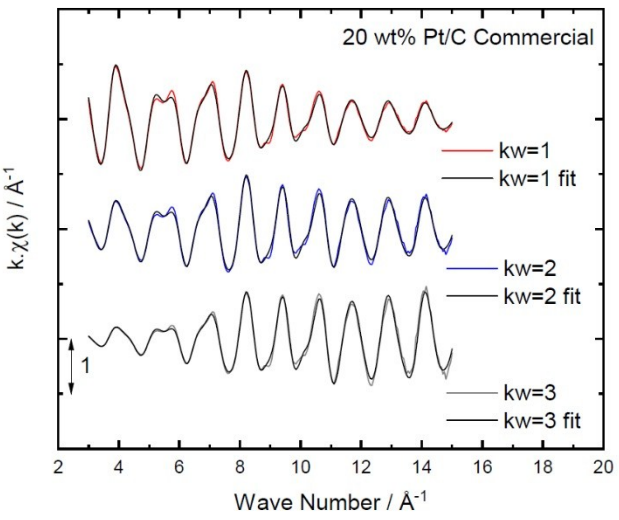
Catalyst	XRD d-spacing / Å
MOCD 20 wt% Pt/C	1.39
MOCD 40 wt% Pt/C	1.38
MOCD 60 wt% Pt/C	1.38
Commercial 20 wt% Pt/C	1.38
Commercial 40 wt% Pt/C	1.39
Commercial 60 wt% Pt/C	1.39

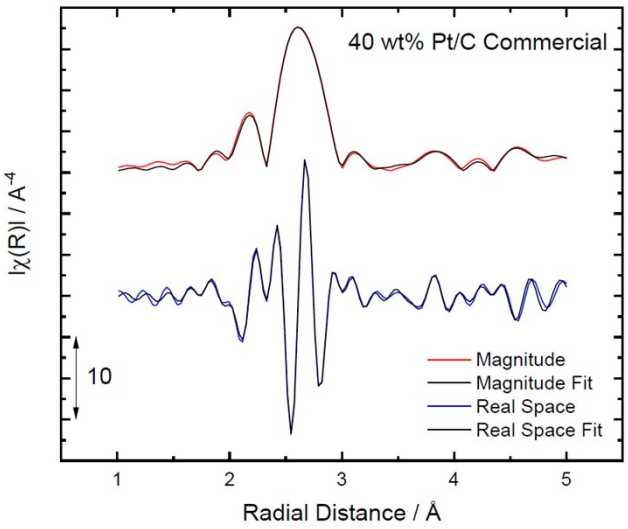


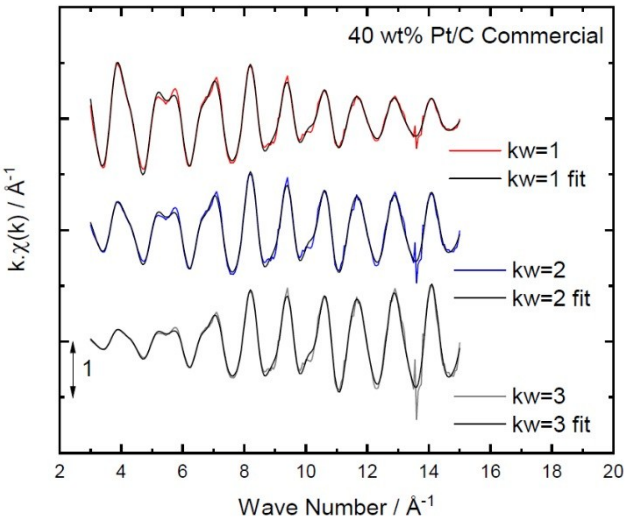

60 wt% Pt/C MOCD
|χ(R)| / Å-4
10
Magnitude
Magnitude Fit
Real Space
Real Space Fit
Radial Distance / Å


60 wt% Pt/C MOCD
k.χ(k) / Å-1
kw=1
kw=1 fit
kw=2
kw=2 fit
kw=3
kw=3 fit
1
Wave Number / Å-1


20 wt% Pt/C Commercial
|χ(R)| / Å-4
10
Magnitude
Magnitude Fit
Real Space
Real Space Fit
Radial Distance / Å


20 wt% Pt/C Commercial
k.χ(k) / Å-1
kw=1
kw=1 fit
kw=2
kw=2 fit
kw=3
kw=3 fit
1
Wave Number / Å-1


40 wt% Pt/C Commercial
|χ(R)| / Å-4
10
Magnitude
Magnitude Fit
Real Space
Real Space Fit
Radial Distance / Å


40 wt% Pt/C Commercial
k.χ(k) / Å-1
kw=1
kw=1 fit
kw=2
kw=2 fit
kw=3
kw=3 fit
1
Wave Number / Å-1

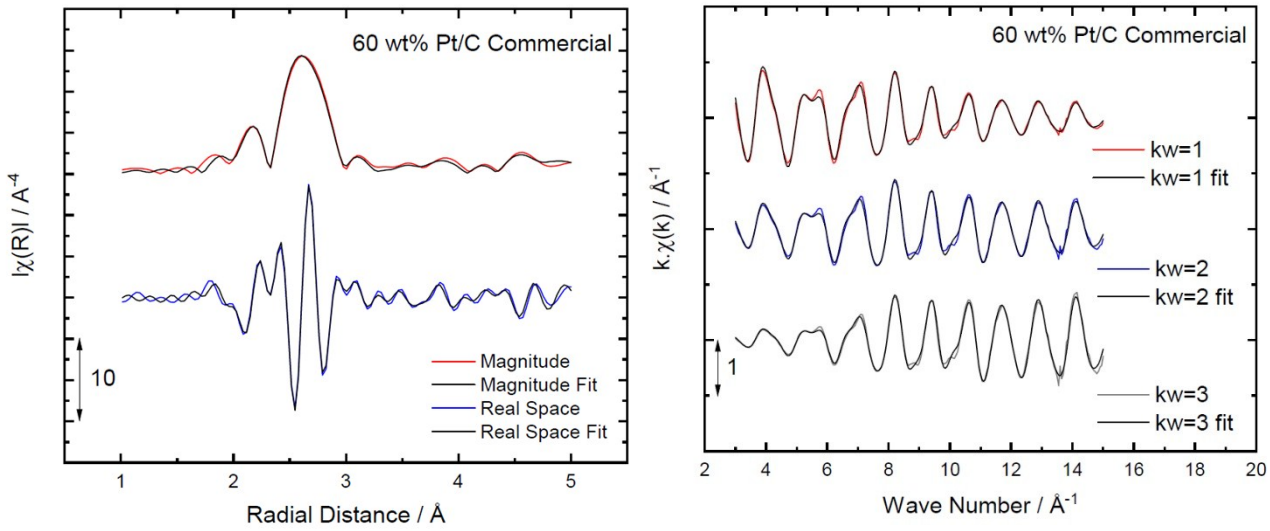


Figure S2: *EXAFS R space magnitude and real space plots and k space plots, k weighting (kw)=1 is scaled by 7.93, 7.646, 8.2, kw=2 is unscaled and kw=3 is scaled by 0.12, 0.113, 0.12 for the 20, 40 and 60 wt% Pt/C MOCD catalysts, respectively. Pt/C Commercial catalysts k space plots, k weighting (kw)=1 is scaled by 7.403, 7.638, 7.763, kw=2 is unscaled and kw=3 is scaled by 0.106, 0.108, 0.111 for the 20, 40 and 60 wt% Pt/C commercial catalysts, respectively.*

Table S2: *Coordination numbers and distances of neighbouring atoms and their disorder factors of the 20 wt% Pt/C MOCD and commercial catalyst.*

Catalyst	Neighbouring atom	N	R (Å)*	σ^2 / 10^3	N_3/N_1
MOCD 20 wt% Pt/C	Pt - Pt_1	10.6 ± 0.4	2.751	5.8 ± 0.18	1.20
	Pt - Pt_2	5.4 ± 1.5	3.890	9.1 ± 1.9	
	Pt - Pt_3	12.7 ± 3.8	4.764	7.8 ± 1.4	
	Pt - Pt_4	8.5 ± 1.4	5.502	9.9 ± 0.90	
Commercial 20 wt% Pt/C	Pt - Pt_1	10.1 ± 0.3	2.749	5.9 ± 0.17	1.11
	Pt - Pt_2	5.1 ± 1.4	3.888	10 ± 2.1	
	Pt - Pt_3	11.2 ± 3.3	4.762	8.1 ± 1.4	
	Pt - Pt_4	8.3 ± 1.3	5.498	10.5 ± 0.95	

* The error associated with distance to neighbouring atoms for the MOCD 20 wt% Pt/C and Commercial 20 wt% Pt/C is ± 0.00058 Å and ± 0.00056 Å, respectively

Table S3: *Coordination numbers and distances of neighbouring atoms and their disorder factors of the 40 wt% Pt/C MOCD and commercial catalyst.*

Catalyst	Neighbouring atom	N	R (Å)*	σ^2 / 10^3	N_3/N_1
MOCD 40 wt% Pt/C	Pt - Pt_1	10.4 ± 0.4	2.751	6.0 ± 0.19	1.20
	Pt - Pt_2	5.2 ± 1.5	3.891	9.0 ± 2.0	
	Pt - Pt_3	12.5 ± 3.8	4.766	7.9 ± 1.4	
	Pt - Pt_4	8.3 ± 1.4	5.503	9.9 ± 0.95	
Commercial 40 wt% Pt/C	Pt - Pt_1	10.1 ± 0.3	2.753	5.7 ± 0.17	1.11
	Pt - Pt_2	5.0 ± 1.3	3.893	8.3 ± 1.6	
	Pt - Pt_3	11.2 ± 3.4	4.768	7.6 ± 1.4	
	Pt - Pt_4	8.7 ± 1.3	5.506	9.8 ± 0.85	

* The error associated with distance to neighbouring atoms for the MOCD 40 wt% Pt/C and Commercial 40 wt% Pt/C is ± 0.00061 Å and ± 0.00055 Å, respectively

Table S4: *Coordination numbers and distances of neighbouring atoms and their disorder factors of the 60 wt% Pt/C MOCD and commercial catalyst.*

Catalyst	Neighbouring atom	N	R (Å)*	σ^2 / 10^3	N_3/N_1
MOCD 60 wt% Pt/C	Pt - Pt_1	10.5 ± 0.4	2.751	5.8 ± 0.18	1.17
	Pt - Pt_2	5.5 ± 1.5	3.891	9.0 ± 1.8	
	Pt - Pt_3	12.3 ± 3.6	4.765	7.5 ± 1.3	
	Pt - Pt_4	8.6 ± 1.4	5.502	9.7 ± 0.86	
Commercial 60 wt% Pt/C	Pt - Pt_1	9.0 ± 0.3	2.749	6.0 ± 0.19	0.93
	Pt - Pt_2	5.1 ± 1.4	3.888	10.5 ± 2.3	
	Pt - Pt_3	8.4 ± 2.8	4.762	7.4 ± 1.6	
	Pt - Pt_4	8.3 ± 1.4	5.499	10.4 ± 1.0	

* The error associated with distance to neighbouring atoms for the MOCD 60 wt% Pt/C and Commercial 60 wt% Pt/C is ± 0.00058 Å and ± 0.00062 Å, respectively

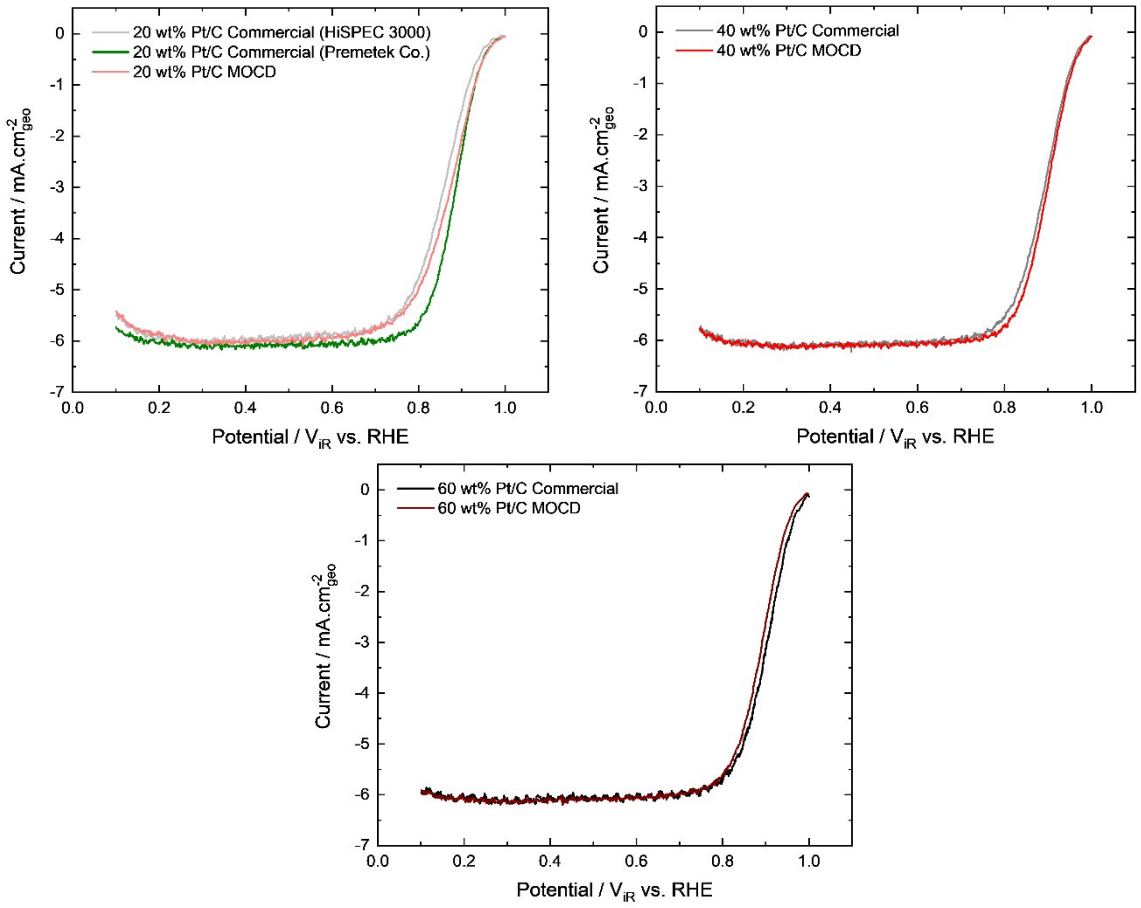


Figure S3: *ORR linear sweep voltammograms of the four commercial Pt/C catalysts with the MOCD Pt/C catalysts, measured in O_2 saturated 0.1 M $HClO_4$ electrolyte at room temperature with a scan rate of 20 $mV.s^{-1}$.*

Table S5: *Electrochemically active surface area (ECSA), ORR mass activity and ORR specific activity for the MOCD and commercial catalysts, error bars from three electrodes and electrochemical characterisations. ORR activity measured in O_2 saturated 0.1 M $HClO_4$ electrolyte at room temperature with a scan rate of 20 $mV.s^{-1}$.*

Catalyst	ECSA / $m^2\ g^{-1}_{Pt}$	Mass Activity / $A\ g^{-1}_{Pt}$	Specific Activity / $\mu A\ cm^{-1}_{Pt}$
MOCD 20 wt% Pt/C	75.4 ± 3.2	426 ± 33	564 ± 26
20 wt% Pt/C (HiSPEC 3000, Alfa Aesar)	76.6 ± 3.6	271 ± 36	354 ± 46
20 wt% Pt/C (Premetek)	88.0 ± 0.2	438 ± 34	497 ± 37

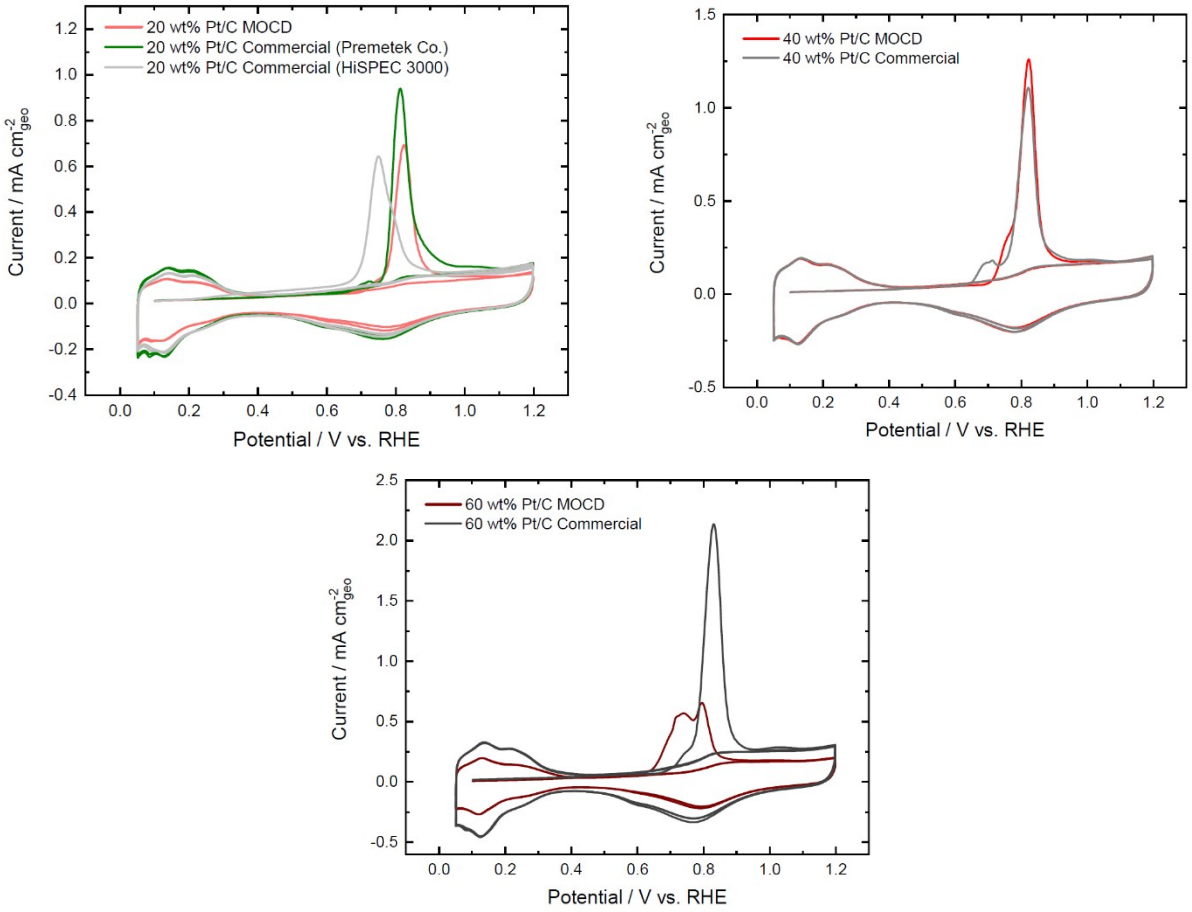


Figure S4: *CO stripping voltammograms of the four commercial Pt/C catalysts with the MOCD Pt/C catalysts, measured in 0.1 M $HClO_4$ electrolyte at room temperature with a scan rate of 20 mV.s^{-1}.*

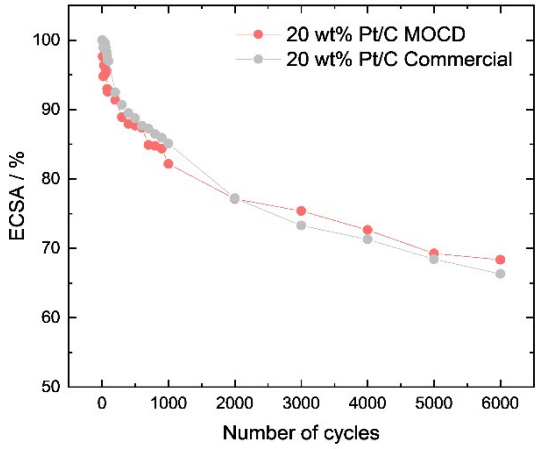


Figure S5: *The change of ECSA after cycling between 0.6 – 1.0 V vs. RHE for 6000 cycles on the 20 wt% Pt/C MOCD and commercial catalysts in 0.1 M $HClO_4$ in room temperature at 20 mV.s^{-1}.*