

Asymmetric Design of Pt/C Catalyst Layer for Enhanced Performance in Proton Exchange Membrane Fuel Cell

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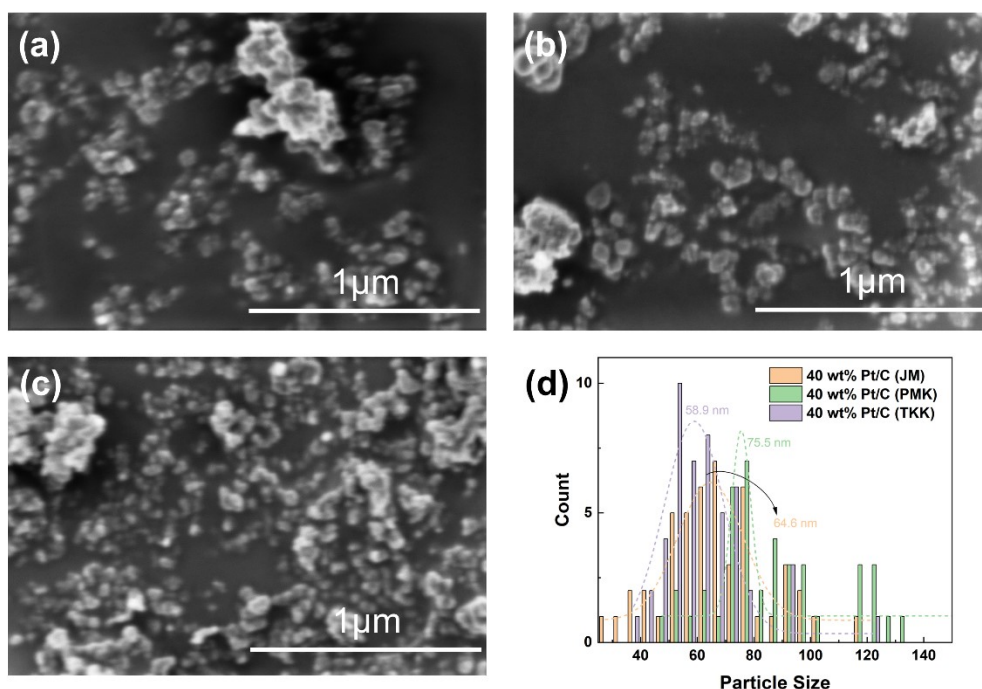


Figure S1. The SEM images of (a) PMK, (b) JM and (c) TKK catalysts. (d) The statistical histogram of carbon particles.

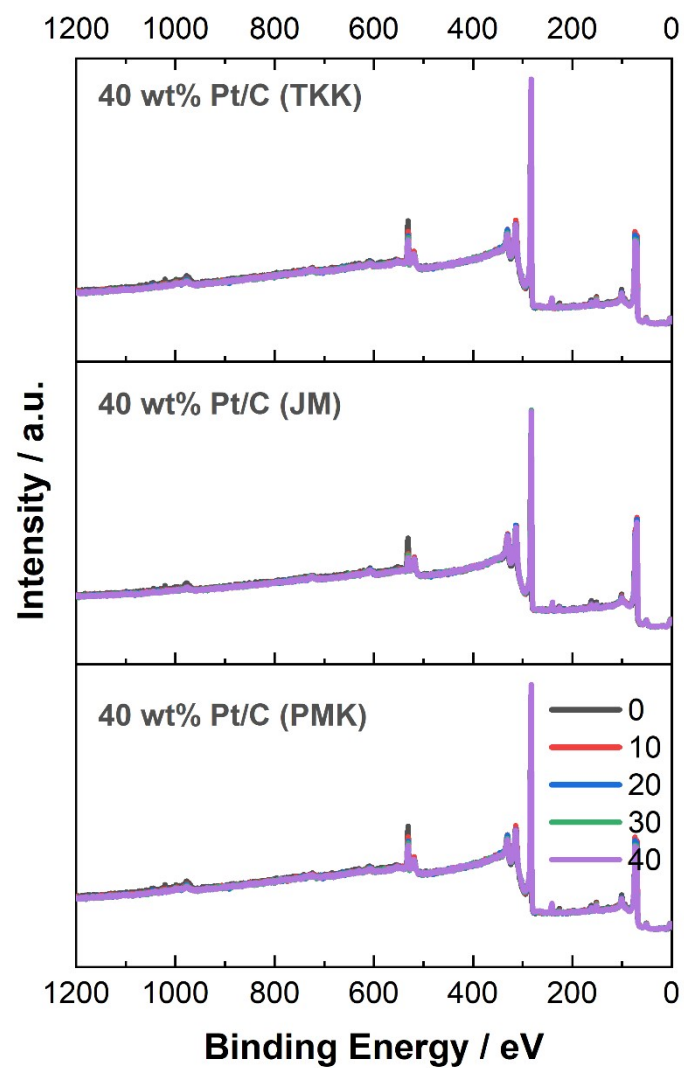


Figure S2. The XPS survey spectra of different Pt/C catalysts with in-situ argon ion etching. 0, 10, 20, 30 and 40 represent the estimated etching depth (nm).

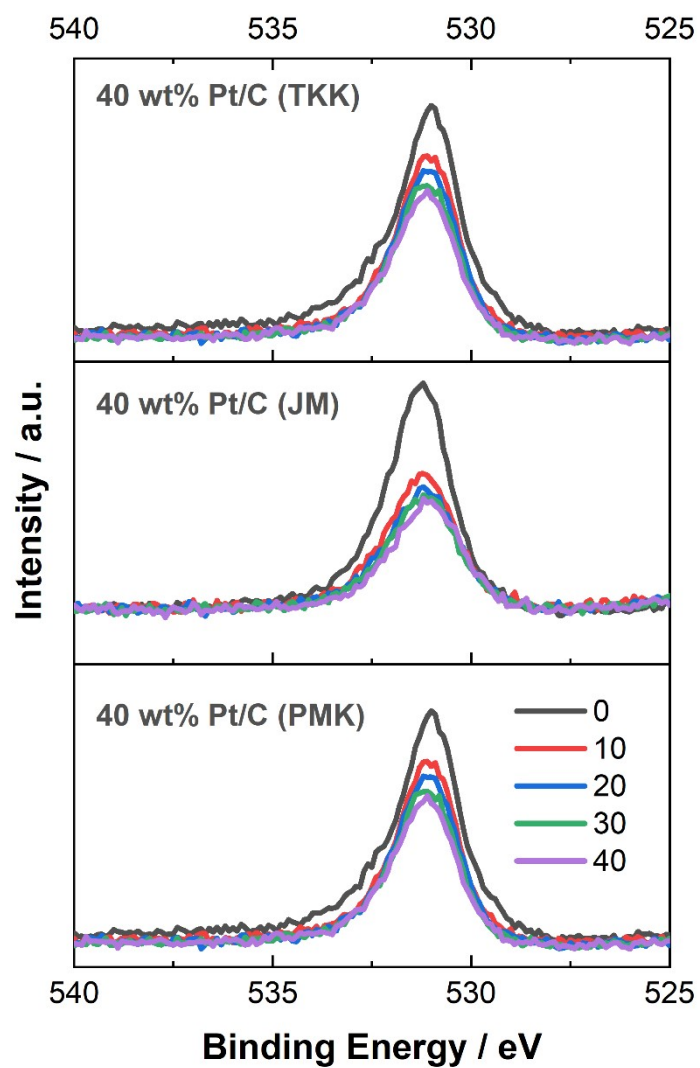


Figure S3. The XPS O 1s spectra of different Pt/C catalysts with in-situ argon ion etching. 0, 10, 20, 30 and 40 represent the estimated etching depth (nm).

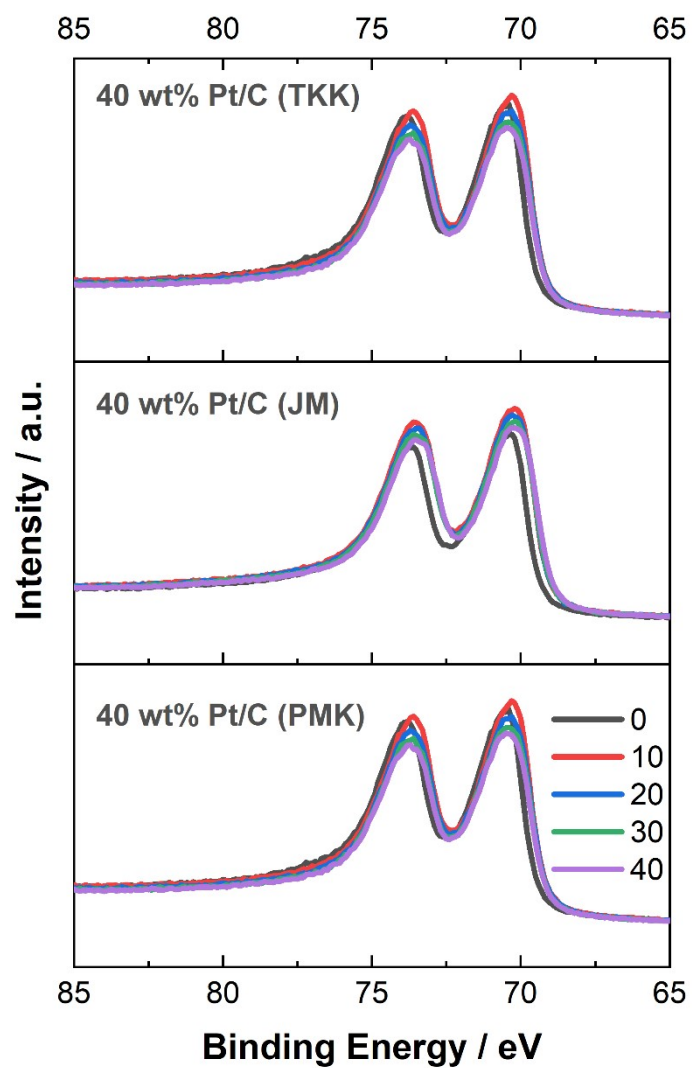


Figure S4. The XPS Pt 4f spectra of different Pt/C catalysts with in-situ argon ion etching. 0, 10, 20, 30 and 40 represent the estimated etching depth (nm).

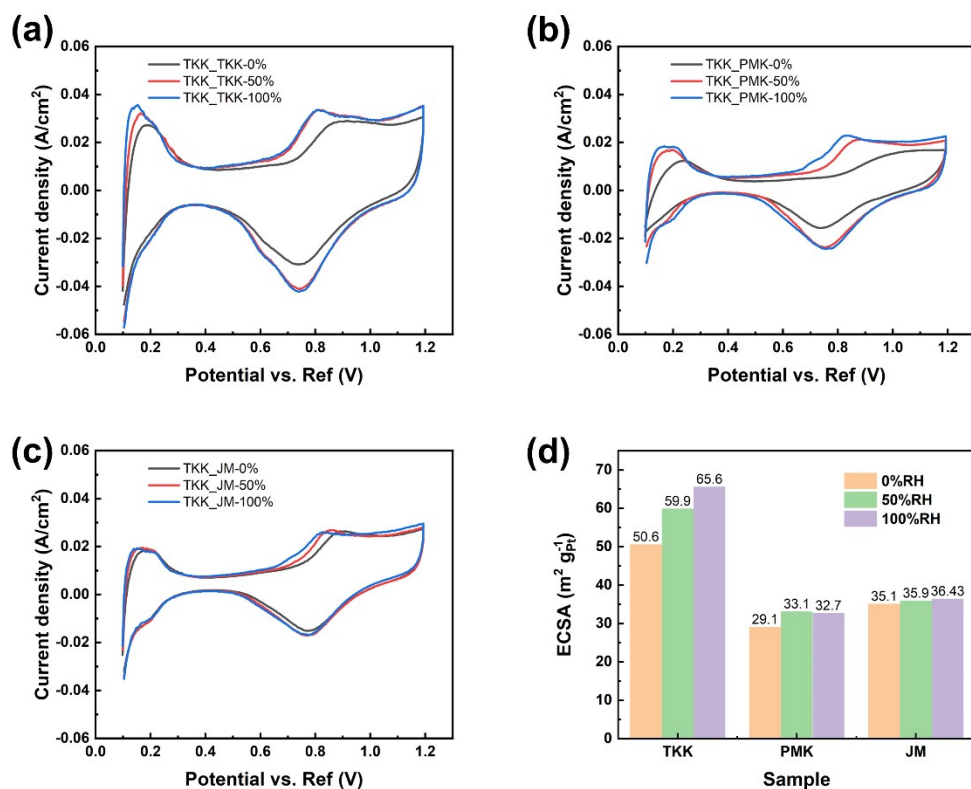


Figure S5. The CV curves of different MEAs under different relative humidity.

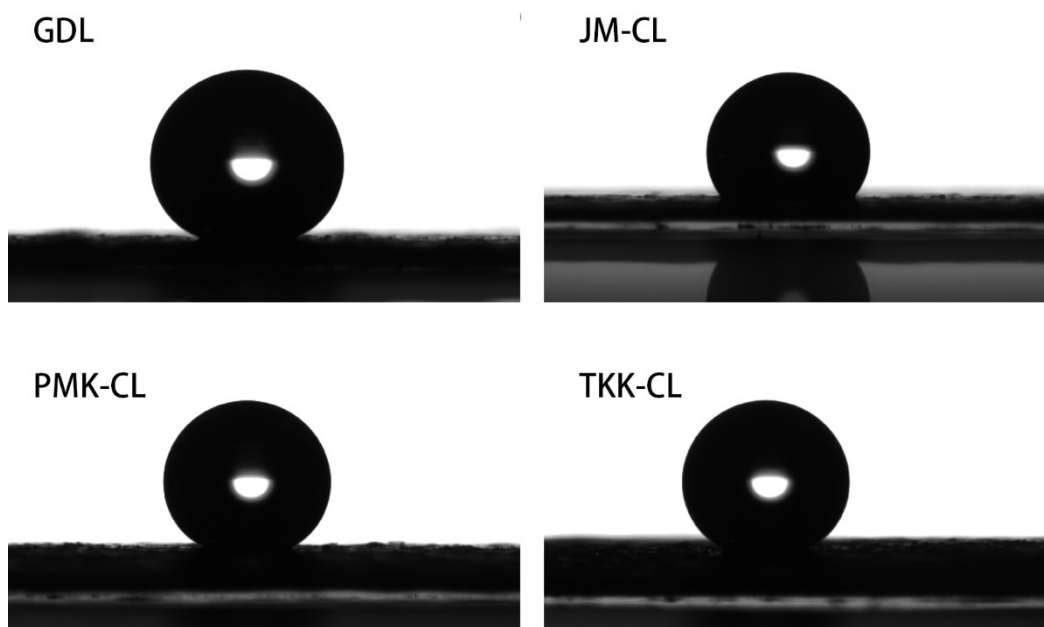


Figure S6. Contact angles of gas diffusion layer and different catalyst layers.

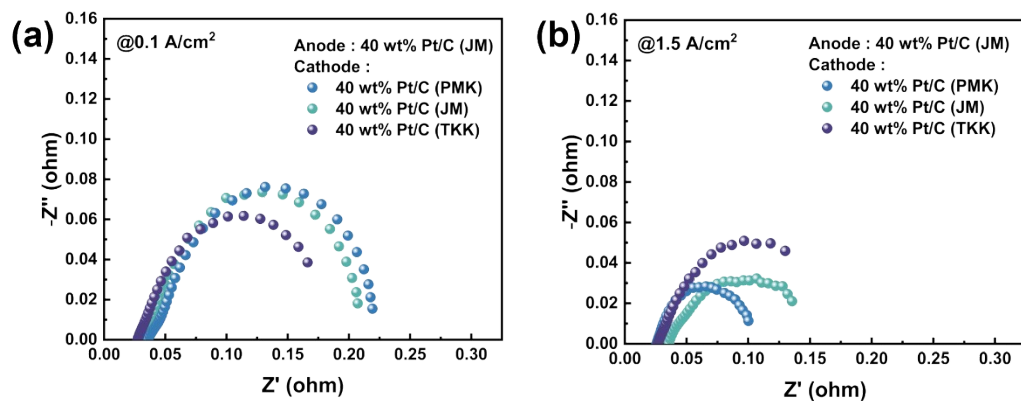


Figure S7. EIS Nyquist plots of the MEAs with different cathode catalysts.

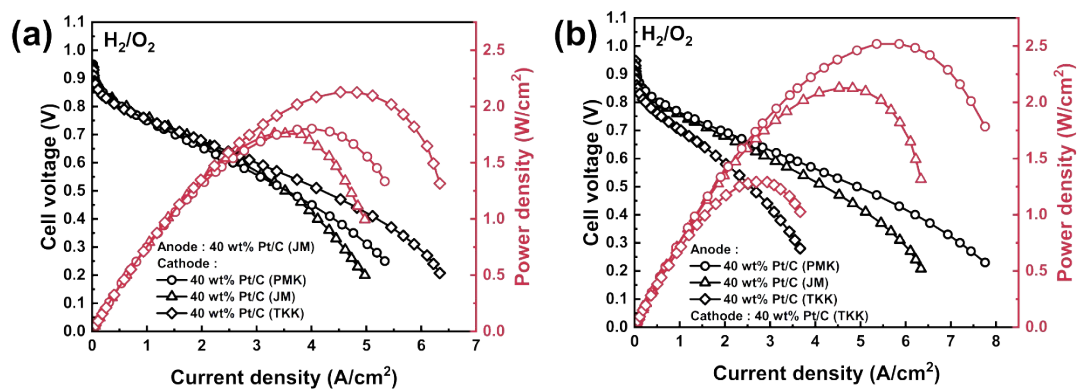


Figure S8. Polarization curves of MEAs under H₂-O₂ with (a) JM as anode catalyst and (b) TKK as cathode catalyst.

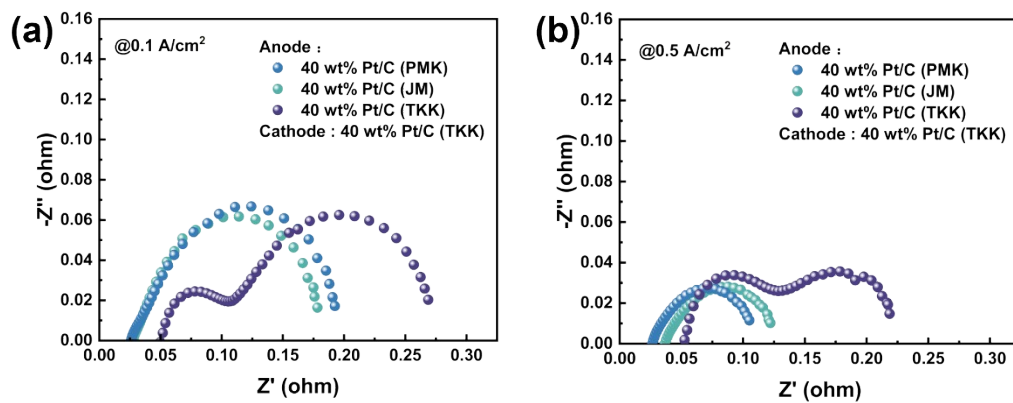


Figure S9. EIS curves of the MEAs with different anode catalysts.

Table S1. Porous structure parameters of different Pt/C catalysts.

Samples	PMK	JM	TKK
Micropore volume / $\text{cm}^3 \text{g}^{-1}$	0.044	0.038	0.114
Mesopore volume / $\text{cm}^3 \text{g}^{-1}$	0.237	0.210	0.378
Total pore volume / $\text{cm}^3 \text{g}^{-1}$	0.352	0.263	0.598
Micropore area / $\text{m}^2 \text{g}^{-1}$	32.0	56.2	62.9
External surface area / $\text{m}^2 \text{g}^{-1}$	109.9	96.1	331.3
BET surface area / $\text{m}^2 \text{g}^{-1}$	141.9	152.3	394.2

Table S2. Contact angles of three catalyst coated substrates and gas diffusion layer.

Samples	PMK	JM	TKK	GDL
1	139.09	139.36	147.18	146.66
2	142.31	141.20	134.56	136.92
3	141.78	143.12	146.24	141.95
4	138.95	144.42	140.07	143.88
5	138.57	146.23	142.16	136.37
Avg.CA°	140.14	142.86	142.04	141.16

Table S3. The power densities of different MEAs.

Anode/Cathode	Power Densities at 0.7V (W cm ⁻²)		Maximum Power Densities (W cm ⁻²)	
	H ₂ -Air	H ₂ -O ₂	H ₂ -Air	H ₂ -O ₂
PMK/PMK	0.54	1.08	0.96	1.94
JM/JM	0.55	1.21	0.83	1.76
TKK/TKK	0.35	0.72	0.65	1.15
JM/PMK	0.51	0.96	0.83	1.80
JM/JM	0.55	1.21	0.83	1.76
JM/TKK	0.72	1.20	0.91	2.13
PMK/TKK	0.77	1.34	0.99	2.52
JM/TKK	0.72	1.20	0.91	2.13
TKK/TKK	0.35	0.72	0.65	1.15