Supporting Information for

Hybrid structure of TiO_2-graphitic carbon as a support of Pt nanoparticles for catalyzing oxygen reduction reaction

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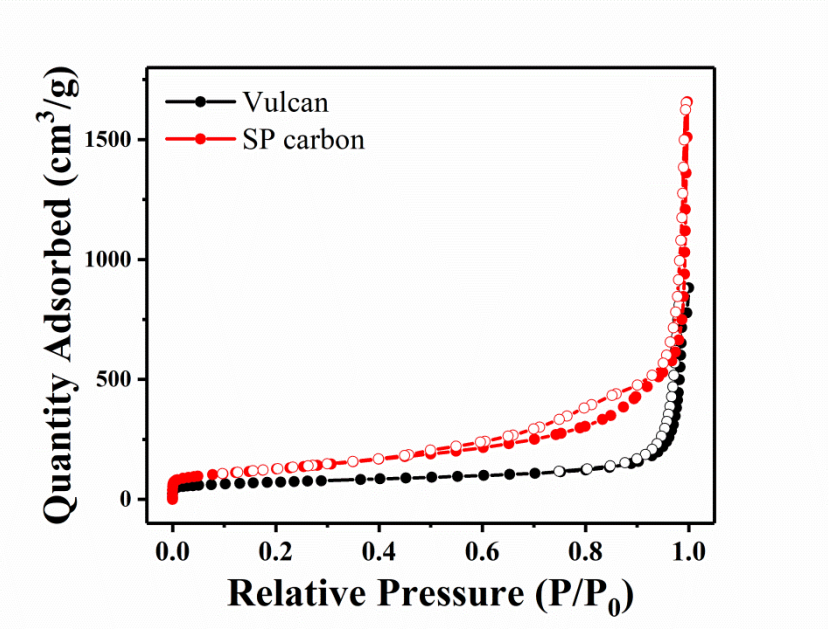

Figure S1. Nitrogen adsorption-desorption isotherms for Vulcan carbon and SP carbon.

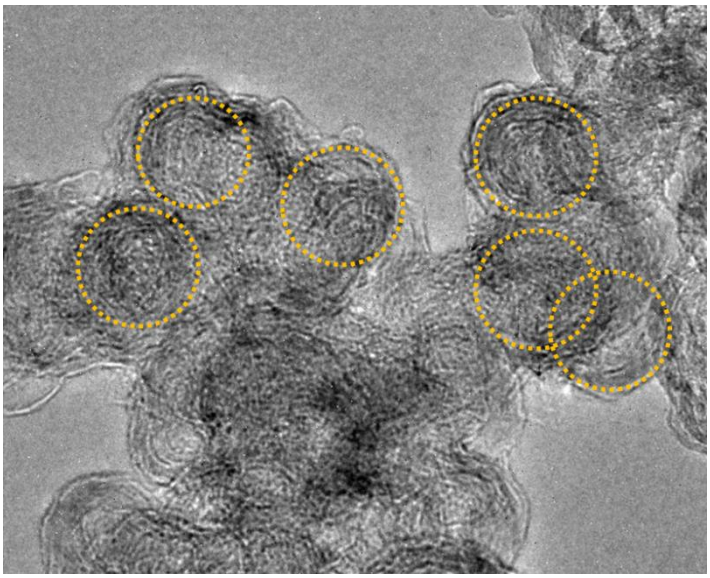

Figure S2. HR-TEM images of SP carbon.

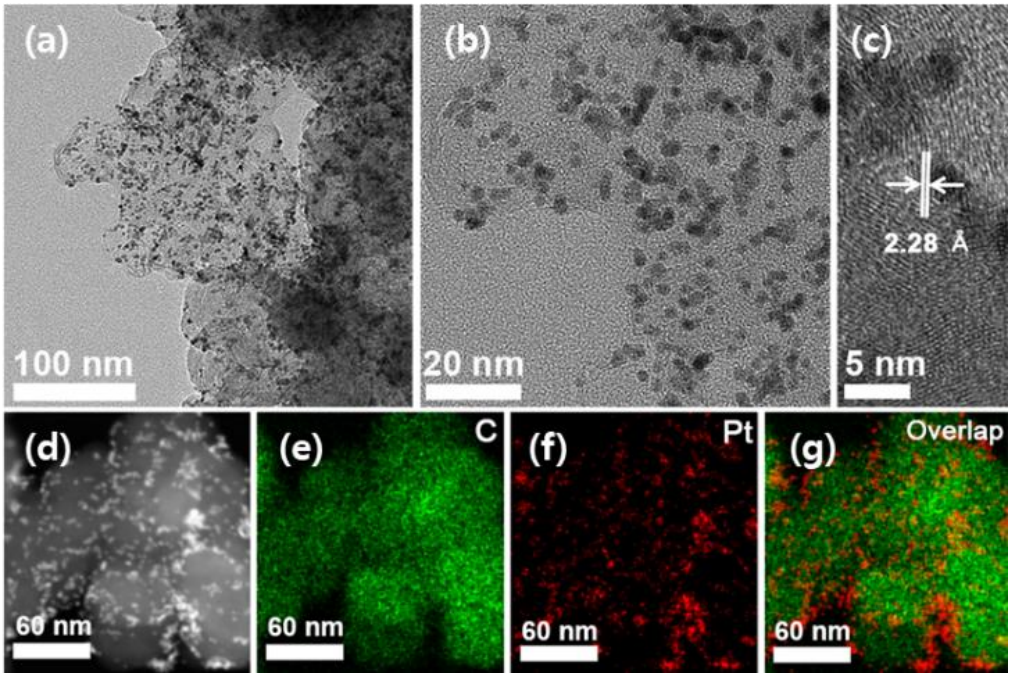

Figure S3. (a) TEM, (b) magnification of TEM and (c) HR-TEM images of SP-Pt. (d) HAADF-STEM image and (e-g) Corresponding elemental mapping images.

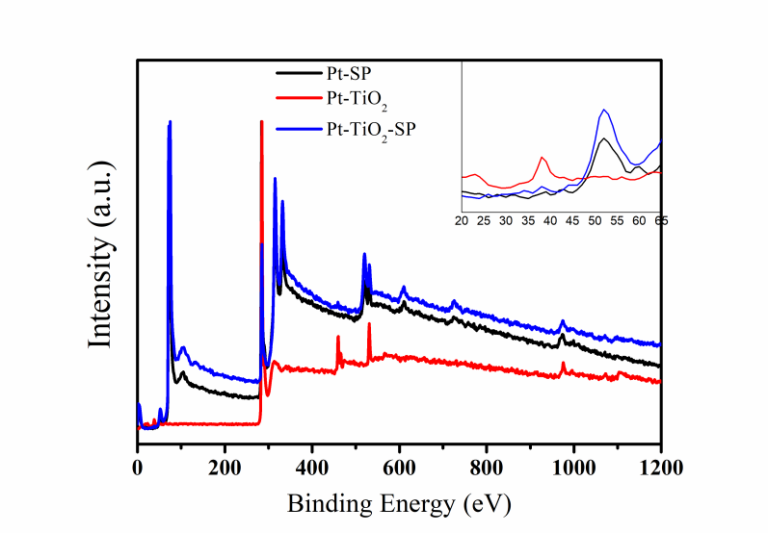

Figure S4. XPS survey spectra of Pt-SP, Pt-TiO_2, and Pt-TiO_2-SP.

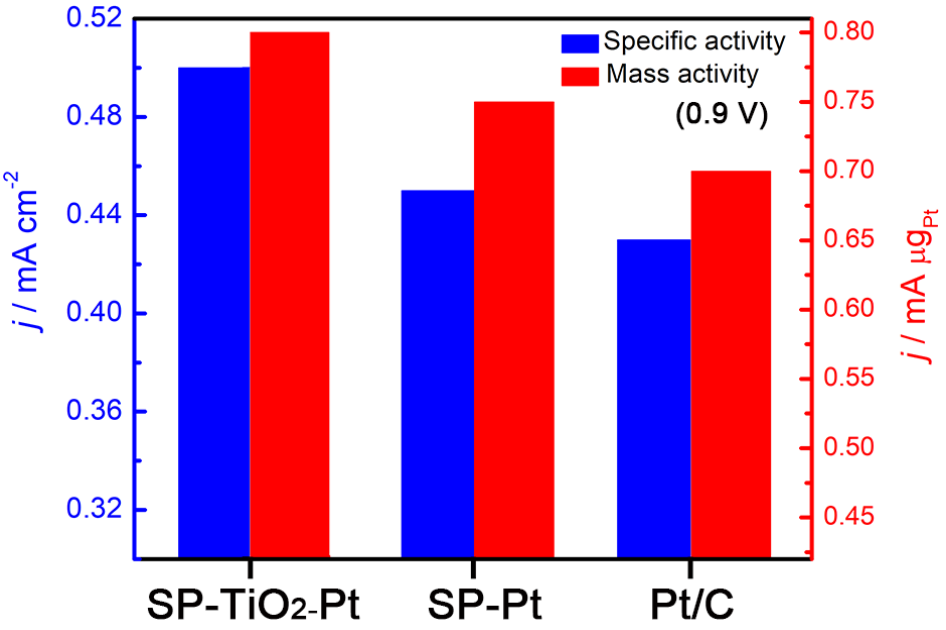

Figure S5. Mass activity and Specific activity of SP-TiO_2, SP-Pt, and commercial Pt/C.

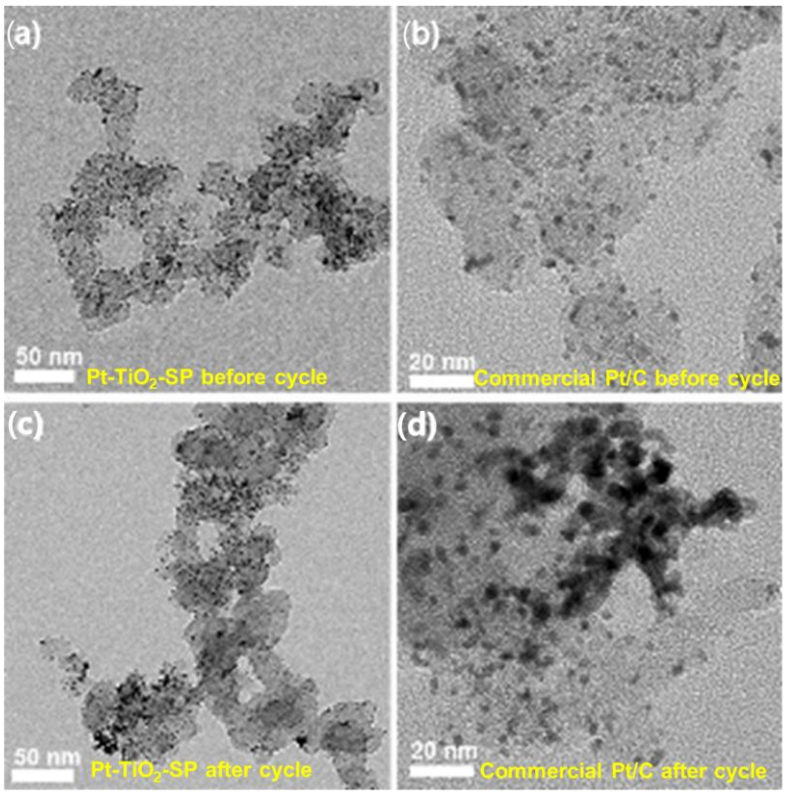

Figure S6. TEM images of before(a,b) and after 5000 cycles(c,d) of Pt-TiO_2-SP(a,c) and commercial Pt/C(b,d).

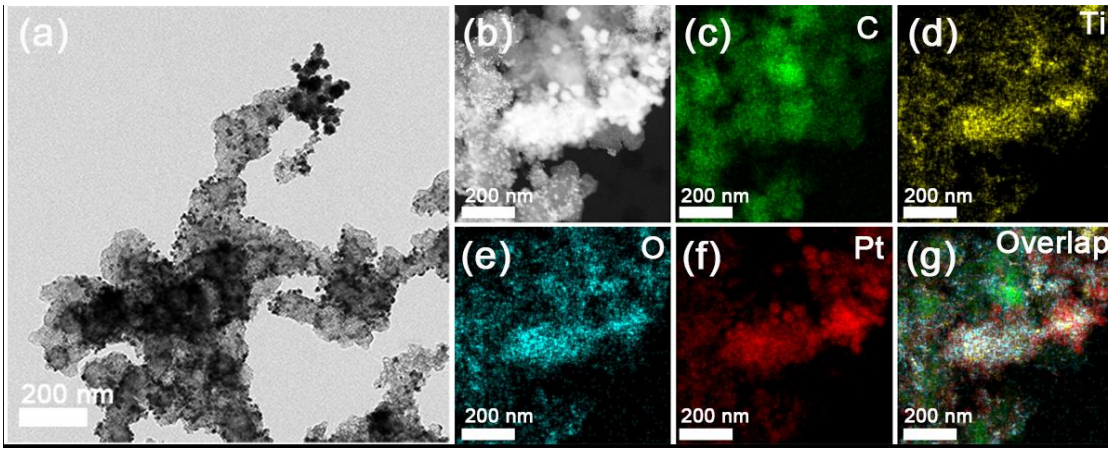

Figure S7. (a) TEM images of after 5000 cycles 40 wt.% Pt on SP-TiO2. Corresponding elemental mapping images(b-g).

Table S1. ORR performances for the present Pt-TiO_2-SP and the reported Pt-based catalyst at 0.9V.

Sample name	Onset potential (V)	Pt loading (%)	Mass activity (Amg^{-1})	Specific activity ($mAcm^{-2}$)	ref
Pt-TiO_2-SP	0.914	36	0.80	0.50	This work
Pt/TiO_2-30	0.967	37	0.045	0.668	[1]
Pt/TiO_2-2/C	0.88	31	0.055(at0.8V)	0.45	[2]
Pt NCs/CNTs-10%	0.87	10	0.167	0.194	[3]

[1] G. Mirshekari, C. Rice, Effects of support particle size and Pt content on catalytic activity and durability of Pt/TiO2 catalyst for oxygen reduction reaction in proton exchange membrane fuel cells environment, Journal of Power Sources, 396 (2018) 606-614.

[2] E.C. Barbosa, L.S. Parreira, I.C. de Freitas, L.R. Aveiro, D.C. de Oliveira, M.C. dos Santos, P.H. Camargo, Pt-decorated TiO2 materials supported on carbon: increasing activities and stabilities toward the ORR by tuning the Pt loading, ACS Applied Energy Materials, 2 (2019) 5759-5768.

[3] J. Liu, J. Yin, B. Feng, T. Xu, F. Wang, Enhanced electrocatalytic activity and stability toward the oxygen reduction reaction with unprotected Pt nanoclusters, Nanomaterials, 8 (2018) 955.

Table S2. Electrical conductivity of SPcarbon, TiO_2-SP, Vulcan carbon, and TiO_2.

Sample name	SPcarbon	TiO_2-SP	Vulcan carbon	TiO_2
Electrical conductivity (S cm^{-1})	3.7	3.0	2.1	immeasurable