

Supporting Information

Pd Nanoparticle/CoP Nanosheet Hybrids: Highly Electroactive and Durable Catalysts for Ethanol Electrooxidation

Sheng-Hua Ye, Jin-Xian Feng, and Gao-Ren Li*

*MOE Laboratory of Bioinorganic and Synthetic Chemistry, KLGHEI of Environment and Energy Chemistry,
School of Chemistry and Chemical Engineering, Sun Yat-sen University, Guangzhou 510275, China*

E-mail: ligaoren@mail.sysu.edu.cn

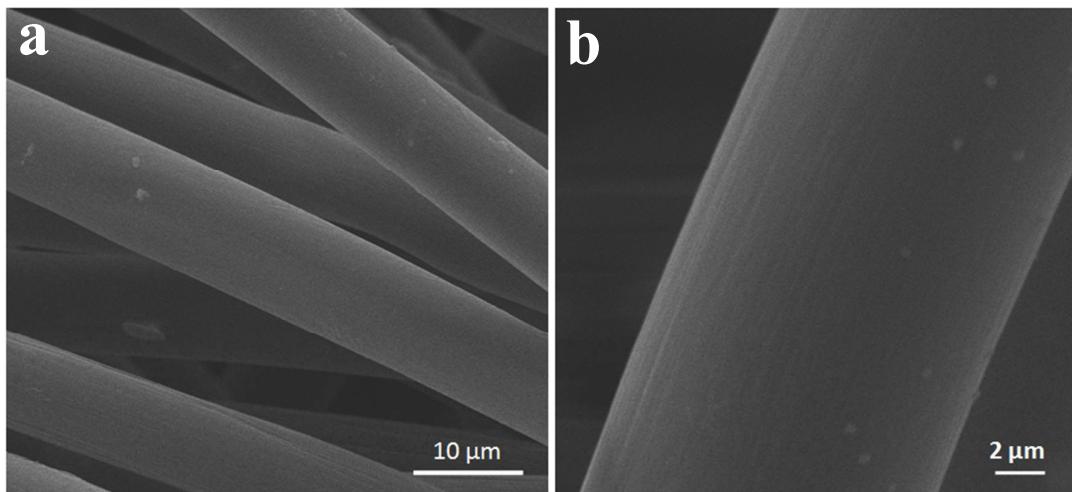


Figure S1. SEM images of CFC with differnt magnifications.

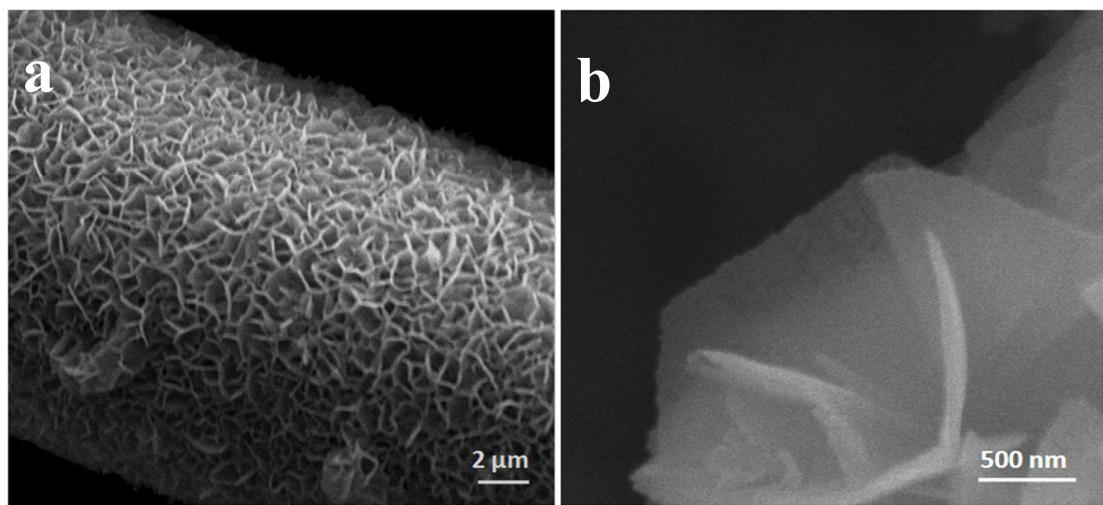


Figure S2. SEM images of $\text{Co}(\text{OH})_2$ NSs/CFC with different magnifications.

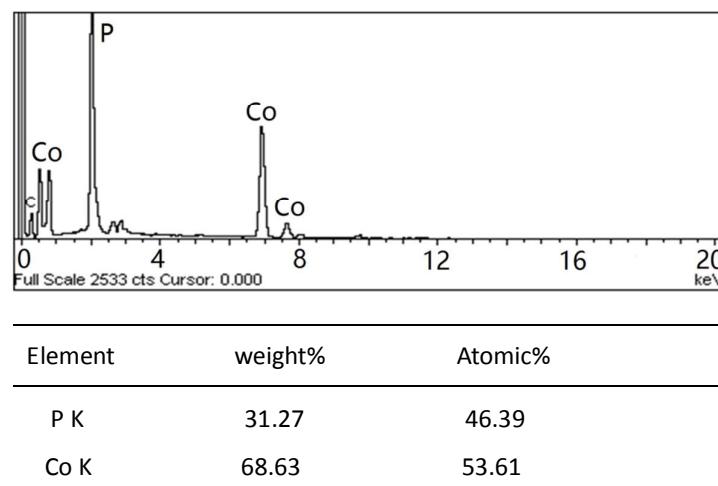


Figure S3. EDS results of CoP NSs/CFC.

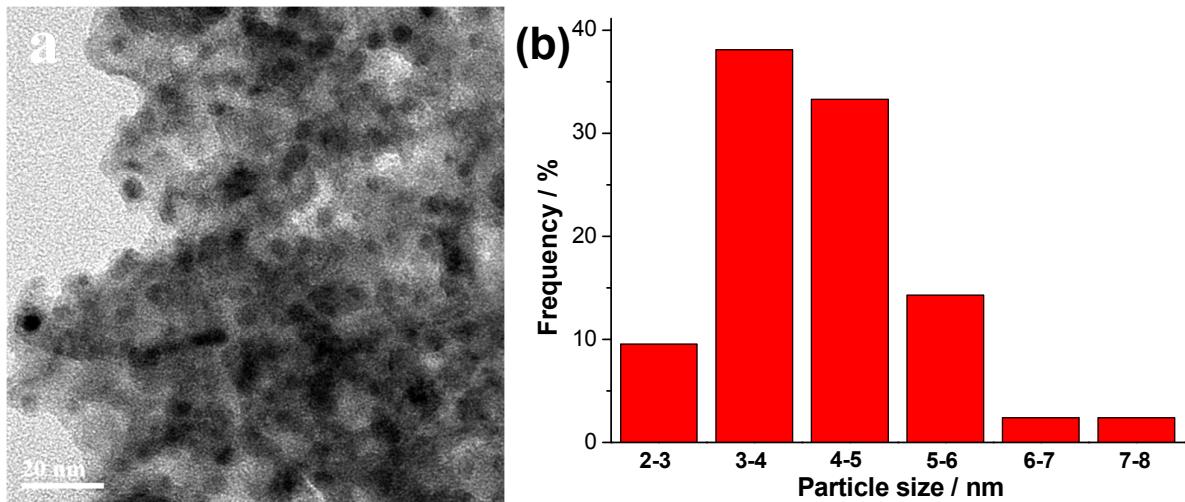


Figure S4 (a) SEM image and (b) size distribution of Pd@CoP NSs/CFC.

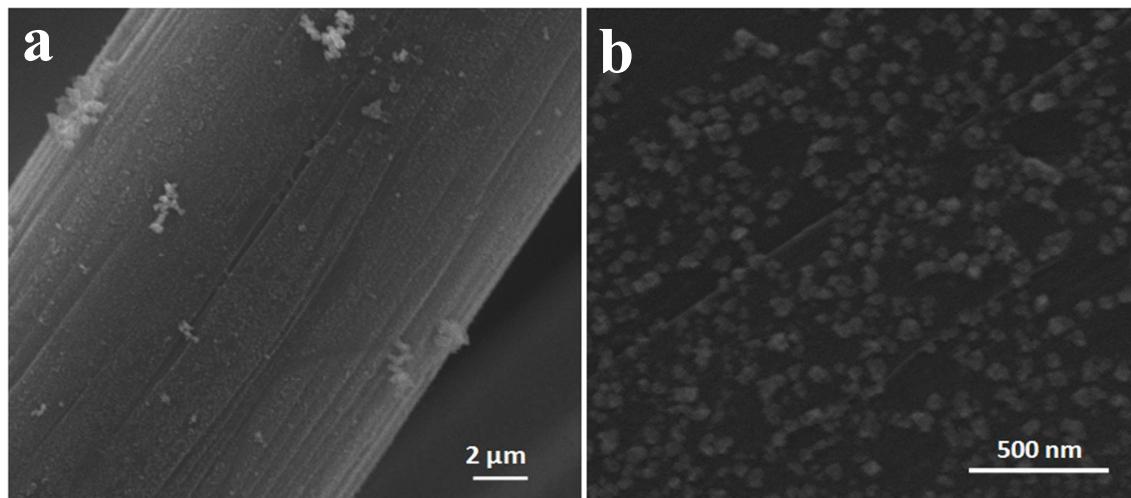


Figure S5. SEM images of Pd/CFC with different magnifications.

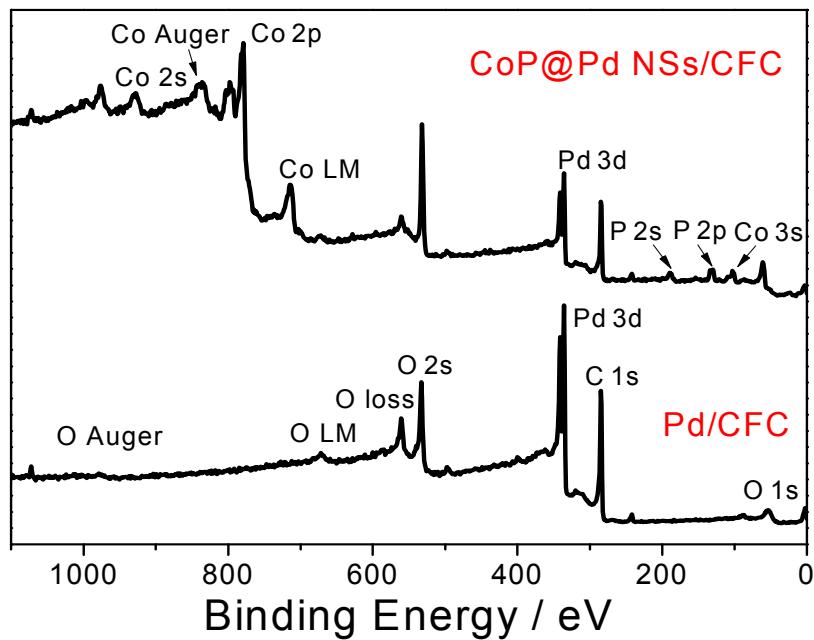


Figure S6. Survey spectra of Pd@CoP NSs/CFC and Pd/CFC.

Table S1. Comparisons of anodic peak current density in forward scan of various electrocatalysts for ethanol oxidation in alkaline media.

Catalysts	Current densities (mA / mg)	Testing conditions	References
Pd@CoP NSs/CFC	1413.3	1.0 M KOH + 1.0 M ethanol, 50 mV/s	This work
convex PdAu NCs	~550	1.0 M KOH + 0.5 M ethanol, 50 mV/s	1
PdAu NCs	1065	0.1 M KOH + 0.5 M ethanol, 50 mV/s	2
Pd-FNMs	~600	0.5 M NaOH + 1.0 M ethanol, 50 mV/s	3
Pd ₃₃ Pt ₆₇ nanowires/GCE	~310	0.5 M NaOH + 1.0 M ethanol, 50 mV/s	4
Pd ₄₅ Pt ₅₅ nanowires/GCE	~950	0.5 M NaOH + 1.0 M ethanol, 50 mV/s	
Pd NWA	308	1.0 M KOH + 1.0 M ethanol, 50 mV/s	5
Pd/PANI/Pd SNTAs	~350	1.0 M NaOH + 1.0 M ethanol, 50 mV/s	6
Au@AgPd NPs	1250	0.3 M KOH + 0.5 M ethanol, 50 mV/s	7
PtSnRh WNWs	990	0.1 M NaOH + 0.1 M ethanol, 50 mV/s	8
PdFe-Fe ₂ O ₃ /MWNTs	1191	1.0 M KOH + 1.0 M ethanol, 50 mV/s	9
PdFe/Fe ₃ O ₄	856.7	1.0 M KOH + 1.0 M ethanol, 50 mV/s	10
Pd/GA/NF	590.2	1.0 M KOH + 1.0 M ethanol, 50 mV/s	11
Pd/rGO/CFP	925	0.5 M NaOH + 1.0 M ethanol, 50 mV/s	12
	1033	0.5 M NaOH + 1.0 M ethanol, 100 mV/s	
Pd-Au/RGO	1024.76	1.0 M KOH + 1.0 M ethanol, 50 mV/s	13
PdPt CANs	1075	1.0 M KOH + 0.5 M ethanol, 50 mV/s	14
Ni ₅₀ Pd ₅₀ /G	614.6	1.0 M NaOH + 0.1 M ethanol, 50 mV/s	15
PdPt NPSs	~1000	0.5 M NaOH + 1.0 M ethanol, 50 mV/s	16
Pd-Sn ANSDs	576	1.0 M KOH + 0.5 M ethanol, 50 mV/s	17

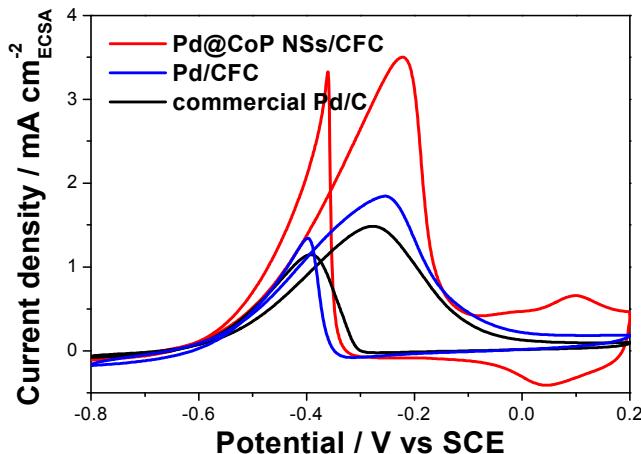


Figure S7. CVs of Pd@CoP NSs/CFC, Pd/CFC and commercial Pd/C with current densities that are normalized to specific active areas in solution of 1.0 M KOH + 1.0 M ethanol at 50 mV/s.

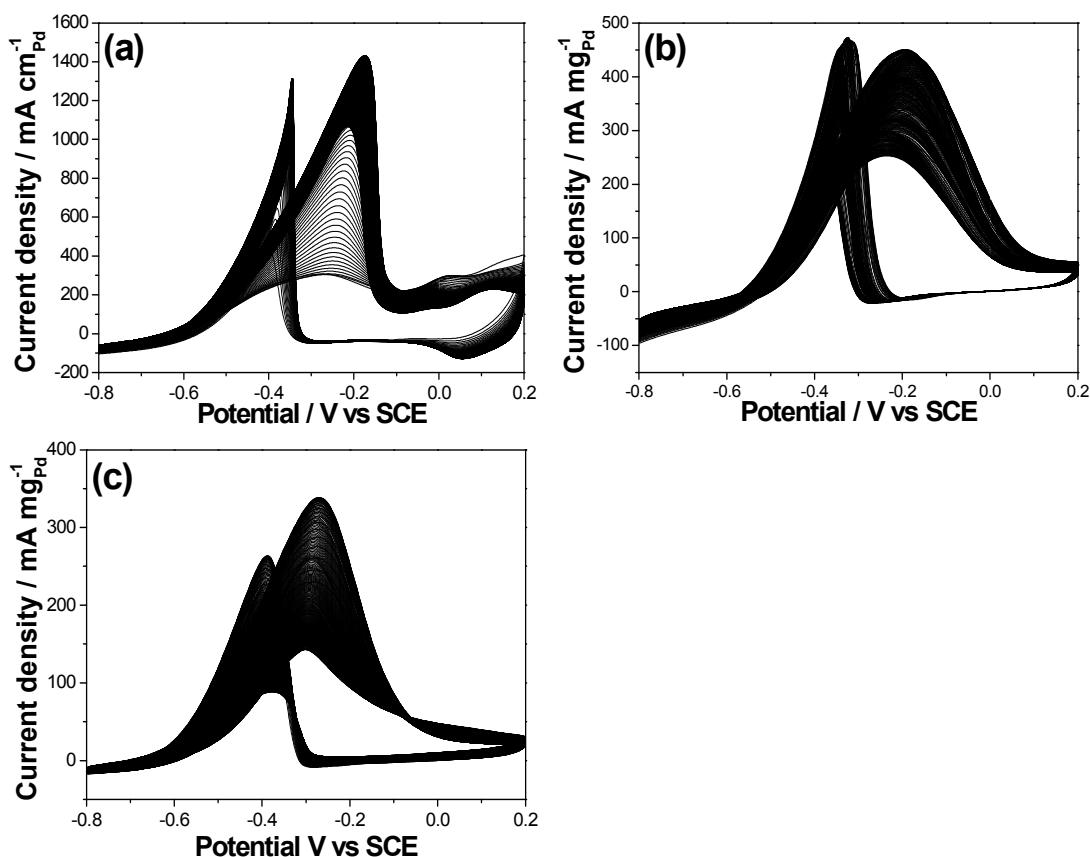


Figure S8. CVs of (a) Pd@CoP NSs/CFC; (b) Pd/CFC and (c) commercial Pd/C from 1st to 250th cycle in 1.0 M KOH + 1.0 M ethanol at 50 mV/s.

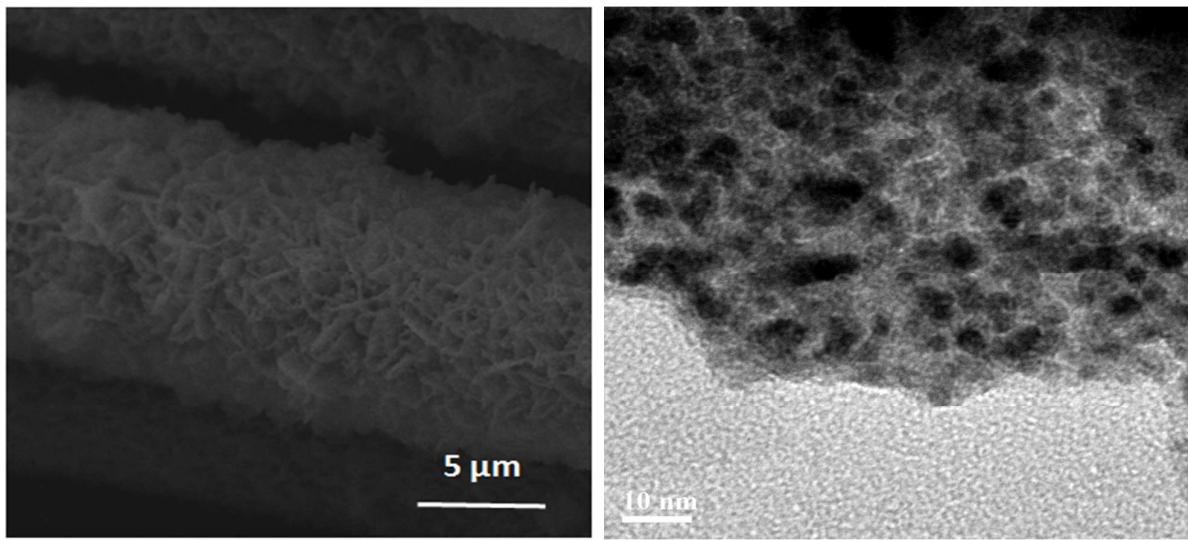


Figure S9. (a) SEM and (b) TEM images of Pd@CoP NSs/CFC after 250 cycles in 1.0 M KOH + 1.0 M ethanol at 50mV/s.

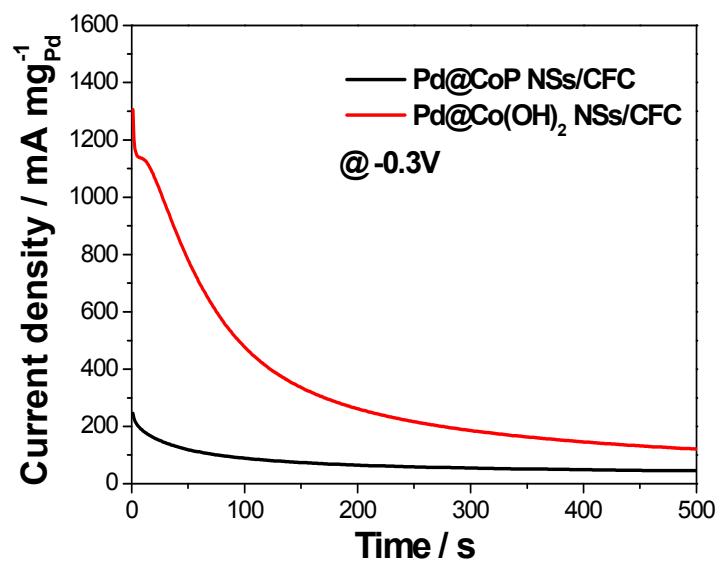


Figure S10. Chronoamperometry curves of Pd@CoP NSs/CFC and Co(OH)₂@Pd NSs/ CFC in 1.0 M KOH + 1.0 M ethanol at 50 mV/s, respectively.

Table S2. Band assignment in ATR-FTIR spectrum.

Band frequency / cm ⁻¹	Assignments
1850 - 2000	bridged CO ¹⁸
1730 - 1850	multi-bonded CO ¹⁸
3607 - 3630	H ₂ O _{ad} , v(OH) ¹⁹
1616	H ₂ O _{ad} , δ(HOH) ¹⁹
3000 - 3500	H ₂ O _{bulk} , v(OH) ^{19c}
1581	CH ₃ COO ⁻ v _s (C=O) ^{20a}
1380	CH ₃ COO ⁻ v _{as} (C=O) ^{20a}
1250 - 1550	adsorbed carbonate ^{20,21}

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