Supplementary Information for

Manipulating electronic and geometric effects of Pt nanoparticles exerted from Co single atoms in the selective hydrogenation of Epichlorohydrin

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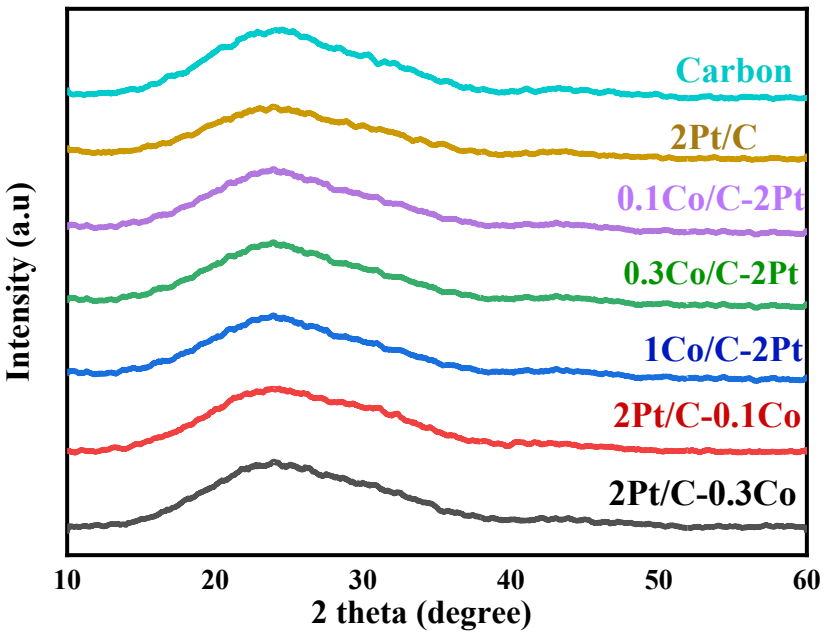

Figure S1. The XRD spectra of different catalysts

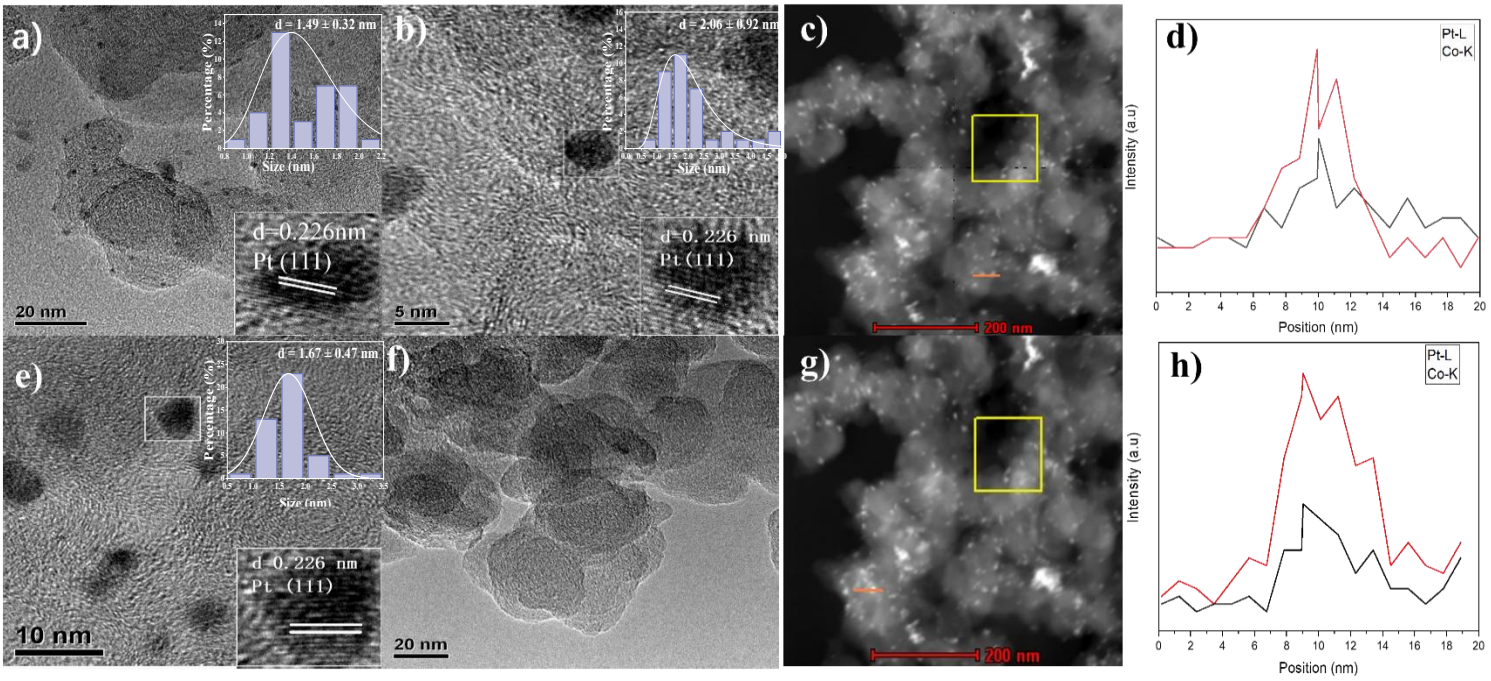

Figure S2. HRTEM images of (a) 2Pt/C, (b) 0.3Co/C-2Pt, (e) 2Pt/C-0.1Co, (f) 2Co/C (insets indicate the magnified images of Pt NPs and TEM histograms); (c, g) STEM images of 2Pt/C-1Co and (d, h) the corresponding EDS pattern of Pt and Co.

Table S1. The structural parameters extracted from the EXAFS spectra of several typical catalysts and Co foil, CoO, Co_3O_4 standards.

* Values are manually adjusted.

Sample	ΔE_0	Co-O interaction			Co-C interaction			Co-Co interaction			Co-Pt interaction			k range	R range	R-factor	χ^2
		N_O	R_{Co-O} (Å)	$\sigma_O^2 \times 10^3$	N_C	R_{Co-C} (Å)	$\sigma_C^2 \times 10^3$	N_{Co}	R_{Co-Co} (Å)	$\sigma_{Co}^2 \times 10^3$	N_{Pt}	R_{Co-Pt}	$\sigma_{Pt}^2 \times 10^3$				
Co foil	-2.61 ± 1.03							12.0	2.52 ± 0.01	6.82 ± 0.91				3.0-9.9	1.0-4.2	0.009	65.6
								6.0	3.55 ± 0.02								
								24.0	4.40 ± 0.01								
CoO	-3.05 ± 0.52	6.0	2.11 ± 0.01	11.5 ± 1.61				12.0	3.03 ± 0.01	7.81 ± 0.70				3.0-9.9	1.0-4.4	0.004	47.8
		8.0	3.61 ± 0.03					6.0	4,13 ± 0.02								
		12.0	4.73 ± 0.02														
Co_3O_4	-8.04 ± 5.63	4.0	1.90 ± 0.15	4.01 ± 8.04				12.0	3.28 ± 0.15	7.38 ± 6.09				3.0-9.9	1.0-3.5	0.08	2020.6
		12.0	3.41 ± 0.04					4.0	3.43 ± 0.07								
1Co/C-2Pt	-3.25 ± 1.48	4.0	2.02 ± 0.01	0.55 ± 1.31	4.0	2.72 ± 0.03	1.50 ± 3.17				4.0	3.73 ± 0.03	1.73 ± 4.68	3.0-9.9	1.0-4.3	0.03	1.38
		2.0	2.25 ± 0.03														
		4.0	3.96 ± 0.05														
		2.0	4.01 ± 0.05														
		4.0	4.33 ± 0.05														
		4.0	4.78 ± 0.05														
2Pt/C-1Co	2.25 ± 2.12	4.0	2.04 ± 0.02	2.76 ± 1.27	4.0	2.78 ± 0.04	14.5 ± 10.6				4.0	3.75 ± 0.04	2.80 ± 2.74	3.0-9.9	1.0-4.2	0.03	1.53
		2.0	2.24 ± 0.04		4.0*	3.00 ± 0.04											
		4.0	3.90 ± 0.07														
		2.0	4.22 ± 0.06														
		4.0	4.32 ± 0.06														

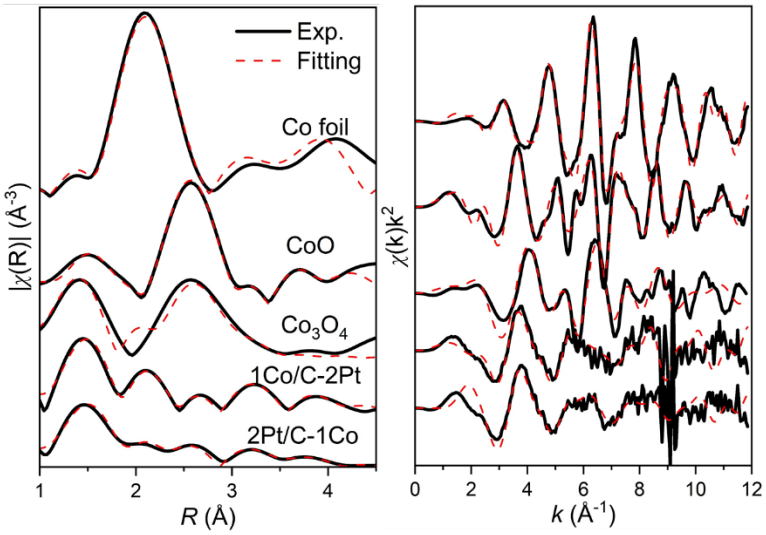

Figure S3. The amplitude of Fourier transforms (*right*) and the Co k^2-weighted EXAFS spectra (*left*) for the several typical catalysts and Co foil, CoO, Co_3O_4 standards. The solid lines represent experimental values and the dashed lines are fitted spectra.

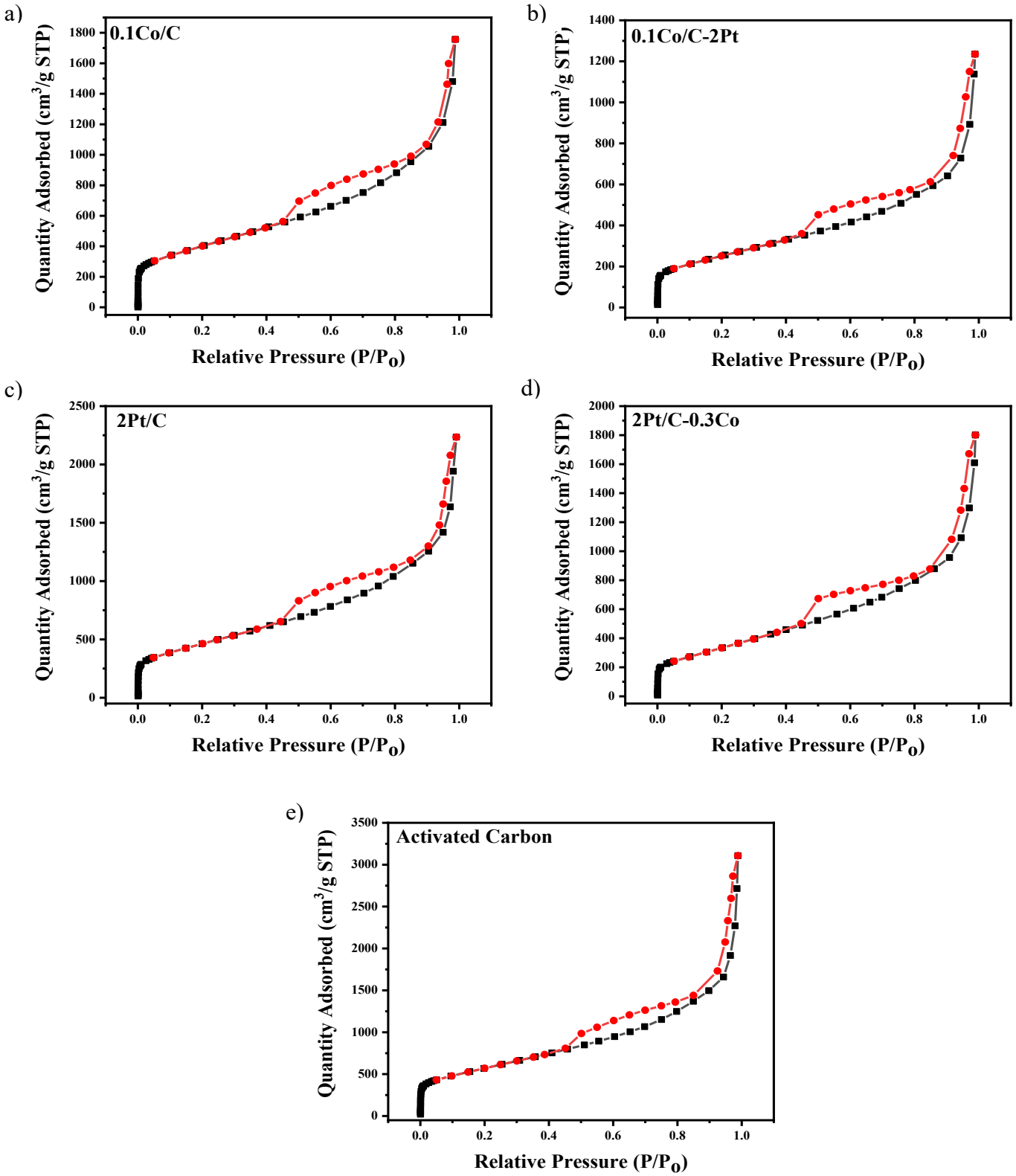

Figure S4. N_2 adsorption-desorption isotherms of different catalysts

Table S2. Physical properties of catalyst indicating specific surface area, pore size and pore volume of different catalysts

Catalyst	**Specific surface area (m^2g^{-1})**	**Pore Volume (cm^3g^{-1})**	**Pore size (nm)**
C	2049.9	4.83	4.71
0.1Co/C	1435.0	2.73	3.81
0.1Co/C-2Pt	901.5	1.91	4.26
2Pt/C	1673.8	3.47	4.16
2Pt/C-0.3Co	1245.5	2.8	4.5

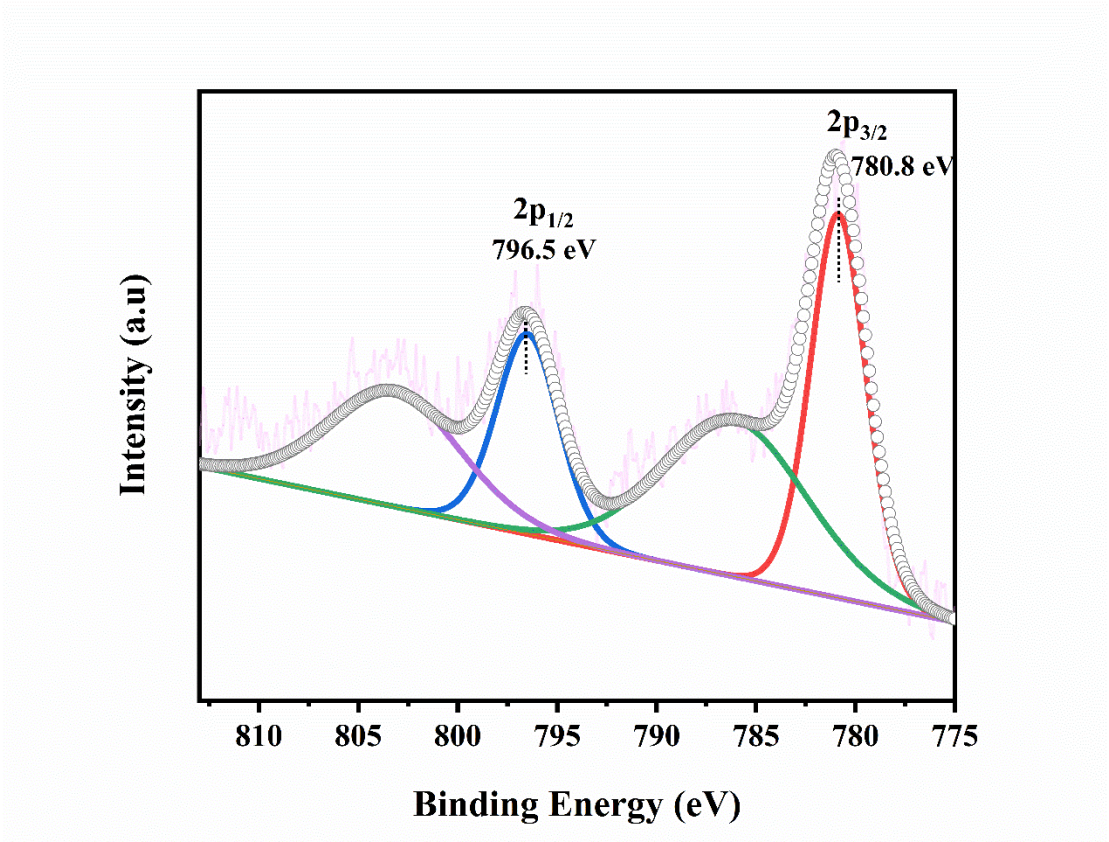

Figure S5. The Co-2p XPS spectra of Co/C without reduction

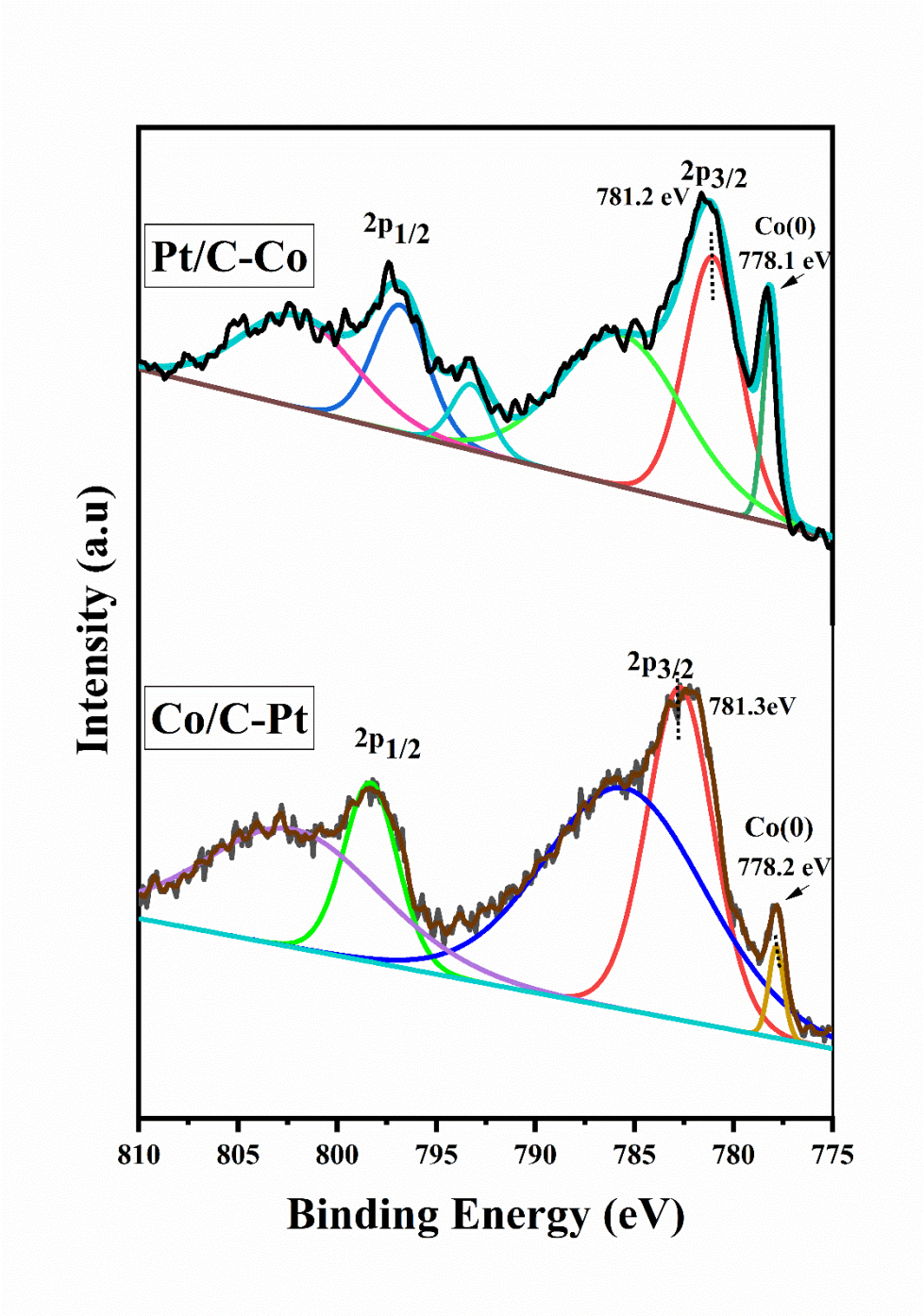

Figure S6. The Co-2p XPS spectra of Co/C-Pt and Pt/C-Co

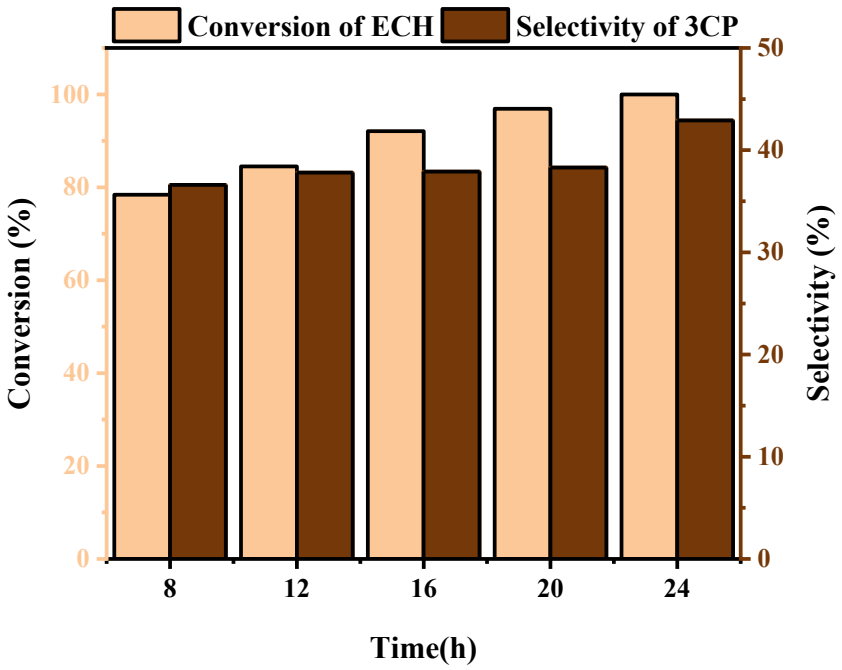

Figure S7. Effect of reaction time on the performance of 2Pt/C-0.3Co

Reaction conditions: temperature, 90°C; Stirring speed, 400rpm; H_2 Pressure, 4MPa; Pt in the catalyst, 0.015 mmol; the molar ratio of substrate to catalyst (S/C), 100:1.

Table S3. Effect of stirring speed on the performance of 0.1Co/C-2Pt catalyst

Stirring speed (rpm)	Conv. (%)
200	42.8
400	43.5
600	47.6

Reaction conditions: temperature, 90°C; Hydrogen Pressure, 4 MPa; reaction time, 30 min; Pt in the catalyst, 0.015 mmol; the molar ratio of substrate to catalyst (S/C) 100:1.

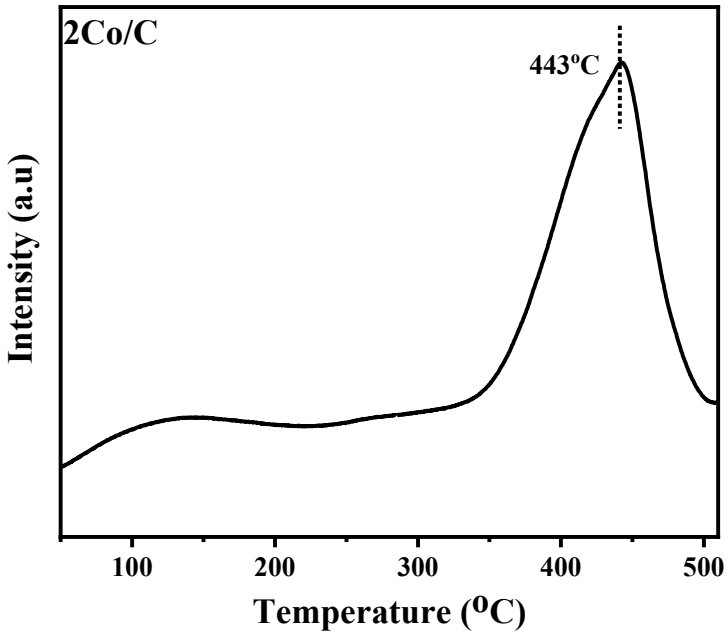

Figure S8. The H_2-TPD profile over 2Co/C catalyst

The H_2-TPD curve over 2Co/C was measured by PCA-1200 chemisorption analyzer furnished with MS-200 mass spectrograph. 50 mg of sample was loaded in a quartz reactor and purged N_2 gas at 120 ºC for 30 mins. 2Co/C was then reduced at 260 ºC with flowing hydrogen (99.99%) for 60 mins. The remaining H_2 in the tube was removed with flowing N_2 for 30 mins. The H_2-TPD curve was then obtained by increasing temperature to 500 ºC with a ramping rate of 10 C min^{-1}.

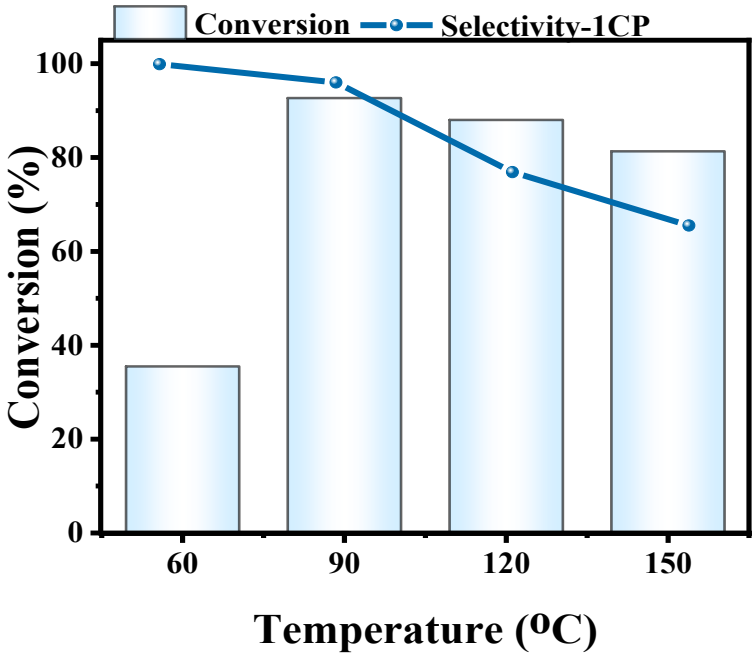

Figure S9. Effect of reaction temperature on the performance of 0.1Co/C-2Pt.

Reaction Conditions: Pressure: 4MPa; Stirring speed: 400 rpm; S/C=100:1; Time: 20 min

Table S4. The stability of the catalyst measured by ICP-OES reaction

Spent Catalyst	Pt wt.%	Co. wt.%
0.1Co/C-2Pt	1.64	0.06
2Pt/C-0.3Co	1.95	0.27

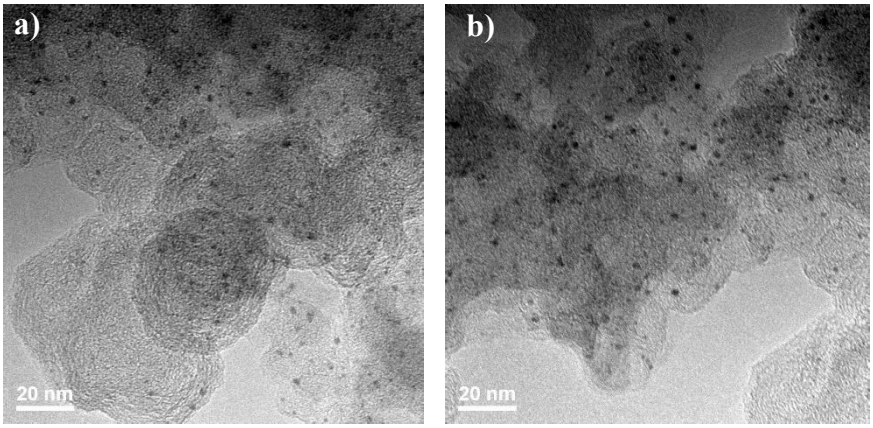

Figure S10. TEM images of spent catalyst of (a) 0.1Co/C-2Pt and (b) 2Pt/C-0.3Co