Electronic supplementary information

Interfacial sites in platinum-hydroxide-cobalt hybrid nanostructure for promoting CO oxidation activity

Wenxue He, Li Huang, Chengyong Liu, Siyu Wang, Zhixin Long, Fengchun Hu, and Zhihu Sun*

National Synchrotron Radiation Laboratory, University of Science and Technology of China, Hefei 230029, P. R. China.



Fig. S1 XRD pattern for Pt/SiO_2 and $Pt@Co(OH)_2/SiO_2$, showing no diffraction peaks in both samples.

^{*}Corresponding author. E-mail: <u>zhsun@ustc.edu.cn.</u>



Fig. S2 Representative TEM image of as-synthesized Pt/SiO_2 . The insets show the size distribution and a HRTEM image indicating the interplanar spacing of 0.20 nm.



Fig. S3 Pt L_3 -edge XANES spectra of as-synthesized and H_2 -reduced Pt@Co(OH)₂/SiO₂. The spectra of Pt foil, PtO₂ and H₂-reduced Pt/SiO₂ are plotted for comparison.



Fig. S4 Pt L₃-edge Fourier transformed EXAFS $k^3\chi(k)$ functions of Pt/SiO₂ and Pt@Co(OH)₂/SiO₂ catalysts that have been reduced by H₂ at 573 K for 45 min and then cooled to 300 K. The least-square fitting curves are shown by circles. The reference spectra of Pt foil and PtO₂ bulk are also plotted for comparison.



Fig. S5 Co K-edge Fourier transformed EXAFS $k^3\chi(k)$ functions of as-synthesized Pt@Co(OH)₂/SiO₂, together with and the reference spectra of Co(OH)₂, CoOOH and Co₃O₄ bulk. The least-square fitting curve of Pt@Co(OH)₂/SiO₂ is also plotted as circles.



Fig. S6 XPS spectra of Pt 4*f* for the as-synthesized Pt/SiO₂ and Pt@Co(OH)₂/SiO₂. A shift of these two peaks toward the low binding energy direction is evident in the case of Pt@Co(OH)₂/SiO₂ as compared to Pt@Co(OH)₂/SiO₂.



Fig. S7 XPS spectrum of Pt 4f for the as-synthesized Pt@Co(OH)₂/SiO₂. Deconvolution analysis shows that it is composed of four components attributed to Pt⁴⁺, Pt²⁺, Pt⁰ and Pt⁵⁻.



Fig. S8 XPS spectra of Co 2p for Pt@Co(OH)₂/SiO₂.



Fig. S9 In situ DRIFTS spectra of CO adsorption on $Co(OH)_2/SiO_2$ within different wavenumber regions at room temperature.

Table	S1	The	weight	contents	of	Pt	and	Co	in	various	samples	determined	by
inductively coupled plasma optical emission spectroscopy analysis.													

Sample	Pt content (wt%)	Co content (wt%)
Co(OH) ₂ /SiO ₂	-	0.26%
Pt/SiO ₂	1.2%	-
Pt@Co(OH) ₂ /SiO ₂	1.1%	0.24%

Sample	Pair	Ν	<i>R</i> (Å)	σ^{2} (Å ²)	$\Delta E_0 (\mathrm{eV})$
	Co-O	6	1.88		
Co_3O_4	Co-O	4	1.92		
	Co-Co	4	2.85		
	Co-O	6	2.10		
$CO(OH)_2$	Co-Co	6	3.18		
C-OOU	Co-O	6	1.83		
COUCH	Co-Co	6	2.83		
Pt foil	Pt-Pt	12	2.77		
	Co-O	5.1	2.09	0.0072	0.8
$Pt@Co(OH)_2/SiO_2$ (reduced)	Co-Co	4.4	3.09	0.0098	0.8
× /	Pt-Pt	10.1	2.75	0.0071	8.1

Table S2 Structural parameters of reduced Pt/SiO_2 and $Pt@Co(OH)_2/SiO_2$ extracted from EXAFS curve-fitting, along with those of Pt foil, $Co(OH)_2$, and Co_3O_4 references.

 \overline{N} , coordination number; R, distance between absorber and backscatter atoms; σ^2 , Debye-Waller factor; ΔE_0 , inner-potential correction.