

CHEMISTRY

A EUROPEAN JOURNAL

Supporting Information

© Copyright Wiley-VCH Verlag GmbH & Co. KGaA, 69451 Weinheim, 2014

Pt₃Co Concave Nanocubes: Synthesis, Formation Understanding, and Enhanced Catalytic Activity toward Hydrogenation of Styrene

Chenyu Wang,^[a] Cuikun Lin,^[b] Lihua Zhang,^[c] Zewei Quan,^[a] Kai Sun,^[d] Bo Zhao,^[b]
Feng Wang,^[e] Nathan Porter,^[a] Yuxuan Wang,^[f] and Jiye Fang^{*[a, f]}

chem_201301724_sm_miscellaneous_information.pdf

Pt₃Co Concave Nanocubes: Synthesis, Formation Understanding and Enhanced Catalytic Activity toward Hydrogenation of Styrene

Chenyu Wang,¹ Cuikun Lin,² Lihua Zhang,³ Zewei Quan,^{1,†} Kai Sun,⁴ Bo Zhao,² Feng Wang,⁵ Nathan Porter,¹ Yuxuan Wang⁶ and Jiye Fang^{*,1,6}

¹Department of Chemistry, State University of New York at Binghamton, Binghamton, New York 13902, USA

²Department of Chemistry, University of South Dakota, Vermillion, South Dakota 57069, USA

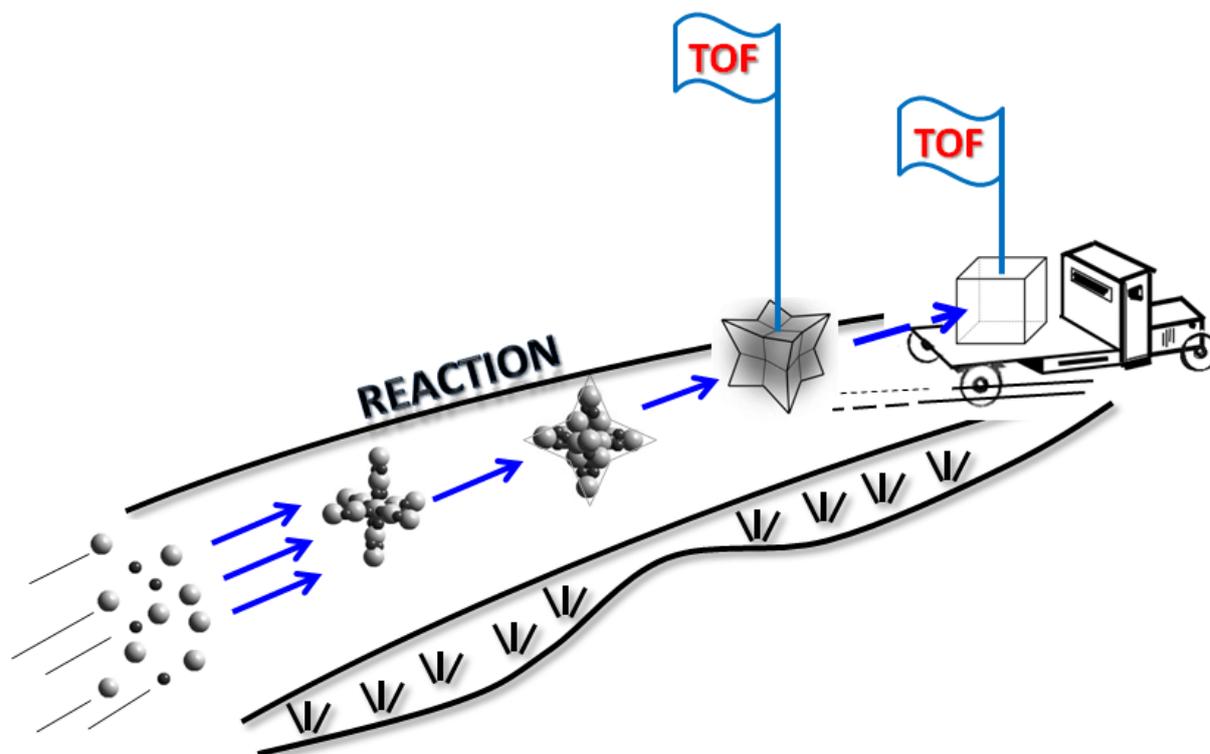
³Center for Functional Nanomaterials, Brookhaven National Laboratory, Upton, New York 11973, USA

⁴Department of Materials Science and Engineering, University of Michigan, Ann Arbor, Michigan 48109, USA

⁵Department of Sustainable Energy Technology, Brookhaven National Laboratory, Upton, New York 11973, USA

⁶Materials Science and Engineering Program, State University of New York at Binghamton, Binghamton, New York 13902, USA

[†]Present Address: EES-14 and MPA-MSID, Los Alamos National Laboratory, Los Alamos, New Mexico 87545, USA



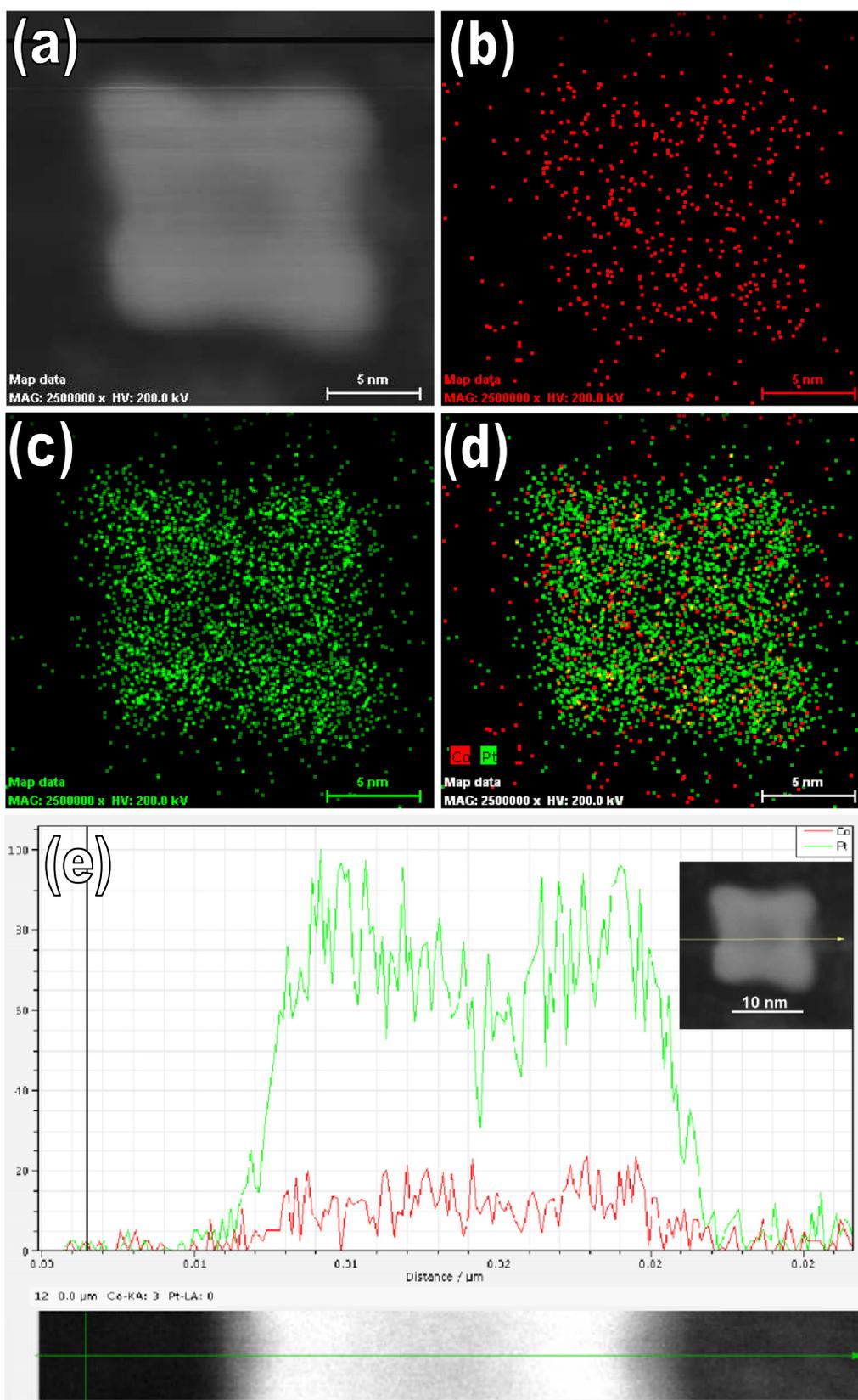


Figure S1. (a), STEM image of a selected concave nanocube; (b)-(d), STEM elemental maps of Co (b, red), Pt (c, green) and Pt+Co overlap (d) on the individual concave nanocube; (e), HAADF-STEM-EDS line scan profile of an individual concave nanocube (red line, Co; green line, Pt; the inset is an STEM image of the selected concave nanocube).

Table S2. ICP-OES Analysis Data.

sample		concentration		molar ratio	suggested formula
		Pt (mg/L)	Co (mg/L)	Pt/Co	
concave	run 1	8.617	1.007	2.585	Pt ₇₂ Co ₂₈
	run 2	4.812	0.570	2.550	
	run 3	7.729	0.900	2.594	
	average			2.577	
concave (after 2h reaction)	run 1	5.935	0.692	2.591	Pt ₇₂ Co ₂₈
	run 2	7.471	0.882	2.559	
	run 3	7.695	0.898	2.589	
	average			2.580	
concave (after 24h reaction)	run 1	7.458	0.879	2.563	Pt ₇₂ Co ₂₈
	run 2	6.011	0.691	2.628	
	run 3	8.908	1.027	2.620	
	average			2.604	
nanocube	run 1	17.60	2.071	2.567	Pt ₇₂ Co ₂₈
	run 2	8.930	1.046	2.579	
	average			2.573	

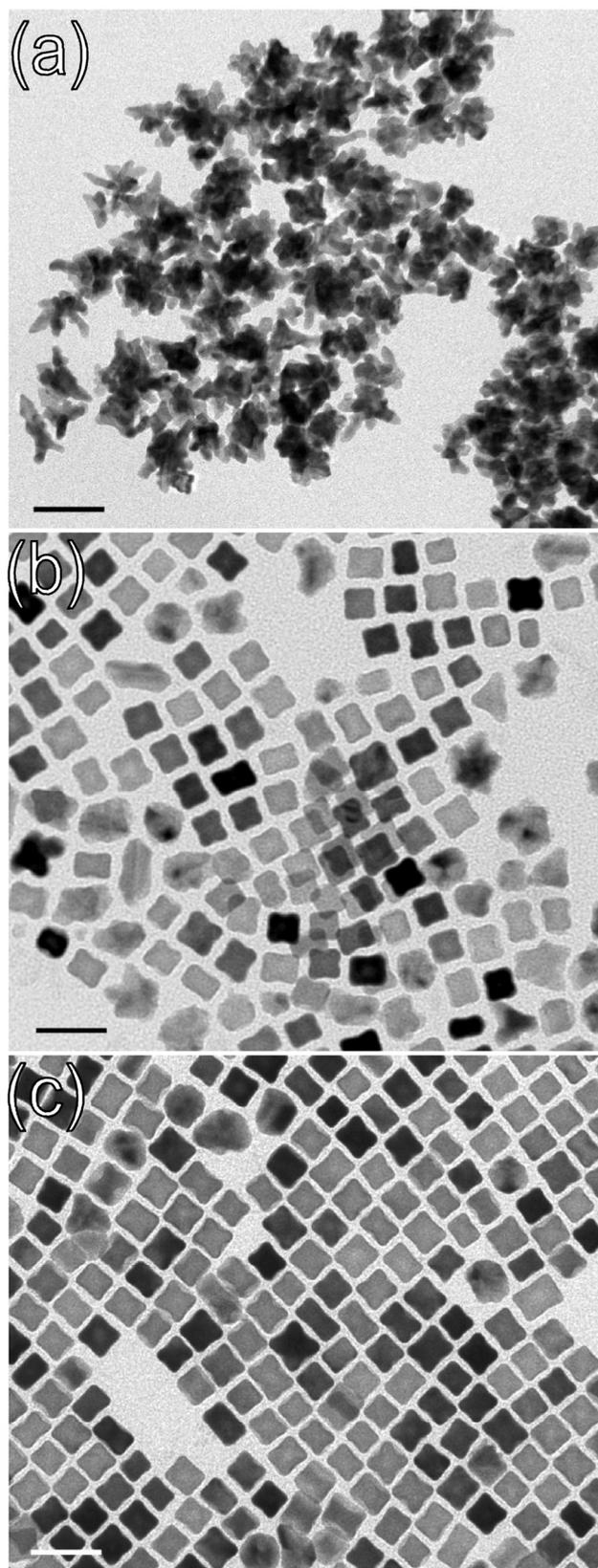


Figure S3. TEM images of Pt₃Co NCs that were taken from the reaction system at different times. Synthesis was conducted using a typical preparation recipe and conditions as stated in the context. (a), after 2 minutes; (b) after 10 minutes; and (c), after 30 minutes. Bar scales: (a), 50 nm; (b) and (c): 25 nm.

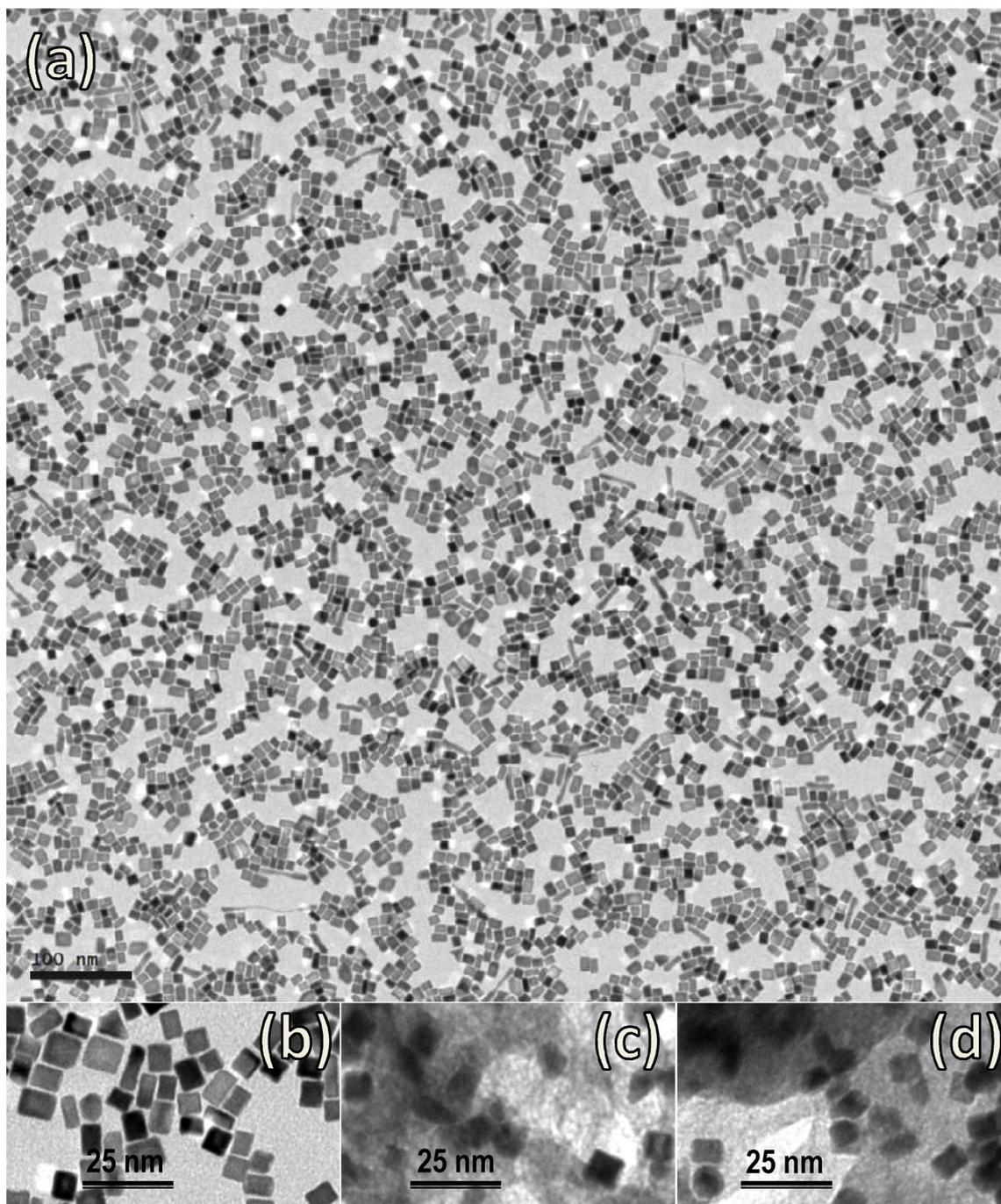


Figure S4. TEM images of Pt₃Co nanocrystals collected at different times after the nucleation reaction. The synthesis was adopted the typical preparation approach but Pt(acac)₂ was replaced⁴¹ with PtCl₄. (a) and (b), 30 sec; (c), 2 min; and (d), 5 min.

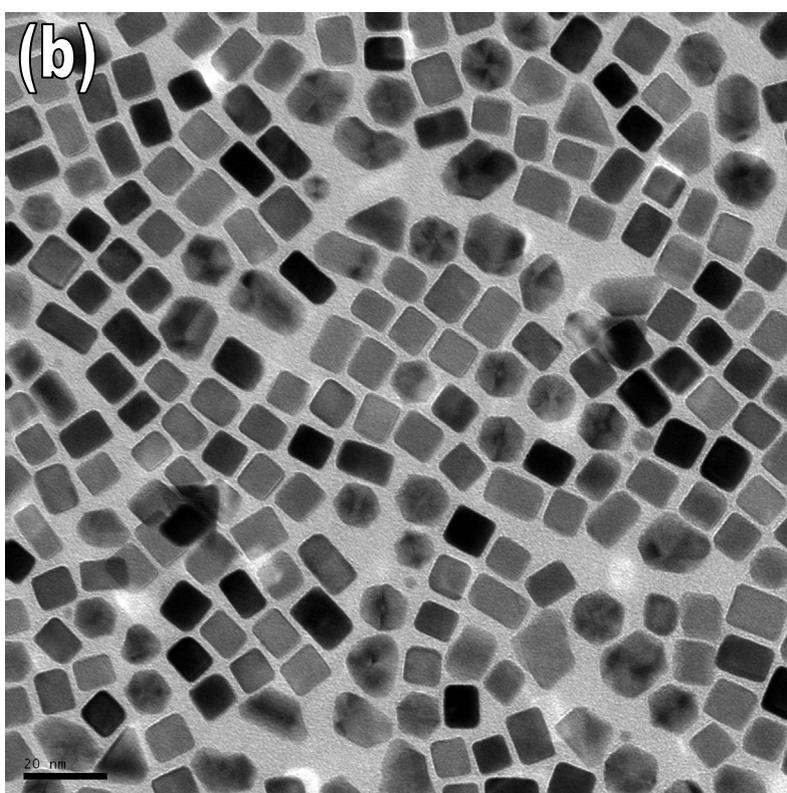
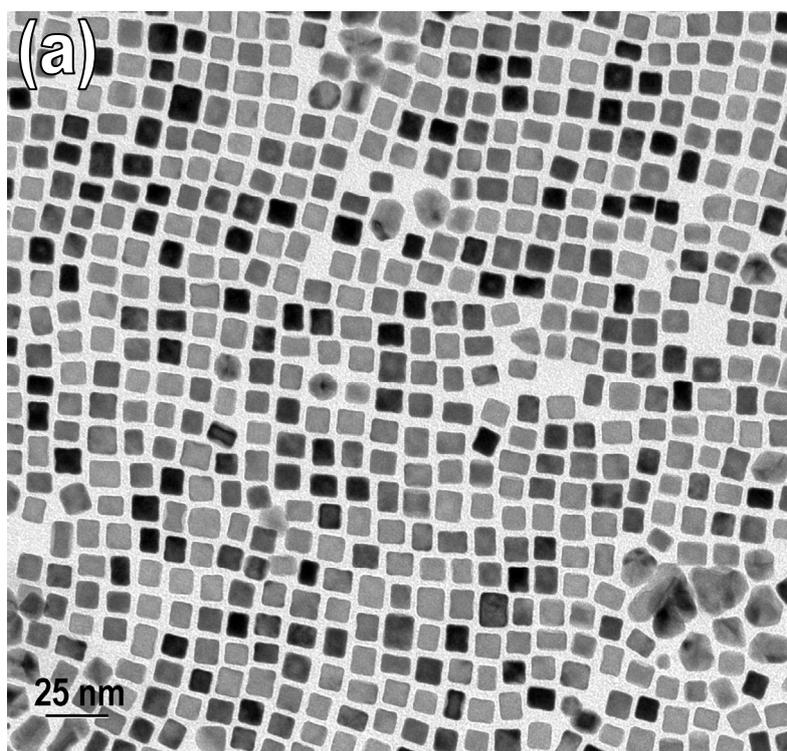


Figure S5. TEM image of (a) Pt₃Co nanocubes and (b) Pt nanocubes used as a class of “reference” catalysts in this study.

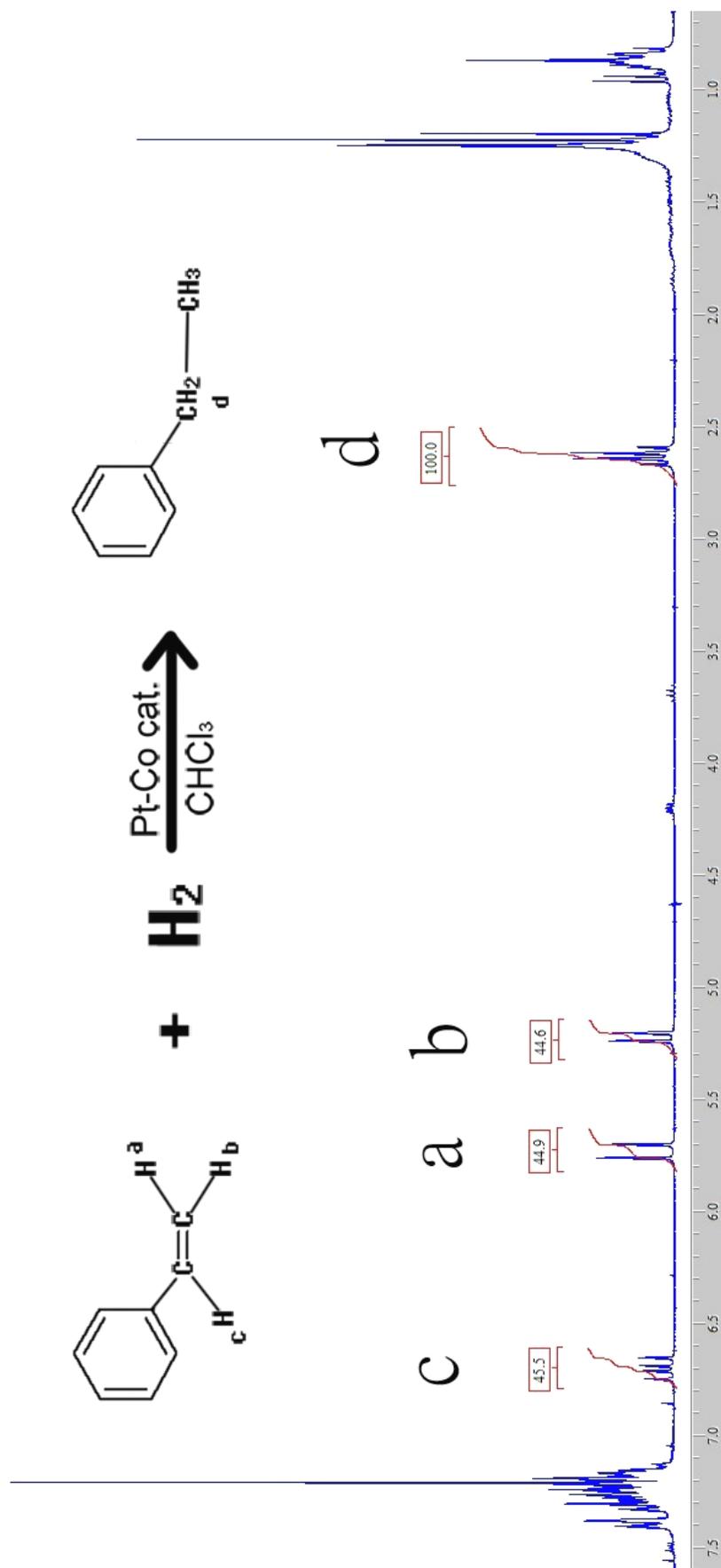


Figure S6. A typical ^1H NMR (300 MHz, CDCl_3) spectrum showing the information of protons from both styrene (residue of the reactant) and ethyl benzene (the converted product).

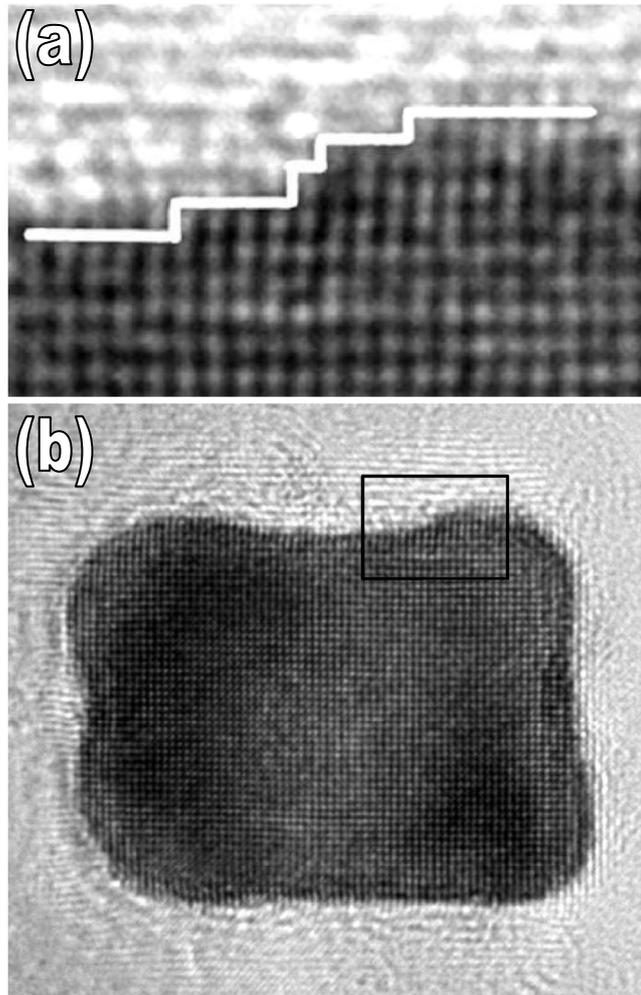


Figure S7. HRTEM image of a selected single Pt₃Co concave nanocube which is different from one presented in Figure 1c. (a) is a zoom-in of a selected part in (b).