

Supporting information

**Particle Size Effects in the Selective Hydrogenation of
Cinnamaldehyde over Supported Palladium Catalysts**

Feng Jiang,^[a,b] Jian Cai,^[a] Bing Liu,^[a] Yuebing Xu,^[a] and Xiaohao Liu^{*[a]}

*^aThe Key Laboratory of Food Colloids and Biotechnology, Ministry of Education,
School of Chemical and Material Engineering, Jiangnan University, Wuxi, Jiangsu
Province, 214122, China*

Corresponding author: liuxh@jiangnan.edu.cn (X.H. Liu)

*^bJiangsu Key Laboratory of Advanced Catalytic Materials and Technology,
Changzhou University, 213164, China*

1. Catalytic Results

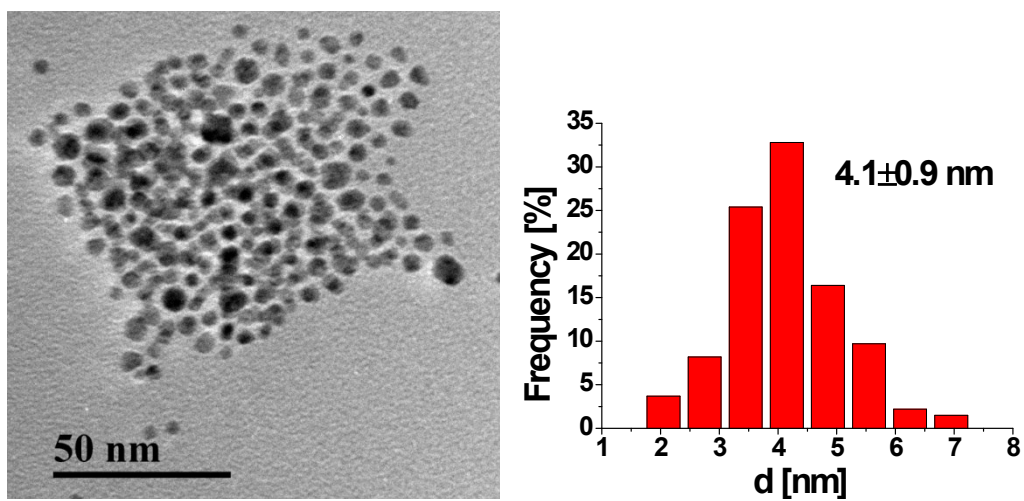


Fig. S1 TEM images of Pd NPs (left) and particle size distribution (right)

Table S1 the catalytic performance over 0.1wt% Pd-Ac/ γ -Al₂O₃ catalyst^a

Reaction time, min	Conversion, % CAL	Average reaction rate (mol _{CAL} g _{Pd} ⁻¹ h ⁻¹)	Selectivity, %	
			HCAL	HCOL
10	13.0	295	95.9	4.1
35	28.8	187	95.8	4.2
60	40.1	152	95.3	4.7
120	60.6	115	95.2	4.8
250	75.1	68	94.1	5.9

^a Reaction conditions: CAL 10 g, p-xylene 40 g, Pd 0.2 mg, 80 °C, H₂ 2 MPa, 800 rpm.

Table S2 The comparison of selectivity and reaction rate data reported in the literature.

Catalyst	Pd, nm	Conditions of CAL hydrogenation	Selectivity to HCAL, %	Reaction rate, $\text{mol}_{\text{CAL}} \text{g}_{\text{Pd}}^{-1} \text{h}^{-1}$	Ref.
Pd/C	5.5-6	Toluene; 22 °C; atmospheric H_2	65%	0.7 ^a	[1]
Pd/NRGO(N-doped reduced graphene oxides)	<1.4	H_2O ; 70 °C; 2 MPa H_2	95.9%	157 ^b	[2]
	<1.4	H_2O ; 70 °C; 2 MPa H_2	96.1%	125 ^c	
	3.2	H_2O ; 70 °C; 2 MPa H_2	93.4%	97 ^b	
Pd/RGO	11.1	H_2O ; 70 °C; 2 MPa H_2	87.3%	17 ^b	[2]
Pd/GO	13.4	H_2O ; 70 °C; 2 MPa H_2	86.4%	17 ^b	[2]
Pd/ γ - Al_2O_3	5.7	Decalin; 100 °C; 2 MPa H_2	93.9%	11 ^d	[3]
Pd/BP(Boronate microparticles)	1.52	Methanol; 25 °C; 0.1 MPa H_2	92%	50 ^e	[4]
Pd/ SiO_2	1.55	H_2O ; 25 °C; 0.1 MPa H_2	87%	12 ^e	[4]
Pd/AC	-	Cyclohexane; 140 °C; 1 MPa H_2	90%	39 ^a	[5]

^aInitial rate; ^bAverage rate in 0.5 h; ^cAverage rate in 0.75 h; ^dAverage rate in 1 h; ^eAverage rate in 4 h.

Table S3 Influence of calcination temperature on the catalytic performance of Pd/ γ -Al₂O₃ catalyst^a

Sample	Reduction Temperature, °C	CAL Conversion, %	Selectivity, %	
			HCAL	HCOL
Pd/ γ -Al ₂ O ₃ ^b	200	98.9	91.6	8.4
	300	100	92.2	7.8
	400	99.7	91.3	8.7
	500	82.6	87.7	12.3

^a Reaction conditions: CAL 10 g, p-xylene 40 g, Pd 0.5 mg, 80 °C, 6 h, H₂ 2 MPa, 800 rpm.^b Reduction in H₂ at 250 °C for 0.5 h, calcination for 5 h under N₂ atmosphere.Table S4 Influence of reduction temperature on the catalytic performance of Pd/ γ -Al₂O₃ catalyst^a

Sample	Reduction Temperature, °C	CAL Conversion, %	Selectivity, %	
			HCAL	HCOL
Pd/ γ -Al ₂ O ₃ ^b	250	100	92.2	7.8
	350	100	92.2	7.8
	450	99.9	91.9	8.1
	550	99.9	90.7	9.3

^a Reaction conditions: CAL 10 g, p-xylene 40 g, Pd 0.5 mg, 80 °C, 6 h, H₂ 2 MPa, 800 rpm.^b Reduction in H₂ for 0.5 h, calcination at 300 °C for 5 h under N₂ atmosphere.**References:**

- [1] T. Szumelda, A. Drelinkiewicz, R. Kosydar and J. Gurgul, *Appl Catal A*, 2014, **487**, 1-15.
- [2] R. F. Nie, M. Miao, W. C. Du, J. J. Shi, Y. C. Liu and Z. Y. Hou, *Appl Catal B*, 2016, **180**, 607-613.
- [3] A. M. R. Galletti, C. Antonetti, A. M. Venezia and G. Giambastiani, *Appl Catal A*, 2010, **386**, 124-131.
- [4] S. Fujiwara, N. Takanashi, R. Nishiyabu and Y. Kubo, *Green Chem*, 2014, **16**, 3230-3236.
- [5] A. Cabiacc, T. Cacciaguerra, P. Trens, R. Durand, G. Delahay, A. Medevielle, D. Plee and B. Coq, *Appl Catal A*, 2008, **340**, 229-235.