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APPENDICES

Appendix A The catalytic activity, 1-hexene selectivity and n-hexane selectivity of low loaded Pd supported on alumina catalyst

Example: Pd-W/Al₂O₃ ratio 1.0

File name	Peak area			Mole of Components			%Conv.	%Hexene Selec.
	Reactant	Product	Solvent	Mole Reactant	Mole Product	Mole Solvent		
1PdW00	5594000	379790	105300292	1.77E-07	1.40E-08	3.32E-06	0.00	0.00
1PdW01	6107000	842327	113414111	1.62E-07	2.73E-08	3.58E-06	8.14	92.41
1PdW02	5517000	1202200	107414211	1.47E-07	4.14E-08	3.39E-06	9.62	90.23
1PdW03	5473000	1597800	101144143	1.18E-07	6.89E-08	3.19E-06	21.58	95.93
1PdW04	4725000	1903000	100341198	8.56E-08	9.80E-08	3.17E-06	27.45	89.97
1PdW05	3900000	2696000	102478543	5.72E-08	1.25E-07	3.24E-06	33.11	95.23
1PdW06	3832000	3106000	104899114	3.47E-08	1.45E-07	3.31E-06	41.39	92.68
1PdW07	2675000	2849000	112345099	1.96E-08	1.60E-07	3.55E-06	43.54	93.15
1PdW08	2791000	3847000	98851424	1.01E-08	1.68E-07	3.12E-06	48.53	87.34
1PdW09	2231432	4218000	107421098	4.90E-09	1.73E-07	3.39E-06	53.38	97.39
1PdW10	1664000	4079000	100125199	2.17E-09	1.75E-07	3.16E-06	55.71	92.67
1PdW11	1035000	3111000	109834115	8.53E-10	1.76E-07	3.47E-06	60.69	88.52
1PdW12	1258000	5100000	101114555	3.03E-10	1.77E-07	3.19E-06	66.51	90.66
1PdW13	933860	5623000	100055489	7.13E-11	1.77E-07	3.16E-06	76.45	92.44
1PdW14	498948	5458000	99988443	1.33E-11	1.77E-07	3.16E-06	81.42	96.87
1PdW15	326578	5958100	104097773	2.23E-12	1.78E-07	3.29E-06	85.14	92.32
							100.00	97.98

Calculation: At File name 1PdW12

$$\begin{aligned}\text{Sol}^{\text{D}} \quad \text{From 1-Hexyne conversion (\%1-Hy}_{\text{conv}}) &= \frac{(\text{moles of 1-Hy}_{\text{initial}} - \text{moles of 1-Hy}_{\text{final}})}{\text{moles of 1-Hy}_{\text{initial}}} \times 100 \\ &= \frac{(3.0281 \times 10^{-10} - 7.131 \times 10^{-11})}{3.0281 \times 10^{-10}} \times 100 \\ &= 76.45 \%\end{aligned}$$

$$\begin{aligned}\text{From 1-Hexene selectivity (\%1-Hexene}_{\text{sel}}) &= \frac{(\text{moles of 1-He}_{\text{final}} - \text{moles of 1-He}_{\text{initial}})}{\text{moles of 1-Hy converted}} \times 100 \\ &= \frac{(1.77138 \times 10^{-7} - 1.76924 \times 10^{-7})}{(3.0281 \times 10^{-10} - 7.131 \times 10^{-11})} \times 100 \\ &= 92.44 \%\end{aligned}$$

So, file name 1PdW12 shows 1-Hexyne conversion ($\%1\text{-Hy}_{\text{conv}}$) = 76.45 % and 1-Hexene selectivity ($\%1\text{-Hexene}_{\text{sel}}$) = 92.44 %

Table A1 The catalytic activity, 1-hexene selectivity and n-hexane selectivity of 0.3%Pd supported on alumina catalyst

0.3%Pd							
Reaction time (h)	0.5	3	6	9	12	15	18
1-Hexyne conversion (%)	0.22	5.57	15.42	26.03	43.18	61.11	100.00
1-Hexene selectivity (%)	38.75	45.31	52.67	56.21	57.84	59.85	65.62
n-Hexane selectivity (%)	3.86	4.62	5.15	6.74	9.54	13.56	28.74

Appendix B The catalytic activity, 1-hexene selectivity and n-hexane selectivity of Pd-Cu supported on alumina catalysts

Table B1 The catalytic activity, 1-hexene selectivity and n-hexane selectivity of Pd-Cu with Pd/Cu ratio of 0.25

Pd-Cu ratio 0.25							
Reaction time (h)	0.5	3	6	9	12	15	18
1-Hexyne conversion (%)	0.22	2.43	3.56	6.42	9.06	12.76	16.42
1-Hexene selectivity (%)	7.68	8.54	9.32	12.52	16.12	18.98	20.47
n-Hexane selectivity (%)	14.63	15.61	15.54	18.61	21.94	28.51	34.85

Table B2 The catalytic activity, 1-hexene selectivity and n-hexane selectivity of Pd-Cu with Pd/Cu ratio of 0.5

Pd-Cu ratio 0.5							
Reaction time (h)	0.5	3	6	9	12	15	18
1-Hexyne conversion (%)	0.27	4.58	11.04	13.14	13.67	18.23	26.32
1-Hexene selectivity (%)	11.57	14.13	21.42	23.45	24.64	27.04	27.45
n-Hexane selectivity (%)	12.61	13.61	13.55	16.15	19.85	26.95	32.52

Table B3 The catalytic activity, 1-hexene selectivity and n-hexane selectivity of Pd-Cu with Pd/Cu ratio of 1.0

Pd-Cu ratio 1.0							
Reaction time (h)	0.5	3	6	9	12	15	18
1-Hexyne conversion (%)	0.39	5.41	5.77	12.15	23.08	24.62	30.25
1-Hexene selectivity (%)	15.32	19.53	24.99	28.24	29.74	30.23	30.56
n-Hexane selectivity (%)	10.51	11.56	11.56	14.21	17.12	24.73	30.14

Table B4 The catalytic activity, 1-hexene selectivity and n-hexane selectivity of Pd-Cu with Pd/Cu ratio of 1.5

Pd-Cu ratio 1.5							
Reaction time (h)	0.5	3	6	9	12	15	18
1-Hexyne conversion (%)	0.46	3.10	7.56	14.13	23.37	28.83	37.08
1-Hexene selectivity (%)	20.13	23.24	26.21	31.13	34.12	37.52	37.24
n-Hexane selectivity (%)	8.42	9.03	9.51	12.51	15.73	22.93	28.21

Table B5 The catalytic activity, 1-hexene selectivity and n-hexane selectivity of Pd-Cu with Pd/Cu ratio of 2.0

Pd-Cu ratio 2.0							
Reaction time (h)	0.5	3	6	9	12	15	18
1-Hexyne conversion (%)	0.67	5.67	5.65	20.12	24.77	45.04	48.11
1-Hexene selectivity (%)	29.42	32.01	40.25	42.13	44.43	46.94	46.34
n-Hexane selectivity (%)	6.41	7.25	7.56	10.25	13.25	20.14	26.83

Appendix C The catalytic activity and 1-hexene selectivity of Pd-W supported on alumina catalysts

Table C1 The catalytic activity and 1-hexene selectivity of Pd-W with Pd/W ratio of 0.25

Pd-W ratio 0.25							
Reaction time (h)	0.5	3	6	9	12	15	18
1-Hexyne conversion (%)	8.45	30.68	46.43	60.25	77.95	95.99	100.00
1-Hexene selectivity (%)	90.14	89.53	83.25	82.98	86.48	82.26	88.05

Table C2 The catalytic activity and 1-hexene selectivity of Pd-W with Pd/W ratio of 0.5

Pd-W ratio 0.5							
Reaction time (h)	0.5	3	6	9	12	15	18
1-Hexyne conversion (%)	5.88	11.14	19.57	32.87	48.53	67.52	100.00
1-Hexene selectivity (%)	90.08	90.52	81.25	78.98	89.20	83.45	78.69

Table C3 The catalytic activity and 1-hexene selectivity of Pd-W with Pd/W ratio of 1.0

Pd-W ratio 1.0							
Reaction time (h)	0.5	3	6	9	12	15	18
1-Hexyne conversion (%)	7.96	21.58	41.39	53.38	66.51	85.14	100.00
1-Hexene selectivity (%)	93.21	97.93	92.68	97.39	90.66	92.32	97.98

Table C4 The catalytic activity and 1-hexene selectivity of Pd-W with Pd/W ratio of 1.5

Pd-W ratio 1.5							
Reaction time (h)	0.5	3	6	9	12	15	18
1-Hexyne conversion (%)	7.02	22.58	33.20	43.86	58.63	86.13	100.00
1-Hexene selectivity (%)	91.99	89.40	83.24	79.39	78.22	87.45	86.28

Table C5 The catalytic activity and 1-hexene selectivity of Pd-W with Pd/W ratio of 2.0

Pd-W ratio 2.0							
Reaction time (h)	0.5	3	6	9	12	15	18
1-Hexyne conversion (%)	6.69	11.91	22.57	36.52	54.53	83.13	100.00
1-Hexene selectivity (%)	91.87	89.51	89.29	86.98	86.08	83.45	80.69

Appendix D Atomic Absorption Spectroscopy (Varian) Results

Example: from Table D1, 0.3% Pd = 2.70 ppm, weight = 0.096

Calculation: $\%Metal = \frac{\{Conc.(\frac{g}{ml})(100ml)\}}{gCatalyst} \times 100$

$$\begin{aligned} \text{Sol}^n \quad \text{From} \quad \%Metal &= \frac{\{Conc.(\frac{g}{ml})(100ml)\}}{gCatalyst} \times 100 \\ \%Metal &= \frac{2.70 \times 10^{-6} \times 100}{0.096} \times 100 \\ &= 0.28 \%Pd \end{aligned}$$

So, the amount of 0.3%Pd supported on Alumina catalyst, analyzed by AAS, equals 0.28%

Table D1 Low loaded Pd supported on alumina catalyst

Pd Results				
Sample	Conc (ppm)	Wt(g)	Factor	% Pd
Pd	2.70	0.096	1041.67	0.28

Table D2 Pd-Cu supported on alumina catalysts

Pd Results				
Sample	Conc (ppm)	Wt(g)	Factor	% Pd
Pd 0.25	1.8	0.114	1754.38	0.32
Pd 0.5	3.43	0.109	915.75	0.31
Pd 1.0	3.72	0.109	917.43	0.34
Pd 1.5	3.24	0.108	919.96	0.30
Pd 2.0	3.56	0.114	873.36	0.31

Cu Results				
Sample	Conc (ppm)	Wt(g)	Factor	% Cu
Cu 0.25	4.13	0.114	1754.39	0.72
Cu 0.5	4.23	0.109	915.75	0.39
Cu 1.0	2.07	0.109	917.43	0.19
Cu 1.5	1.50	0.109	919.96	0.14
Cu 2.0	1.07	0.115	873.36	0.09

Table D3 Pd-W supported on alumina catalysts

Pd Results				
Sample	Conc (ppm)	Wt(g)	Factor	% Pd
Pd 0.25	2.88	0.113	882.61	0.25
Pd 0.5	2.59	0.107	934.58	0.24
Pd 1.0	4.06	0.110	908.27	0.37
Pd 1.5	2.96	0.113	881.83	0.26
Pd 2.0	2.49	0.105	952.38	0.24

W Results				
Sample	Conc (ppm)	Wt(g)	Factor	% W
W 0.25	32.00	0.113	882.61	2.82
W 0.5	18.33	0.107	934.58	1.71
W 1.0	10.67	0.110	908.27	0.97
W 1.5	9.00	0.113	881.83	0.79
W 2.0	6.33	0.105	952.38	0.60

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