Supporting information

Efficient Ni Based Catalysts for Hydrotreatment of Lignin Dimer Model Compounds to Cycloalkanes/Cycloalkanols

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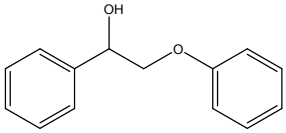
Supporting information list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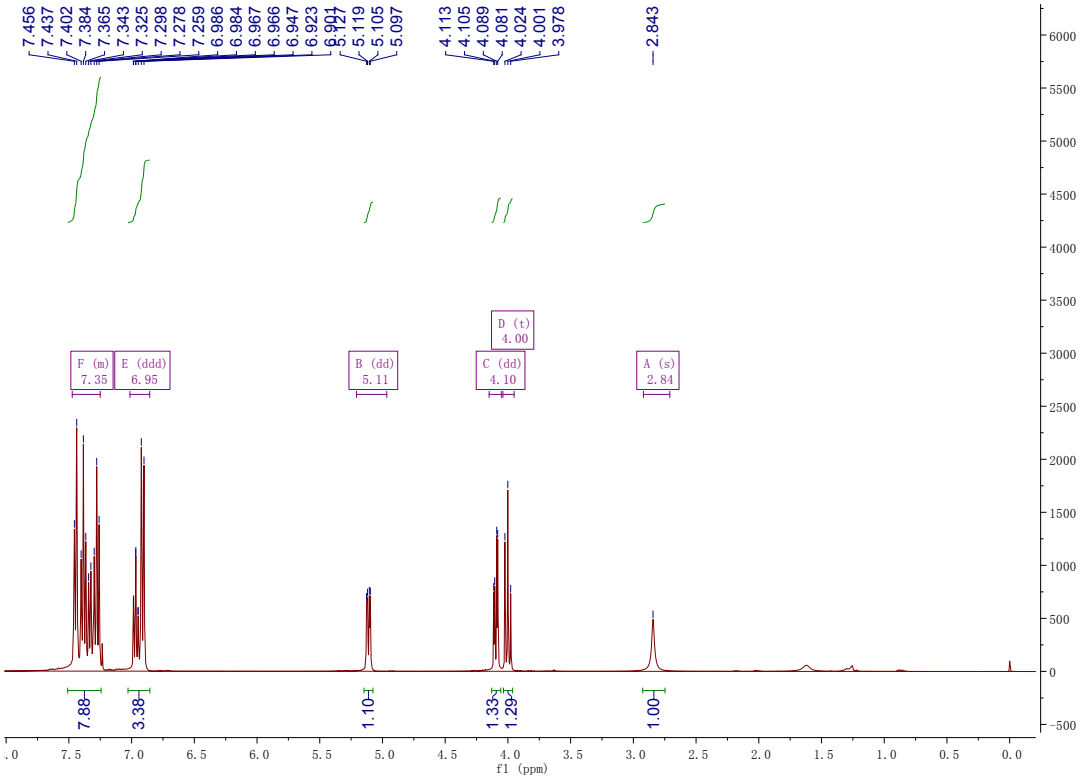
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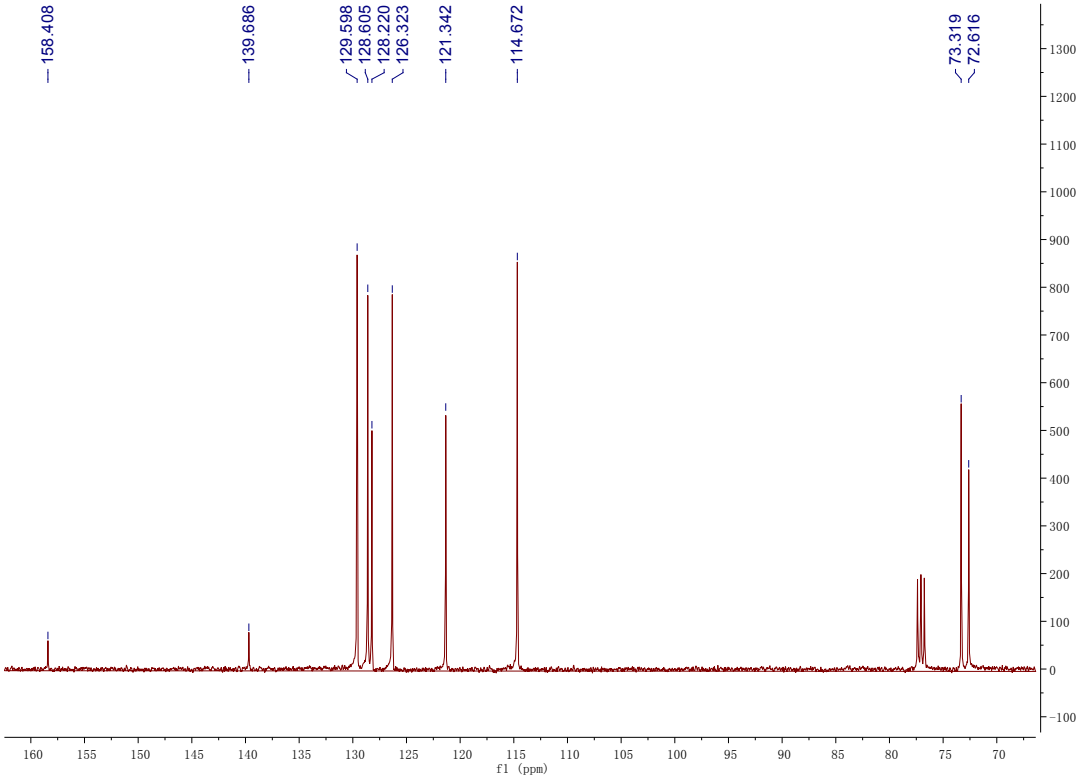
6.966
6.947
6.923
6.901
5.127
5.119
5.105
5.097
4.113
4.105
4.089
4.081
4.024
4.001
3.978
2.843
F (m) 7.35
E (ddd) 6.95
B (dd) 5.11
D (t) 4.00
C (dd) 4.10
A (s) 2.84
7.88
3.38
1.10
1.33
1.29
1.00
f1 (ppm)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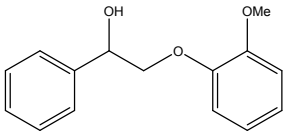
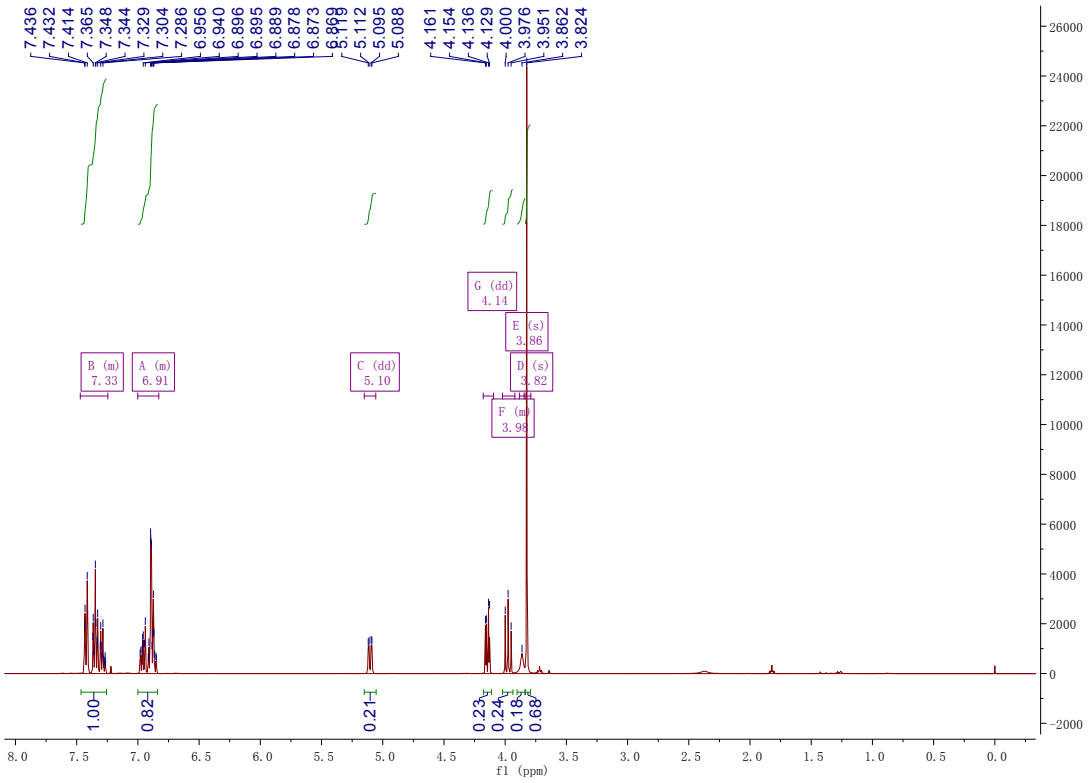

OH
OMe
O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6.895
6.889
6.878
6.873
6.869
5.119
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5.095
5.088
4.161
4.154
4.136
4.129
4.000
3.976
3.951
3.862
3.824
G (dd) 4.14
E (s) 3.86
B (m) 7.33
A (m) 6.91
C (dd) 5.10
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0.18
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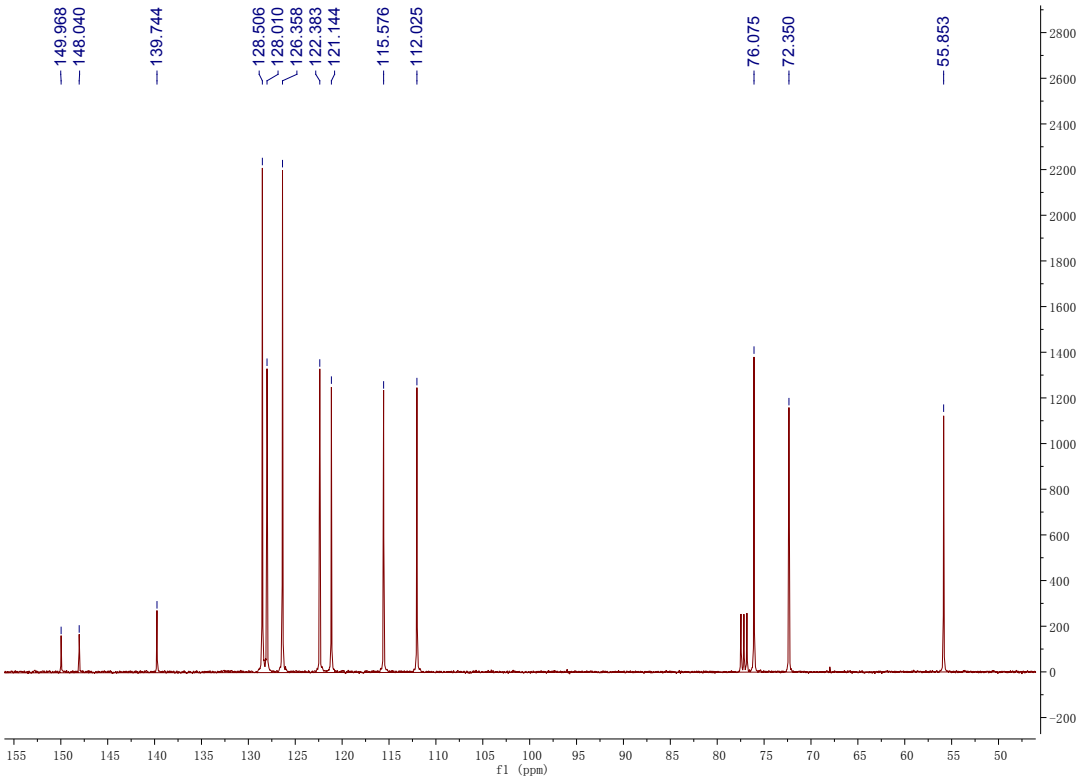
f1 (ppm)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f1 (ppm)

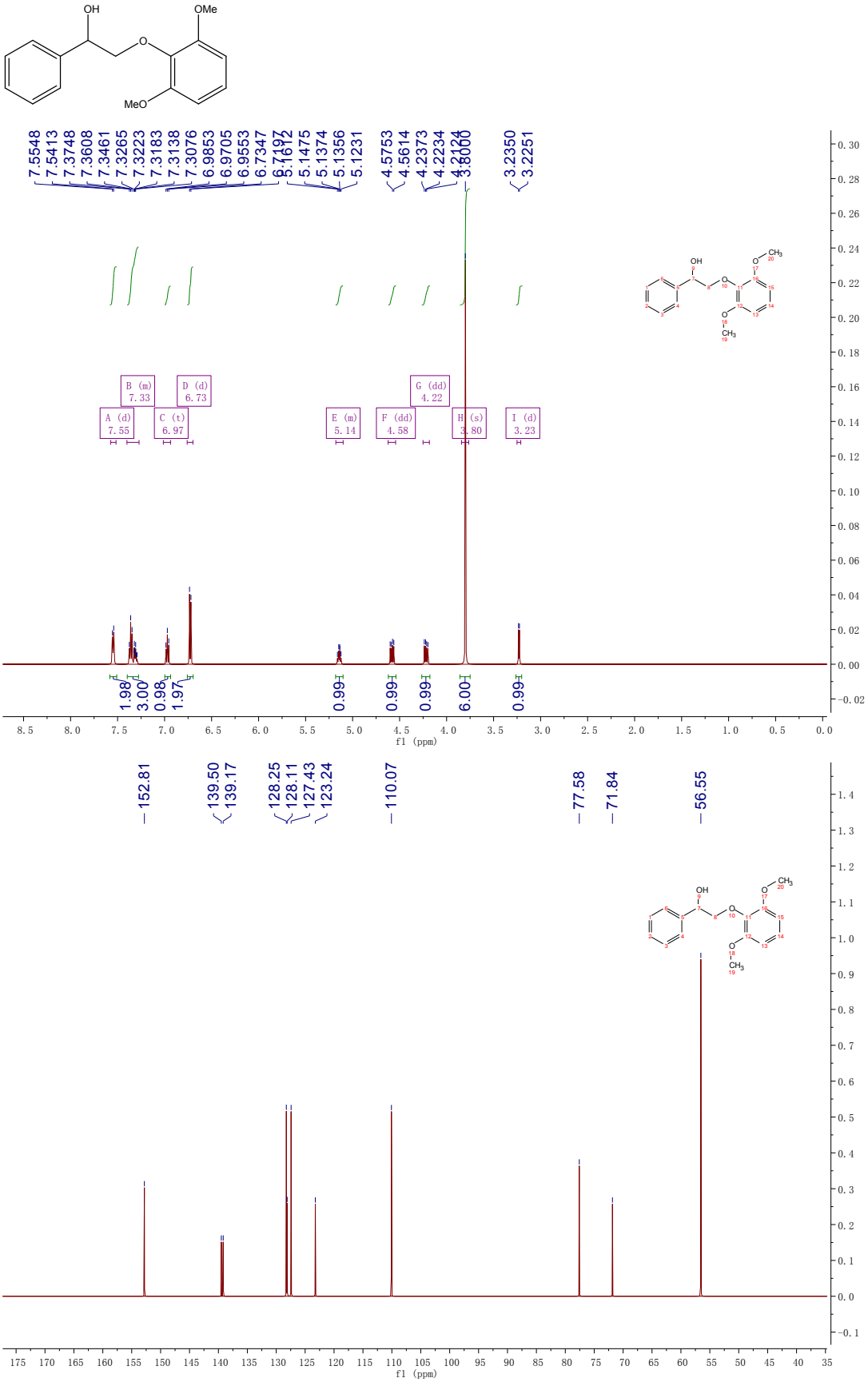


Fig. S1 NMR of three β-O- 4 model compounds

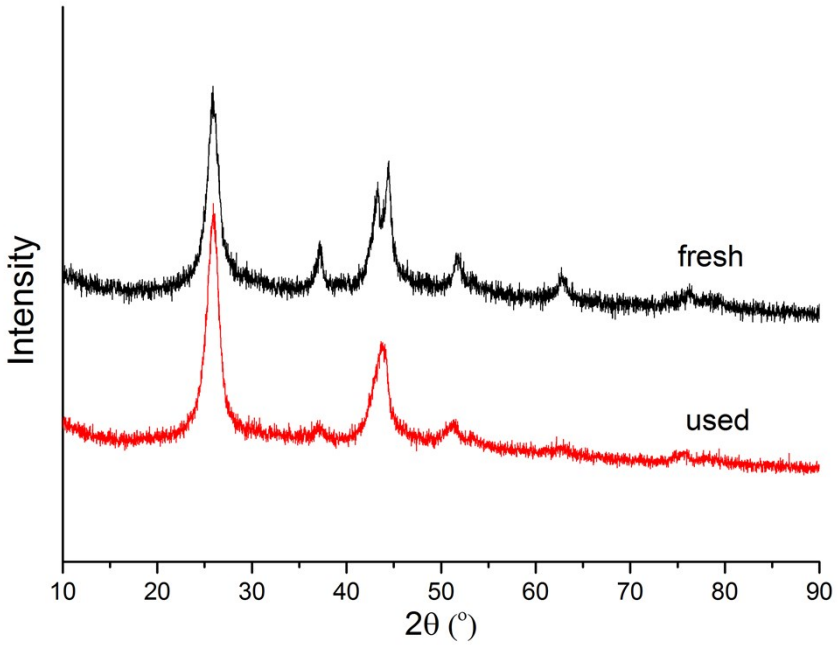


Fig. S2 XRD of fresh and used Ni3La1/CNT catalyst

Table S1 ICP analysis for NiLa/CNT catalysts before and after reaction

Catalysts	Metal element compositions		
	Ni	La	Ni/La
Ni3La1/CNT	14.88	5.06	2.94
Ni2La2/CNT	9.94	9.79	1.01
Ni1La3/CNT	5.02	14.91	0.33

Table S2 ICP analysis for Ni3La1/CNT catalysts before and after five runs

Catalysts	Metal element compositions		
	Ni	La	Ni/La
Ni3La1/CNT[a]	14.88	5.06	2.94
Ni3La1/CNT[b]	13.03	4.21	3.09

a-fresh catalyst; b-catalyst reused after five runs.

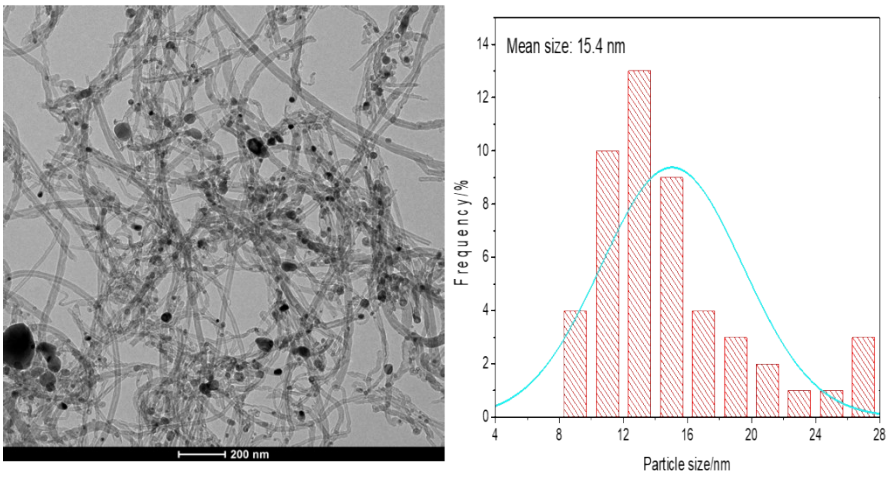


Fig. S3 TEM micrographs of different Ni1La3/CNT catalyst and average size of Ni1La3/CNT catalyst

Table S3 Quantity of NiLa/CNT catalysts

Catalyst	Quantity (mmol/g)
Ni/CNT	4.84342
Ni3La1/CNT	4.27182
Ni2La2/CNT	3.46187
Ni1La3/CNT	2.33541

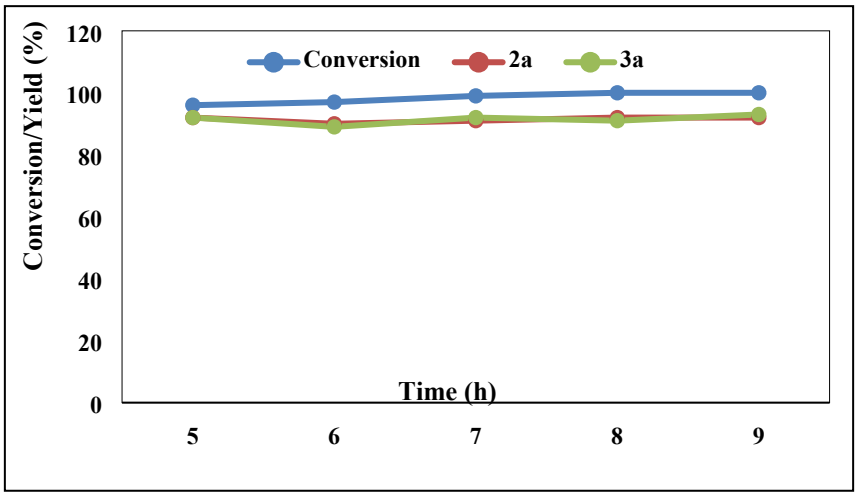
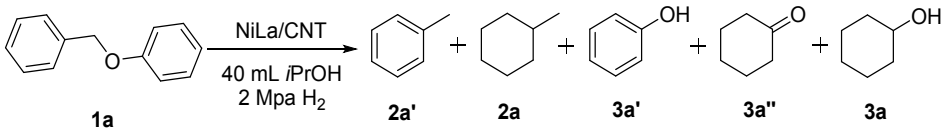


Fig. S4 Results with reaction time of longer than 5 h

Table S4 Results with short times and low temperatures



1a 2a' 2a 3a' 3a'' 3a

Entry	Cat.	Conv. (%)[c]	Yield (%)				
			2a'	**2a**	**3a'**	**3a''**	**3a**
1 [a]	Ni3La1/CNT	18	10	6	12	1	4
2 [b]	Ni3La1/CNT	20	11	7	12	0	6

[a] Reaction conditions: **1a** (500mg), Cat. (50mg), *i*PrOH (40 mL), 2.0 MPa H_2, 1 h, 240 ℃; [b] Reaction conditions: **1a** (500mg), Cat. (50mg), *i*PrOH (40 mL), 2.0 MPa H_2, 4 h, 200 ℃.