Electronic Supplementary Information

The catalytic behaviour in aqueous-phase hydrogenation over a

renewable Ni catalyst derived from perovskite-type oxide

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Fig. S1 The comparison of Ni catalyst with Cu and Pd/Pt catalysts in hydrogenation of

furfural



Fig. S2 The morphology of LaNiO $_3$ precursor and Ni-LN650.

(a) SEM image of LaNiO₃, (b) SEM image of Ni-LN650, (c) TEM image of Ni-LN650.



Fig. S3 Adsorption and desorption isotherm curves of Ni-LN550, Ni-LN650 and Ni-

LN750 catalysts.



Fig. S4 the CO pulse chemisorption for Ni-LN550, Ni-LN650, Ni-LN750, Ni-LN850 and Ni-LN650 (after reaction)



Fig. S5 The XRD patterns of LaNiO₃ precursor derived at different calcination temperatures.



Fig. S6 The XRD patterns of Ni catalysts derived from the LaNiO₃ precursors calcining at different temperatures.



Fig. S7 The H₂-TPR profiles of LaNiO₃ precursor derived at different calcination temperatures.



Fig. S8 The XPS spectra of La 3d+ Ni 2p, Ni3p and O 1s for the Ni-LN550, Ni-LN650 and Ni-LN750 catalysts.



Fig. S9 The influence of calcination time on furfural conversion and product selectivity in aqueous-phase hydrogenation of furfural at 120 $^{\circ}$ C and 1 MPa H₂. Other conditions: 1.0 mmol furfural, 30 mg catalyst, 10 mL DI water, stirring speed 800 rpm.

		5.85 6.06	6.52 8.75 С но	5 7.18 ОН ОН	10.25	9.08	
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RT: 0.00	- 23.90	5 a5	9.08				NL:
50	60 °C	4.24 5.07 5.78 6.06 6.21 7.82	8,29 9.82 10.25 10,88	12.01 12.55 13. <u>69</u> 14.22	14.77 15.39 16. <u>77</u> 17.18	18.49 <u>18</u> .95 20.15 21	8.32E8 TIC MS 60 1.33 22.53 23.35
100 50	80 °C	5.84 4.24 5.07 5.57 6.06 4.25 7.82	9.05 8.18 9.29 10.26 10.88	12 <u>0</u> 3 12.56 13 <u>.82</u> 14. <u>1</u> 8	14.78 18 <u>25</u> 16.77 17. <u>6</u>	<u>80 18.48</u> 19.00 19.99 2'	NL: 5.35E8 TIC M5 80 1.46 22.04 22.53 23.32
100 50	100 °C	5.85 0.09 4.26 5.08 5.58 0 6.52 7.31 7.83	9.07 8. <u>98 9.30 10.26 10.88</u>	12. <u>01</u> 12.43 13. <u>89</u> 14.16	14 <u>.</u> 78 <u>15</u> .31 16.77 17. <u>8</u>	<u>80 18,49 19.00 20.15 20,61</u>	NL: 6.83E8 TIC MS 100 21. <u>96</u> 22.32 22.72
International Contraction	120 °C	6.53 4.26 4.40 5.87 6.08 6.83 7.83	9.06 8.19 9.30 9.83 10.89	11.78 12.58 13. <u>73 14.2</u> 1	14.79 15,39 18.78 1 <u>7</u> ,3	1 18.49 19 _. 49 20.15 <u>2</u>	NL: 5.44E8 TIC MS 120 1.42 22.33 22.67
50 TIT	130 °C	6.52 4.22 5.07 5.57 6.77 7.83	9.06 8.19 9.44 10.13 10.89	12 <u>0</u> 3 12.56 13.74	14.79 18 <u>.44</u> 18.78 18	8. <u>10</u> 18.49 19. <u>78</u> 20.16 20.96	NL: 5.15E8 TIC MS 140 22. <u>33</u> 22.70 <u>23</u> .11
100 50	140 °C	6.52 4.22 5.07 5.57 6.77 7.83	9.06 8_19 9.44 10.13 10.89	12 <u>0</u> 3 12.56 13.74	14.79 10 <u>.44</u> 10.78 18	3 <u>,10</u> 18.49 19 <u>,78</u> 20.16 20.96	NL: 5.15E8 TIC MS 140 22.33 22.70 23,11
100 50	150 °C	6.56 4.22 5.06 5.57 0.94 7.83	8.75 9.83 10.89	11.99 12.57 13.14 <u>13.</u> 60	14.79 15,41 16.78 18	3. <u>09</u> 18.50 19.51 20.15 2	21.43 22.51 23.02
100 50 0	170 °C	4.24 4.38 5.58 6.22 7.18 4.5 6 7 8	8.73	12 <u>0</u> 3 12.57 <u>12.93</u> 14.05 12 13 14	14.79 15.39 16.78 <u>17.2</u>	2 18.50 19,15 20.16 20,83 18 19 20 21	21_43_22.33_22_81 22_22_23
	55.79			Time (min)			
	80,22 7101 81,92 99,85 10,00 10,00,00,00,00,00 80 80 10,00 12	, 125,57 (39,12, 146,59, 164,45, 172,54, 175,55, 193,34 1 40 46 160 200	206.75 215.30 220.93 241.30 249.13 220 240	26554 27596 264.57 204.92 313 260 280 300 m/z	er 220,8e 2 30,12 268,85 3 220 240 260	74.50 <u>297.39</u> 403.05 4 0.55 4 32.94 42 350 450 420	17.56 447.71 456.81 467.22 476.10 492.17 440 480 800

Fig. S10 The GC-MS spectrogram of liquid products obtained at different reaction

temperature.



Fig. S11 The scission of THFOL at α and β positions.



Fig. S12 The concentration of FOL and THFOL in the liquid product by using FOL as reactant.

Reaction condition: 120 °C, 1 MPa H2, 1 mmol FOL, 30 mg Ni-LN650, 10 mL DI water, stirring speed 800 rpm.



Fig. S13 The GC-MS spectrogram for aqueous-phase hydrogenation of aldehydes, alkene and carboxylic acid over Ni-LN650 catalyst

Ni content (%)ª	Ni	Metallic	Active Ni
	dispersion	surface area	diameter
	(%) ^b	(m²/g _{Ni}) ^b	(nm) ^b
25.7	10.8	71.8	9.4
26.2	30.8	205.2	3.3
25.6	25.2	167.9	4.1
26.4	24.1	160.6	4.3
25.3	ЭСГ	177 0	2.0
	20.5	1/7.3	5.8
	Ni content (%) ^a 25.7 26.2 25.6 26.4 25.3	Ni content Ni dispersion (%) ^a (%) ^b 25.7 10.8 26.2 30.8 25.6 25.2 26.4 24.1 25.3 26.5	Ni Metallic Ni content dispersion surface area (%) ^a (%) ^b (m ² /g _{Ni}) ^b 25.7 10.8 71.8 26.2 30.8 205.2 25.6 25.2 167.9 26.4 24.1 160.6 25.3 26.5 177.3

Table S1 The Ni dispersion and other properties of Ni-based catalysts

^a: determined by ICP;

^b: calculated from CO pulse chemisorption.

CO pulse chemisorption: 30 mg catalyst sample was loaded in U type quartz tube and installed in Micromeritics AutoChem II 2920 instrument. The sample was pretreated at 300 °C by a He gas for 1 h. After the sample was cooled to room temperature, the CO pulse chemisorption was tested until the pulse peak become stable (carrier gas: He; Pulse gas: CO).

Catalyst	Furfural	FOL	THFOL
Catalyst	conversion (%)	selectivity (%)	selectivity (%)
Ni-LN650	98.8	12.7	87.2
Impregnated Ni/La ₂ O ₃	84.3	25.4	74.5
Raney Ni			
(particle size \leq 50 μ m,	95.8	18.6	81.3
dispersed in water)			

Table S2 The comparison of Ni-LN650 with impregnated Ni/La2O3 and Raney Ni catalyst in aqueous-phase hydrogenation of furfural

Reaction conditions: Ni-LN650 and Ni/La₂O₃ 30 mg, Raney Ni 1 mL; 120 °C and 1 MPa H₂ for 3 h, 1mmol furfural, 10 mL DI water.