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Supporting information

Mild-temperature hydrodeoxygenation of vanillin over porous nitrogen-doped carbon black supported nickel nanoparticles

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Table S1 Elemental analysis results of Ni-based catalysts.

Catalysts	Atom concentration (%)[a]				Ni loading (%)[b]
	C	N	O	Ni	
Ni/NCB-600	80.84	4.38	12.54	2.24	9.16
Ni/NCB-900	81.12	2.98	13.67	2.22	9.61
Ni/AC	84.55	-	13.32	2.14	9.55
Ni/CB	87.57	-	10.25	2.17	9.48

[a] Detected by XPS analysis.

[b] Detected by ICP-AES analysis.

Table S2 The effect of Ni loading on vanillin hydrogenation.

Catalyst	Conversion (%)	Selectivity (%)		MMP yield / %	Activity (mol-$_{vanillin}$ /(mol-$_{Ni}$ h))	Activity (mol-$_{MMP}$ /(mol-$_{Ni}$ h))
		HMP	MMP			
4.95 % Ni/NCB-900	48.1	52.8	47.2	22.7	21.4	10.1
7.41 % Ni/NCB-900	61.9	37.2	62.8	38.9	18.4	11.6
9.61 % Ni/NCB-900	74.4	35.4	64.6	48.1	17.0	11.0
19.45 % Ni/NCB-900	90.8	26.9	73.1	66.4	10.3	7.5

[a] Reaction conditions: vanillin (228 mg), catalyst (20 mg), H_2O (10 mL), 0.5 MPa H_2, 150 °C, 2 h.

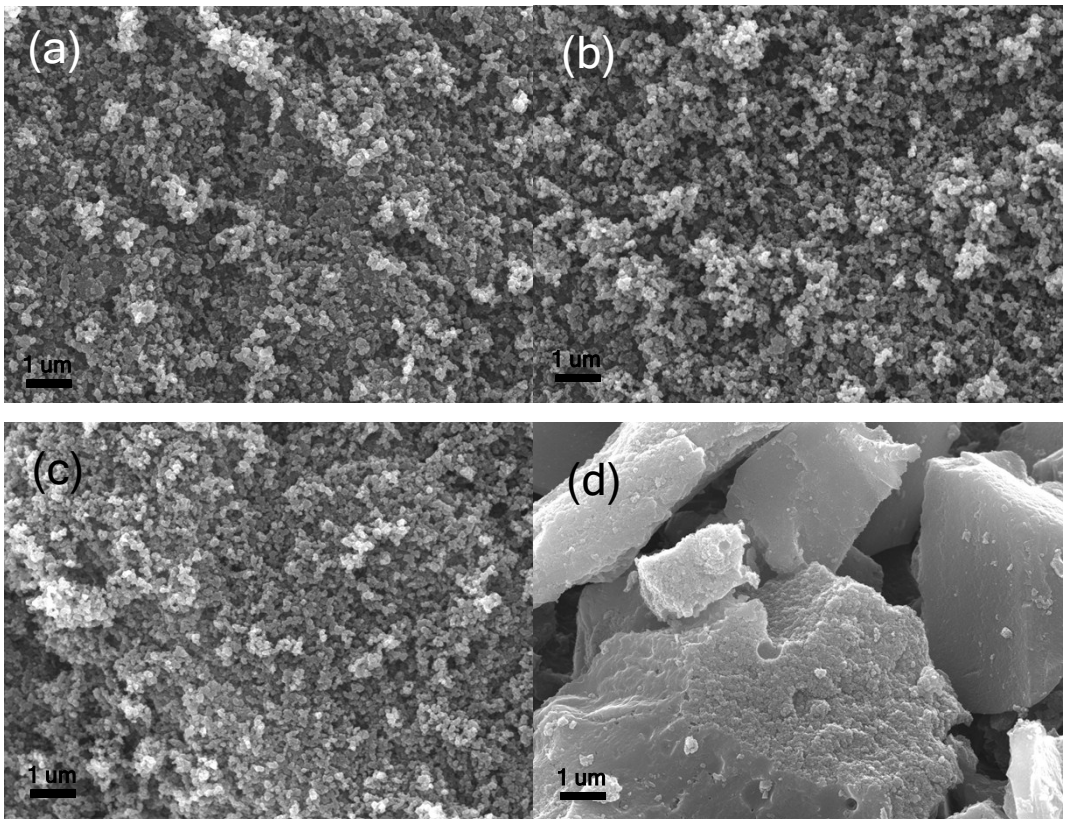

Fig. S1 SEM images of (a) NCB-600, (b) NCB-900, (c) CB and (d) AC.

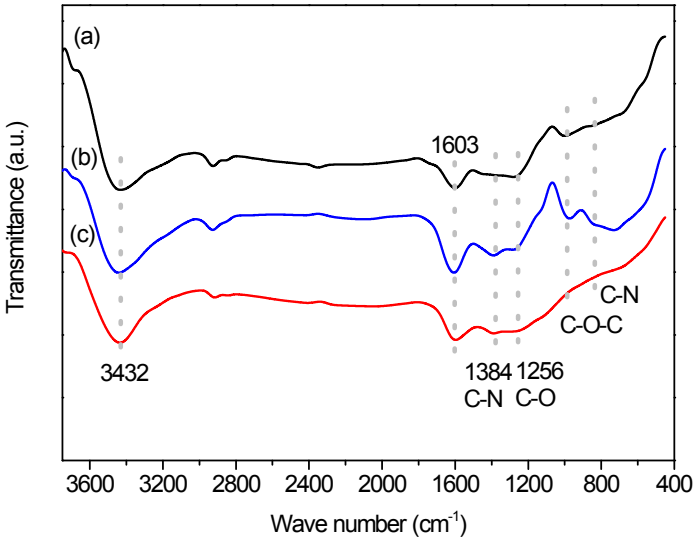

Fig. S2 FTIR spectra of (a) CB, (b) NCB-600 and (c) NCB-900.

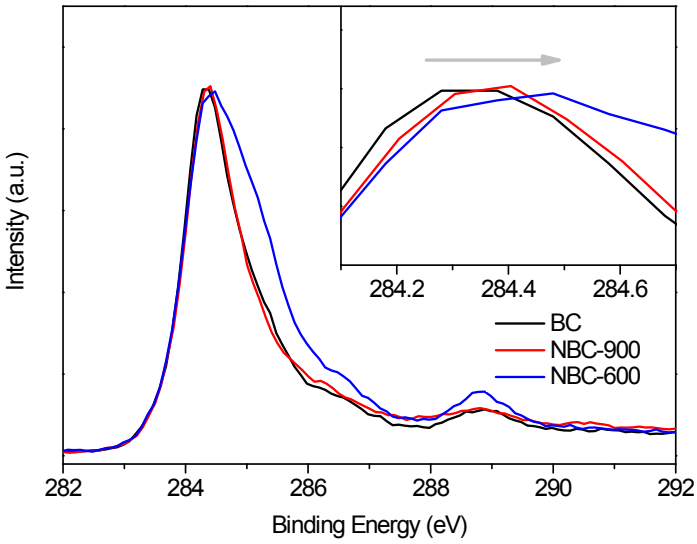

Fig. S3 C1s spectra of CB, NCB-600 and NCB-900.

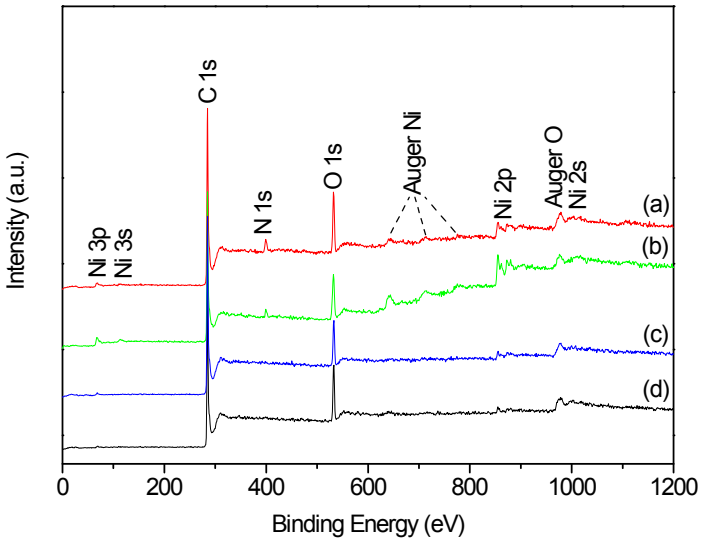

Fig. S4 XPS survey spectra (a) Ni/NCB-600, (b) Ni/NCB-900, (c) Ni/CB and (d) Ni/AC.

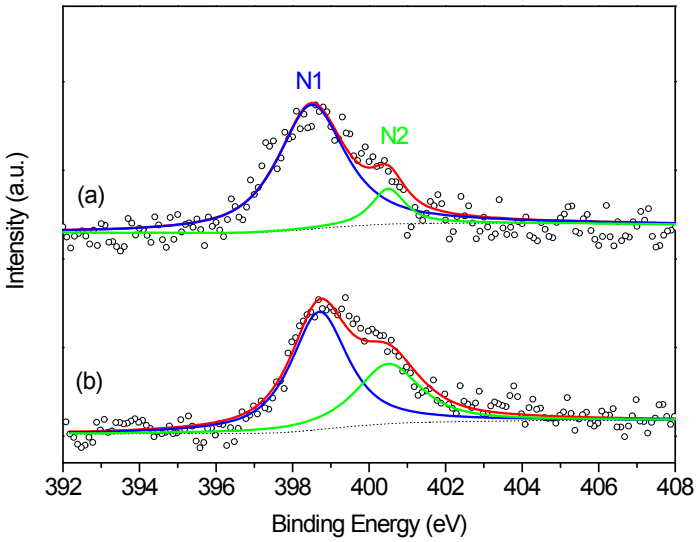

Fig. S5 The N1s spectra of (a) NCB-900 and (b) Ni/NCB-900.

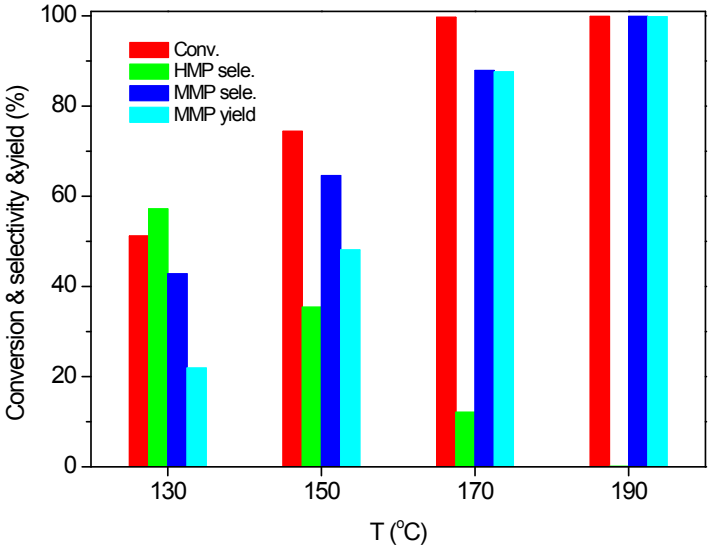

Fig. S6 Temperature-activity profile for selective HDO of vanillin.
Reaction conditions: Vanillin (228 mg), Ni/NCB-900 (20 mg), H_2O (10 mL), 0.5 MPa H_2, 2 h.

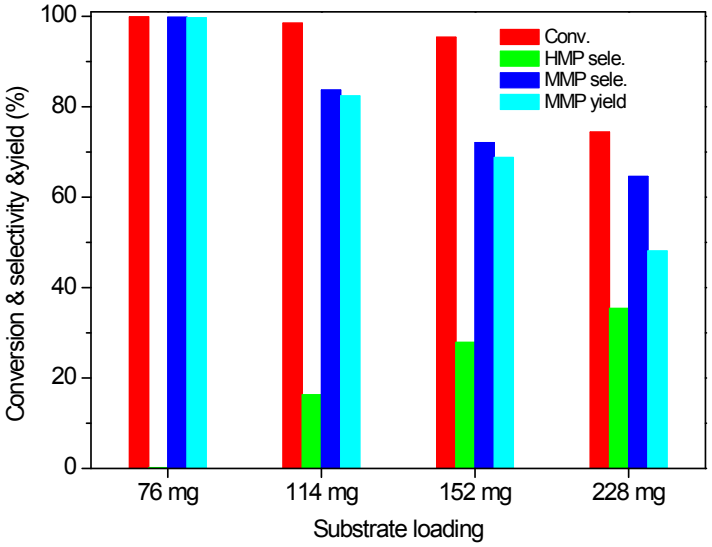

Fig. S7 Substrate loading-activity profile for selective HDO of vanillin.
Reaction conditions: Ni/NCB-900 (20 mg), H_2O (10 mL), 0.5 MPa H_2, 150 °C, 2 h.

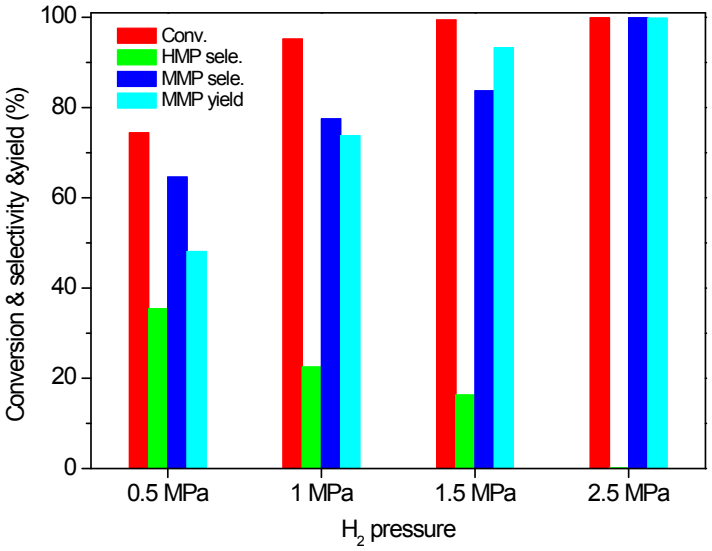

Fig. S8 H_2 pressure-activity profile for selective HDO of vanillin.
Reaction conditions: Vanillin (228 mg), Ni/NCB-900 (20 mg), H_2O (10 mL), 150 °C, 2 h.

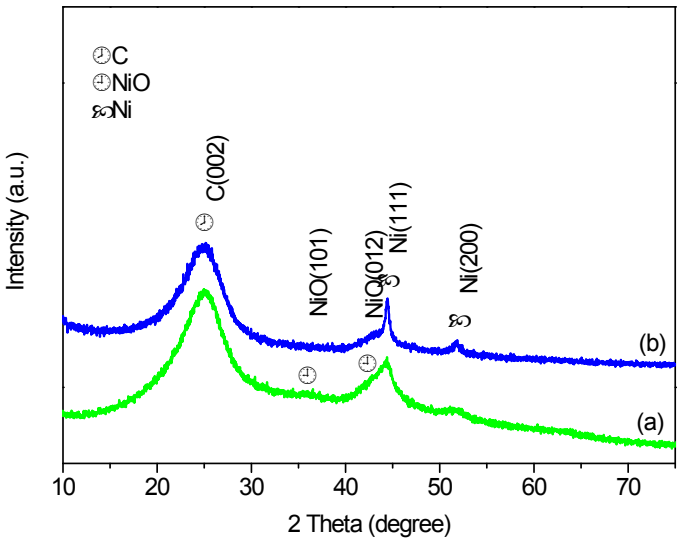

Fig. S9 XRD patterns of (a) fresh and (b) Ni/NCB-900 reused 5 times.

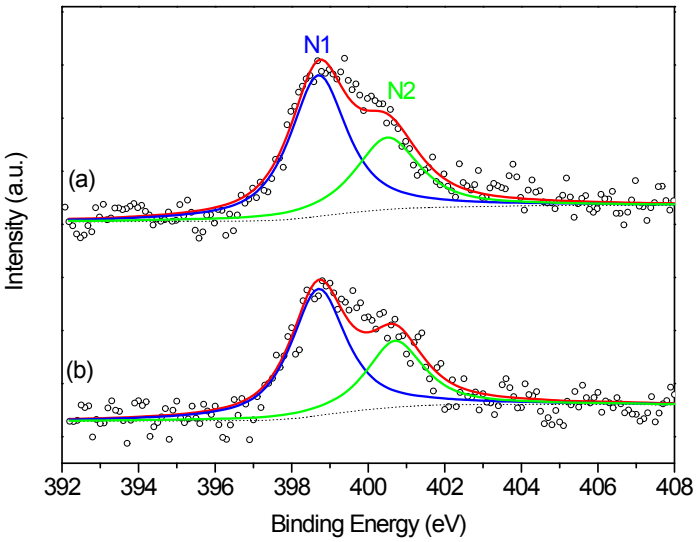

Fig. S10 N1s spectra of (a) fresh and (b) Ni/NCB-900 reused 5 times.

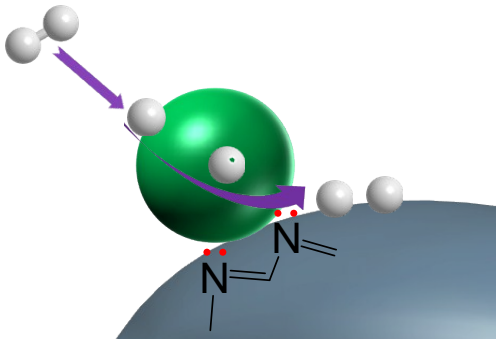

Fig. S11 Schematic diagram of hydrogen spillover over Ni/NCB catalyst.