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Supplementary Information

Ni nanoparticles embedded in nitrogen doped carbon derived from metal-organic framework for efficient hydrogenation of vanillin to vanillyl alcohol

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Table S1 Hydrogenation of vanillin to vanillyl alcohol over various catalysts in literatures and this work

Catalysts	Reaction conditions				Vanillin conversion/%	Vanillyl alcohol Selectivity/%	Reference	Date
	T/℃	p/MPa	t/h	Solvent				
Ru/CNTs	50	1	3	Decalin/ H_2O	100	98.0	[12]	2014
Ru/C	55	1.38	1	H_2O	95	91.0	[13]	2014
Rh/C	100	3	3	H_2O	99	83.0	[14]	2018
Pt/C	100	3	3	H_2O	100	70.0	[14]	2018
Pt/TiO_2	70	2	2	H_2O	58.1	97.9	[15]	2020
Pt/C	100	2.9	3	H_2O	100	63.0	[16]	2018
[a]Pd/CM	100	1	1	H_2O	95	80.0	[17]	2014
Pd/Ru@GO	room	1	12	methanol	100	100	[18]	2020
Ir/ZrO_2	100	3	4	H_2O	100	77.0	[19]	2019
Ni/ZrO_2	100	3	4	H_2O	95	86.0	[19]	2019
Ni/AC	150	0.5	2	H_2O	35.9	75.2	[20]	2017
Co/N-C	150	1	4	H_2O	77.9	61.8	[21]	2017
[b]Ni@CN-425	80	1	2	H_2O	99.5	98.3	This work	

[a]CM: Carbonaceous Microspheres. [b] Ni@CN-425 catalyst in this work is presented for comparsion.

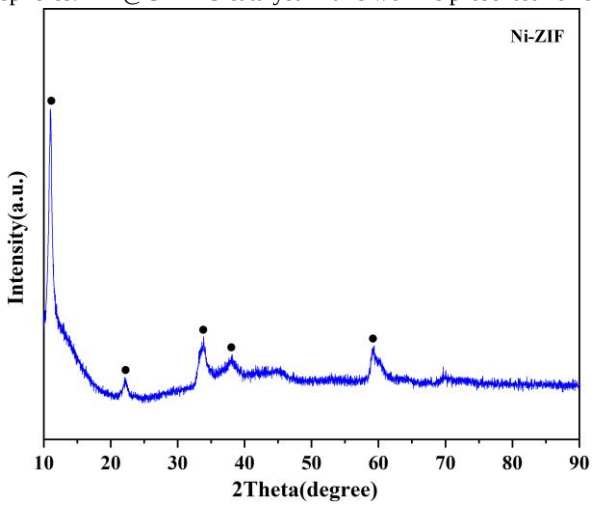

Fig. S1 XRD patterns of Ni-ZIF

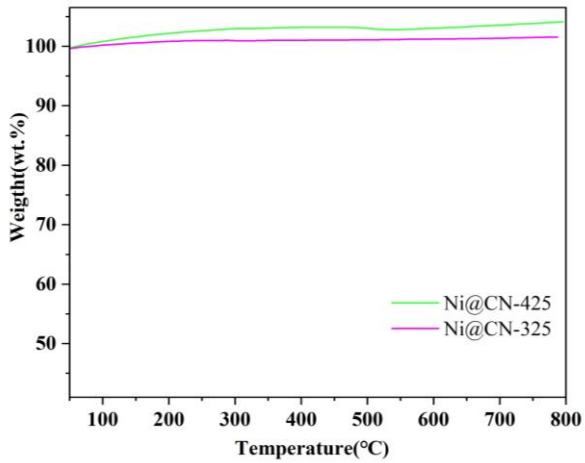

Fig. S2 TGA curves of Ni@CN-325, Ni@CN-425 and Ni@CN-525

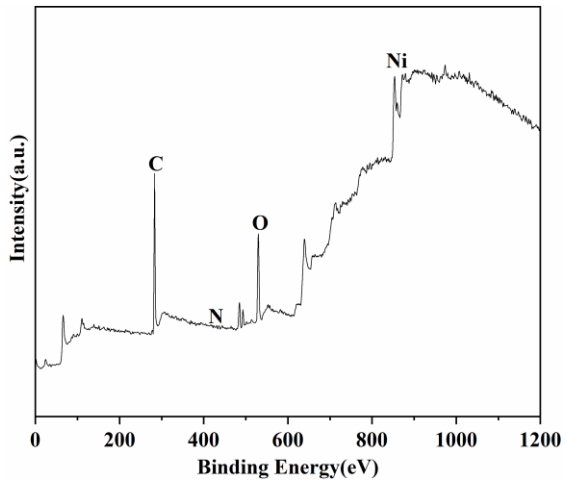

Fig. S3 XPS survey spectrum of Ni@CN-425

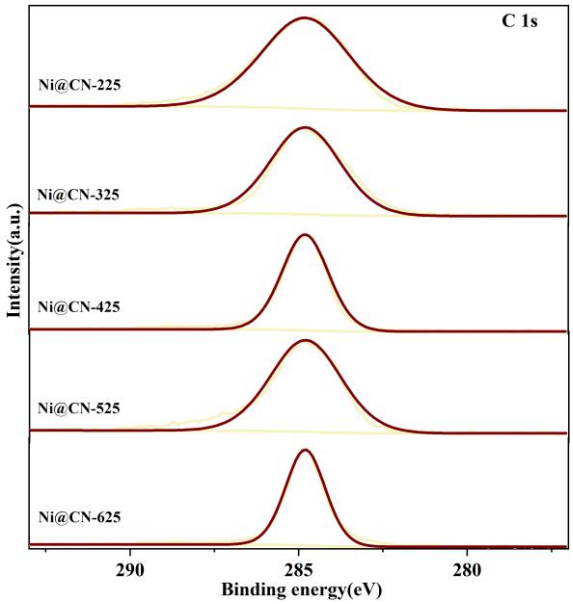

Fig. S4 High resolution XPS spectra of C1s of serial Ni@CN catalysts

Table S2 The content of surface elements of Ni@CN catalysts obtained from XPS

Catalysts	Ni/%	C/%	N/%	O/%
Ni@CN-225	12.1	42.4	3.8	41.7
Ni@CN-325	10.5	63.3	2.7	23.5
Ni@CN-425	7.5	70.0	2.6	19.9
Ni@CN-525	6.0	78.5	2.5	13.0
Ni@CN-625	5.3	80.2	2.2	12.3

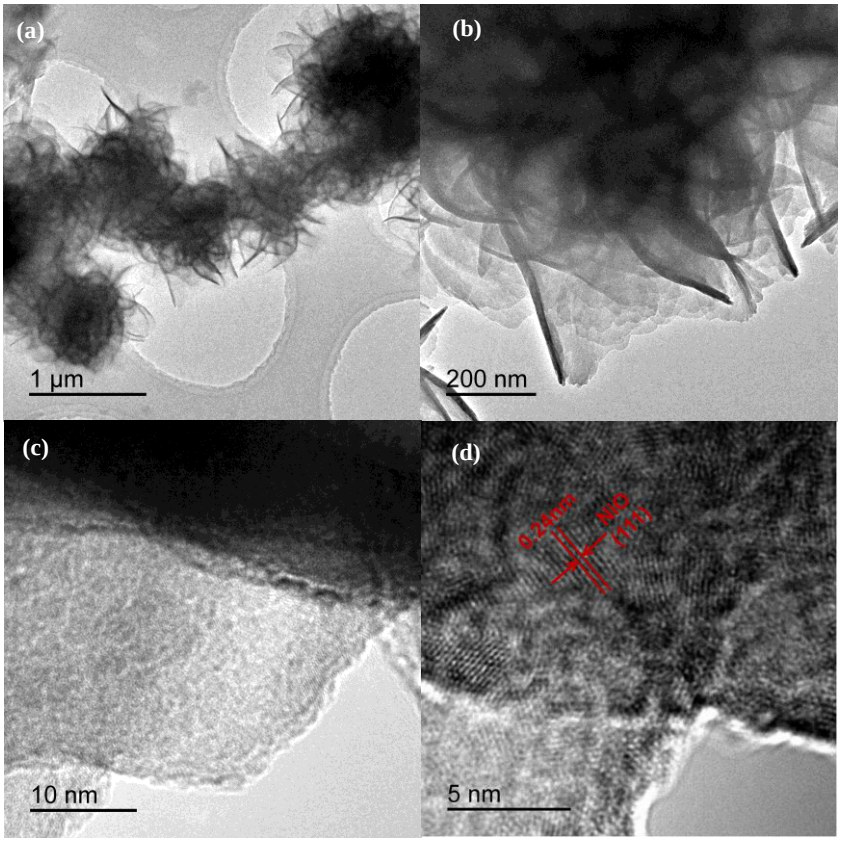

Fig. S5 TEM images of Ni@CN-225 catalyst with different magnification

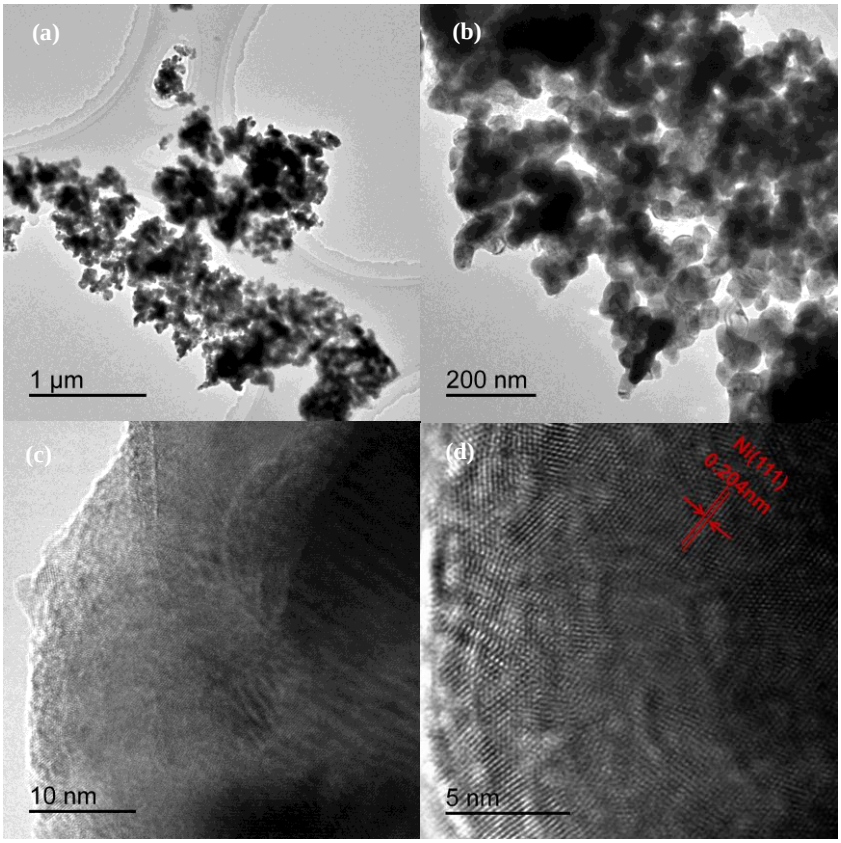

Fig. S6 TEM images of Ni@CN-325 catalyst with different magnification

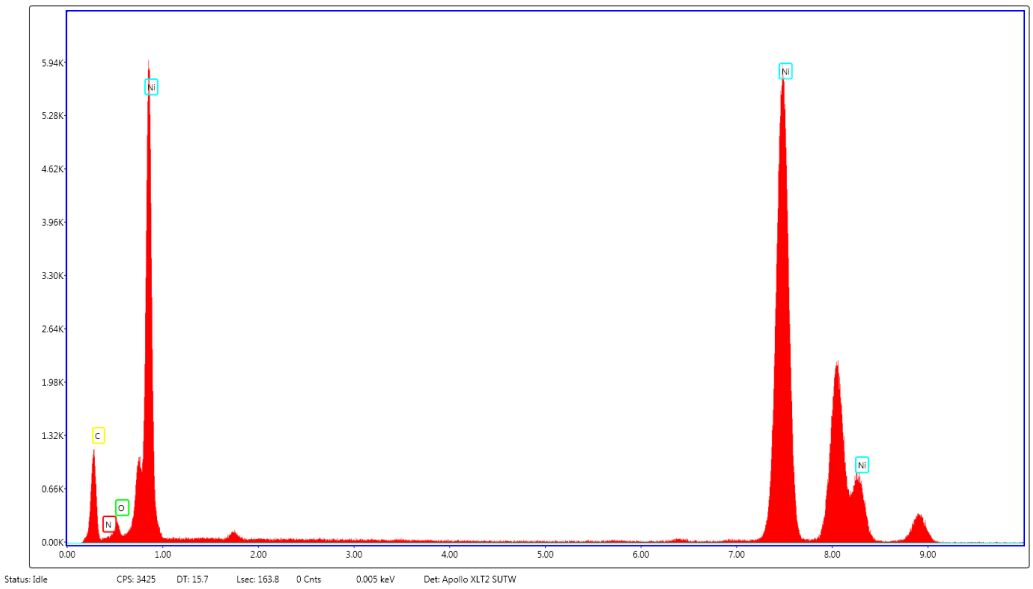

Fig. S7 EDS spectra of Ni@CN-425 catalyst (phase: NiK)

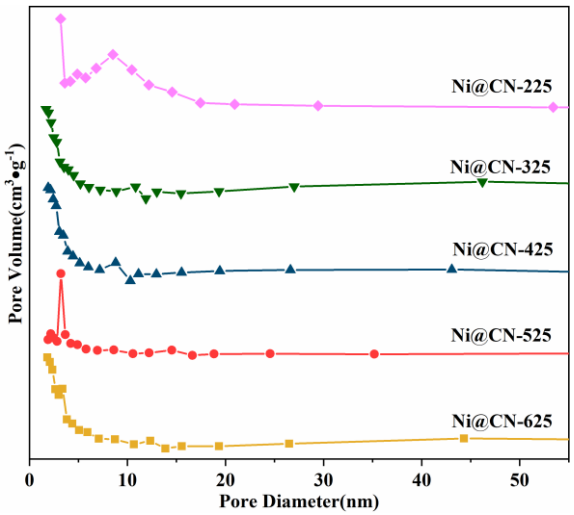

Fig. S8 The BJH (Barrett-Joyner-Halenda) pore distribution curves of Ni@CN catalysts

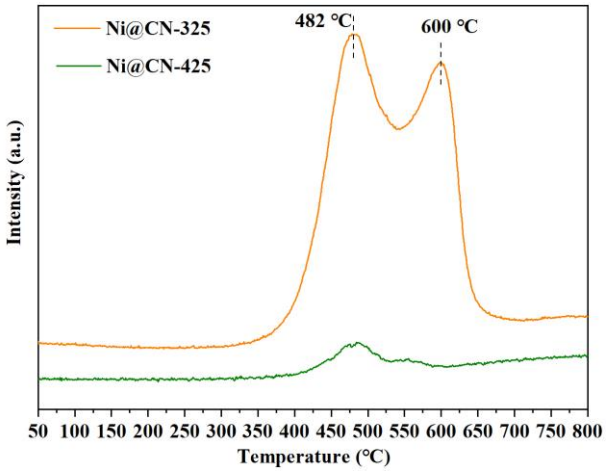

Fig. S9 H_2-TPD profiles of the of Ni@CN-325 and Ni@CN-425

The temperature-programmed desorption of H_2 (H_2-TPD) was measured on AutoChem II 2920 (Micromeritics, USA). About 70 mg catalyst was first pretreated at 300 ℃ for 1.5 h in an argon flow (50 mL/min) before it was cooled to 50 ℃. Then the argon was switched to a 10% H_2/Ar flow (50 mL/min) and kept for 3 h. Subsequently, the H_2/Ar flow was switched to helium flow 50 mL/min) and kept for 1 h in order to eliminate the physically adsorbed H_2. Finally, the temperature was ramped from 50 ℃ to 800 ℃ at a rate of 10 ℃/min in the helium flow.