Supporting Information

MOFs-derived Ni@NC catalyst: synthesis, characterization, and application in one-pot hydrogenation and reductive amination

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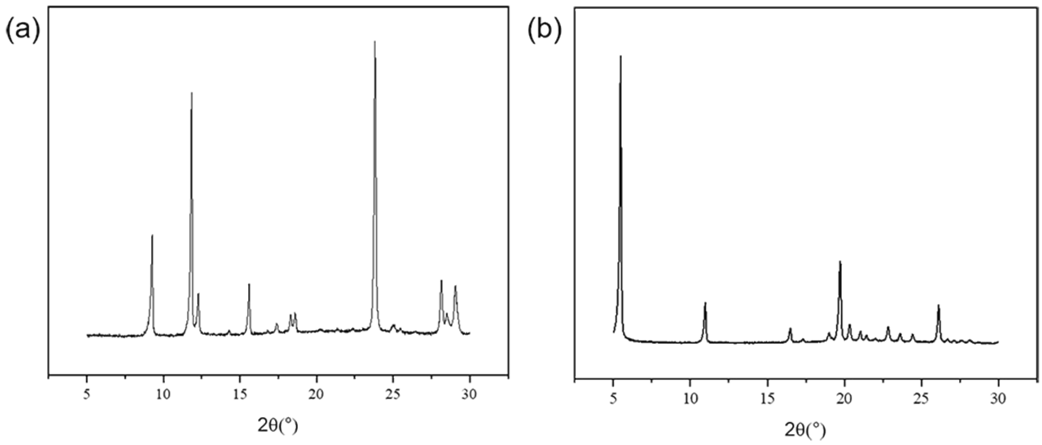

Figure S1. XRD partterns of (a) Ni-MOF-NH_2 and (b) Ni-MOF.

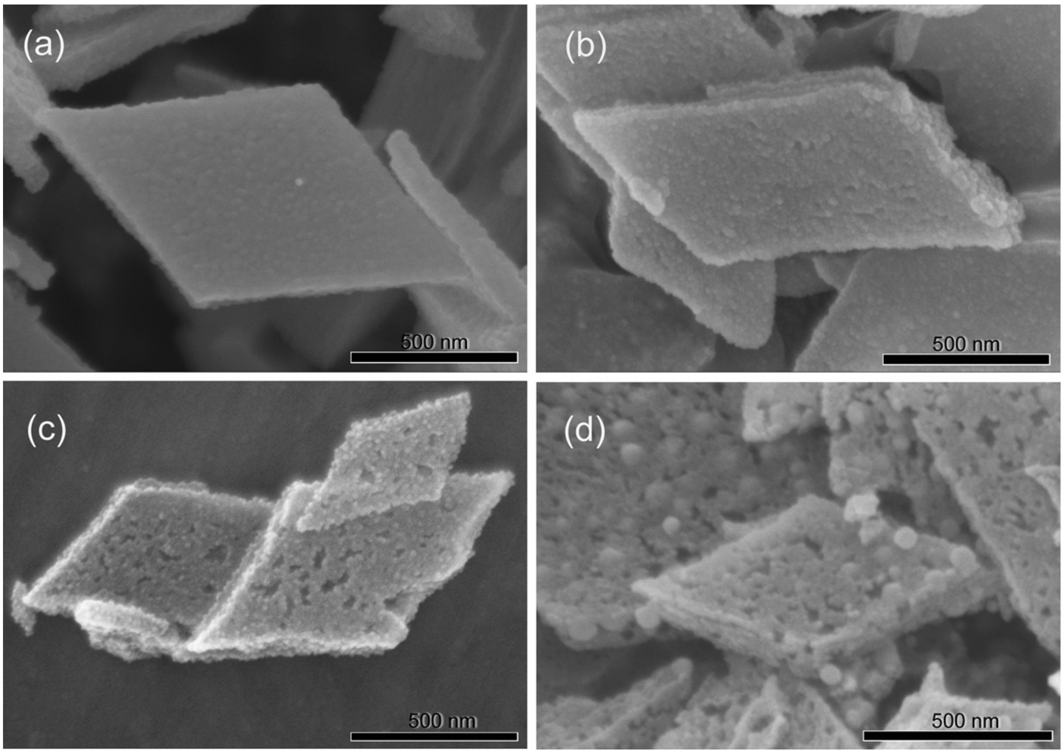

Figure S2. SEM images of (a) Ni@NC-400-1.5, (b) Ni@NC-500-1.5, (c) Ni@NC-600-1.5,(d) Ni@NC-700-1.5.

Table S1. Particle sizes of Ni@C-T-t and Ni@NC-T-t series materials caculated by Debye-Scherrer Equation and measured from TEM images

Sample	Ni@NC-400-1.5	Ni@NC-500-1.5	Ni@NC-600-1.5	Ni@NC-700-1.5	Ni@C-600-1.5	Ni@NC-600-1	Ni@NC-600-2
Size $_{XRD}$/nm	5.5	5.7	6.3	11.0	66.7	5.9	30.9
Size $_{TEM}$/nm	-	5.2-6.4	6.0-7.0	9.6-10.8	-	-	-

Table S2. Physicochemical properties of different Ni hybrids

complex	Surface area (m^2g^{-1})	Pore volume (cm^3g^{-1})	Content(wt%)				
			C	N	H	O	Ni

Ni@NC-400-1.5	240.136	0.441	20.97	3.31	0.892	27.00	47.82
Ni@NC-500-1.5	257.972	0.298	19.95	2.65	0.64	25.78	51.47
Ni@NC-600-1.5	213.413	0.276	18.09	1.87	0.42	25.56	53.28
Ni@NC-700-1.5	184.431	0.233	18.65	1.15	0.28	20.65	59.36
Ni@C-600-1.5	36.605	0.041	1.15	0	0.06	37.71	61.08

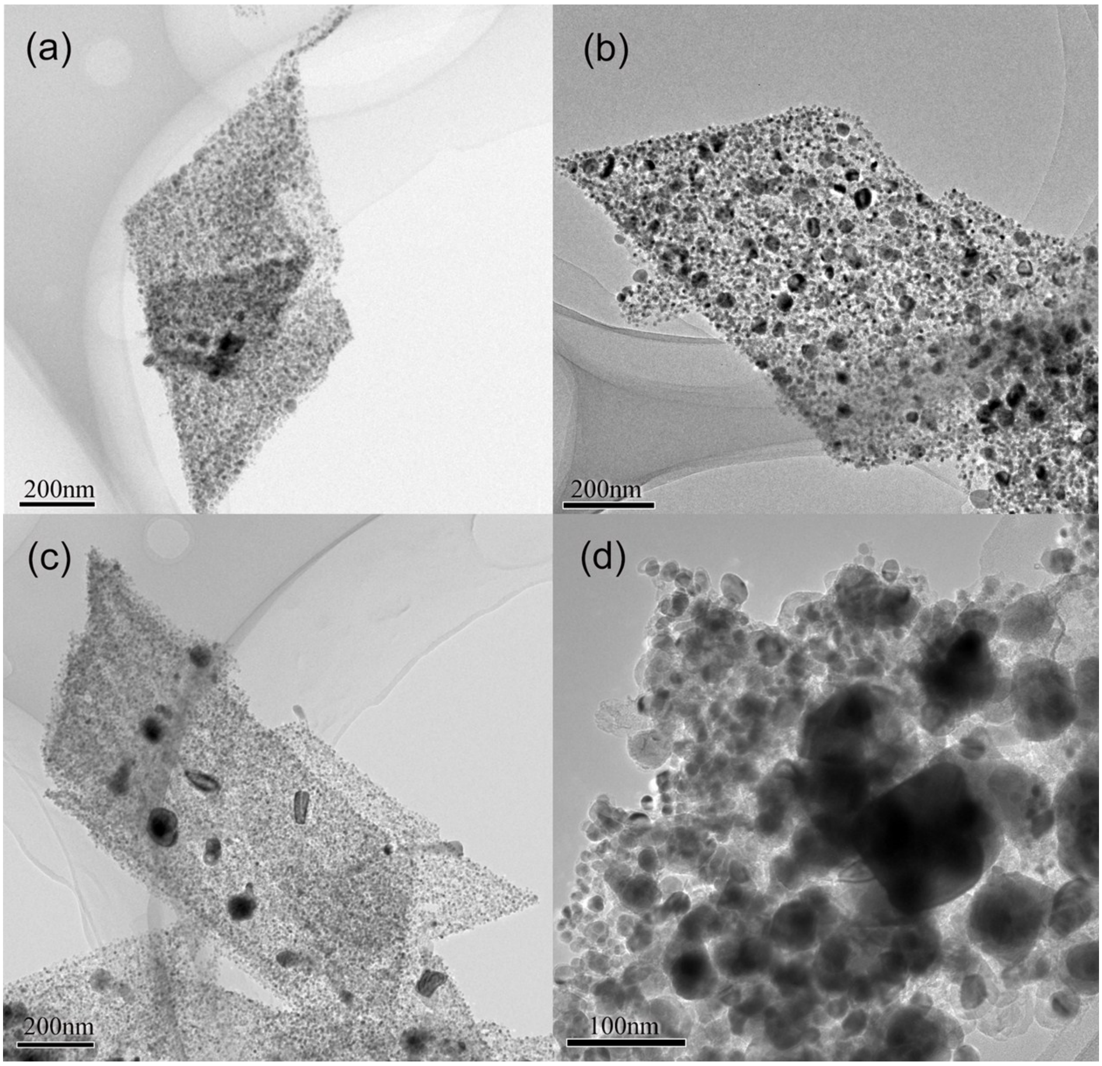

Figure S3. TEM images of (a)Ni@NC-500-1.5; (b) Ni@NC-600-1.5; (c) Ni@NC-700-1.5 and (d)Ni@C-600-1.5 hybrids.

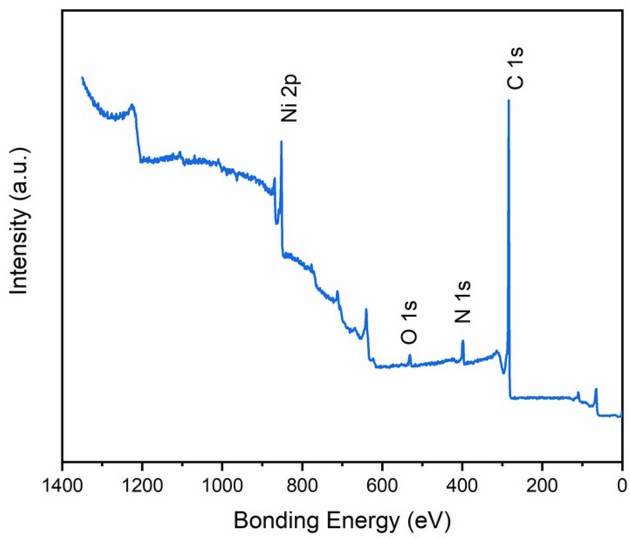

Figure S4. XPS global spectrum of Ni@NC-600-1.5.

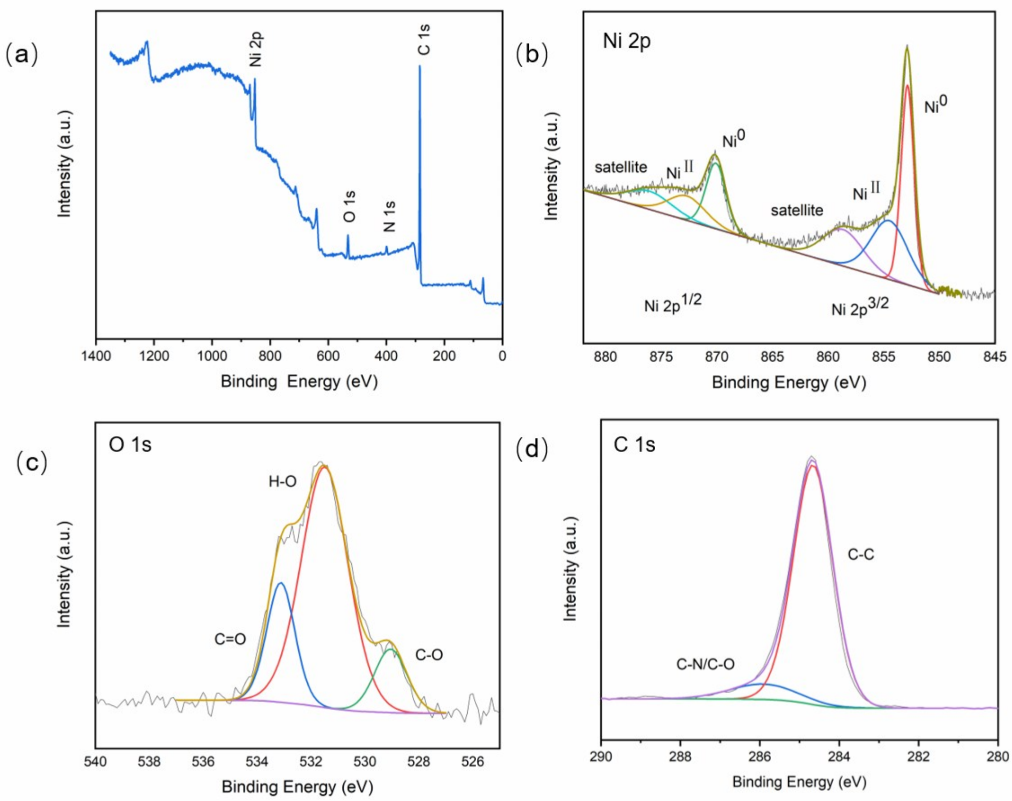

Figure S5. XPS spectra of Ni@NC-500-1.5. (a) Global spectrum, (b) Ni 2p, (c) O 1s and (d) C1s regions.

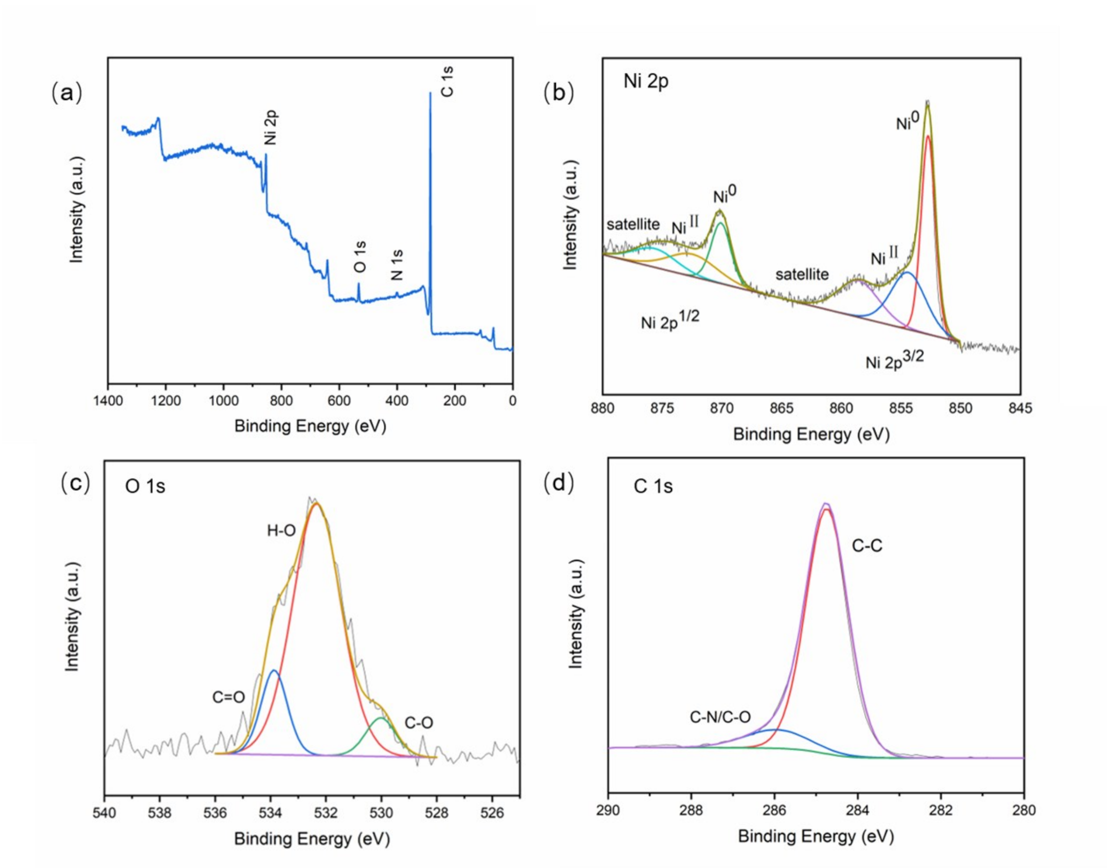

Figure S6. XPS spectra of Ni@NC-700-1.5. (a) Global spectrum, (b) Ni 2p, (c) O 1s and (d) C1s regions.

Table S3. Atomic ratios of different nitrogen species

	Ni-N	Pyridinic N	Pyrrolic N	Graphitic N	Ni-O
Ni@NC-500-1.5	0	50.14	13.40	33.22	3.23
Ni@NC-600-1.5	5.79	37.68	8.98	44.04	3.51
Ni@NC-700-1.5	2.86	34.65	8.45	50.28	3.76

Table S4. Surface element content of materials

	Atomic %			
	C	N	O	Ni
Ni@NC-500-1.5	88.20	3.03	5.17	3.58

Ni@NC-600-1.5	85.95	7.77	2.38	3.91
Ni@NC-700-1.5	90.49	2.67	3.88	2.96

Table S5. Comparison between the catalytic performance for one-pot reductive amination over various catalysts reported

catalyst	T/℃	P/Mpa	t/h	solvent	Yield (%)	Ref
Ni@NC-600-1.5	100	2	4	THF/H_2O (1:1)	98	this work
Co_3O_4/NGr@C	110	5	24	THF/H_2O (10:1)	95	[1]
Co–N_x/C-800-AT	110	1	10	MeOH	70.9	[2]
Co-DABCO-TPA@C-800	120	4	24	t-BuOH	92	[3]
Co/mCN-900	150	1		EtOH	99.8	[4]
MoS_4-catalyst	70	2	18	THF	99	[5]
CuO/Al_2O_3	125	5	0.75	toluene	67	[6]
Pd/Fe_3O_4	RT	1	6	EtOH	92	[7]
Pd/Fe_3O_4	RT	0.1	6	EtOH	94	[8]
Fe@Pd/C	80	3	8	H_2O	96	[9]
Pd/Fe_3O_4@C	60	0.1	8	H_2O	92	[10]
Co_2Rh_2/C	RT	1	24	MeOH	93	[11]
AuPd-Fe_3O_4	RT	0.1	3	MeOH	93	[12]

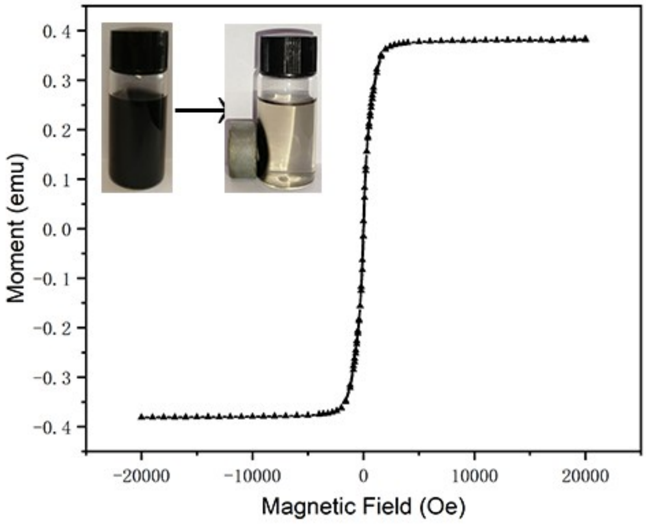

Figure S7. Magnetic hysteresis loop of the as-prepared Ni@NC-600-1.5 composite. Insert: Photograph showing the facile separation of the catalyst via an external magnet.

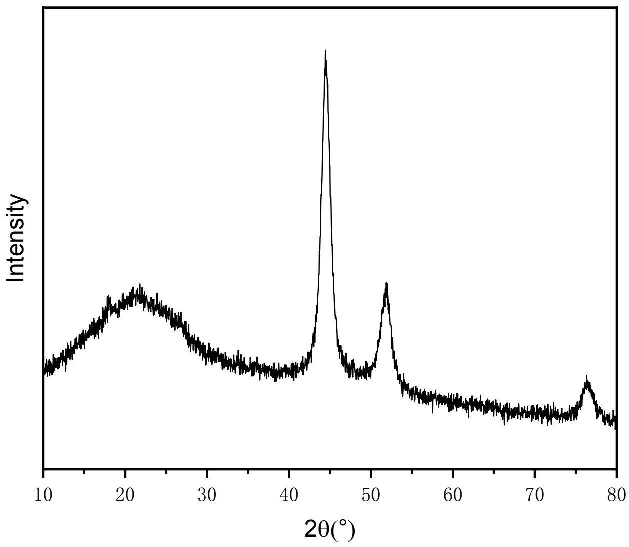

Figure S8. XRD patterns of recycled Ni@NC-600-1.5.

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