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Facile fabrication of ultrafine CoNi alloy nanoparticles supported on hexagonal N-doped carbon/Al_2O_3 nanosheets for efficient protein adsorption and catalysis

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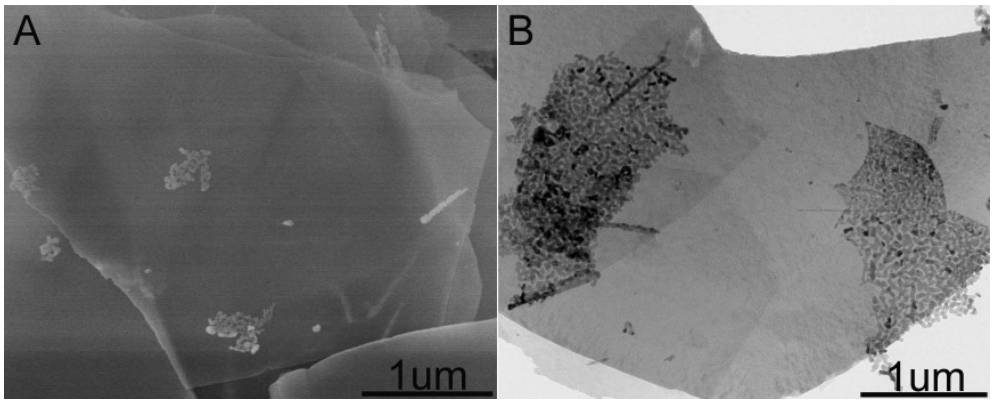

Figure S1. SEM and TEM images of Co/Al_2O_3 (A, B).

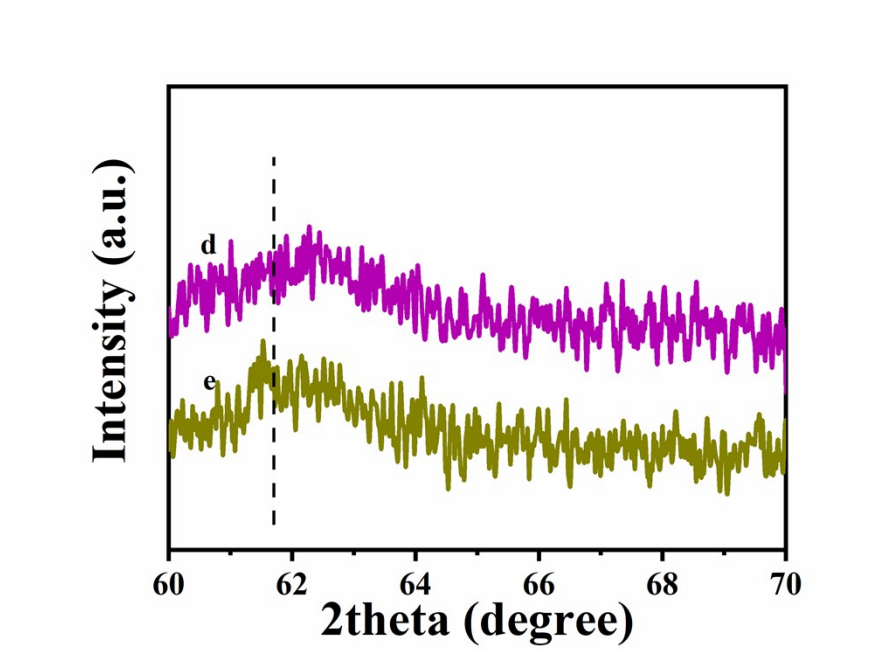

Figure S2. XRD images of C-CoNi/Al_2O_3 (d) C-Co/Al_2O_3(e).

Table S1. N_2 adsorption–desorption isotherms corresponding pore size distributions of the synthesized C-CoNi/Al_2O_3, C-Co/Al_2O_3, Co/Al_2O_3.

Samples	BET Surface Area (m^2 g^{-1})	Pore Volume (cm^3 g^{-1})	Pore Size (nm)
Co/Al_2O_3	8.7	0.0227	10.5
C-Co/Al_2O_3	25.4	0.0298	4.7
C-CoNi/Al_2O_3	33.9	0.0285	3.4

Table S2. The ICP data of C-CoNi/Al_2O_3 with different calcination temperature before and after catalytic reaction.

Catalysts	Co (μg.mg^{-1})	Ni (μg.mg^{-1})
C-CoNi/Al_2O_3	298.29	197.63
C-Co/Al_2O_3	410.86	/
Co/Al_2O_3	266.33	/

Table S3. A full comparison of C-CoNi/Al_2O_3 nanosheets catalysis activity and test condition with other nickel and noble metal catalysts.

Catalyst	Type	K(×10^{-3}s^{-1})	κ(g^{-1}s^{-1})	Reference
C-CoNi/Al_2O_3	nanosheets	3.86	210.58	This work
C-Co/Al_2O_3	nanosheets	2.02	4.92	This work
Co/Al_2O_3	nanosheets	1.21	4.54	This work
Ni/p (AMPS)	Hydrogel	0.9	0.15	1
Ni/MC-550	Nanotube	1.51	338	2
Ni/SiO_2	Core-shell	2.8	0.94	3
RGO-Ni	Nanosheets	0.25	0.04	4
C-Ni/400	Core-shell	5.9	142	5
Ni/SNTs	Nanotube	9.9	31	6
Ni (modified)	Nanoparticles	2.4	0.80	7

Table S4. Isotherm parameters for the adsorption of BHb protein on the C-CoNi/Al_2O_3.

T(℃)	Langmuir model			Freundich model		
	K_d(mg/mL)	Q_m(mg/g)	R^2	K_F(mg/g)	n	R^2
C-CoNi/Al_2O_3	0.10	1164.4	0.9980	585.9	1.72	0.9314
C-Co/Al_2O_3	0.38		0.9997			
Co/Al_2O_3	0.26		0.9984			

Table S5. Properties of different adsorbents for BHb capture

Adsorbent	Capacity (mg g^{-1})	Reference
C-CoNi/Al_2O_3	1164.4	This work

Fe_3O_4@SiO_2@IL	2150	8
CNTs/Fe_3O_4@CuSilicate	302.3	9
Cu-IDA-silica-coated Fe_3O_4	418.6	10
Magnetic HCNTs	2200	11
Ni-MNPs	1054.3	12

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