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Highly mesoporous hierarchical nickel and cobalt double hydroxide composite: fabrication, characterization and ultrafast NO_x gas sensors at room temperature

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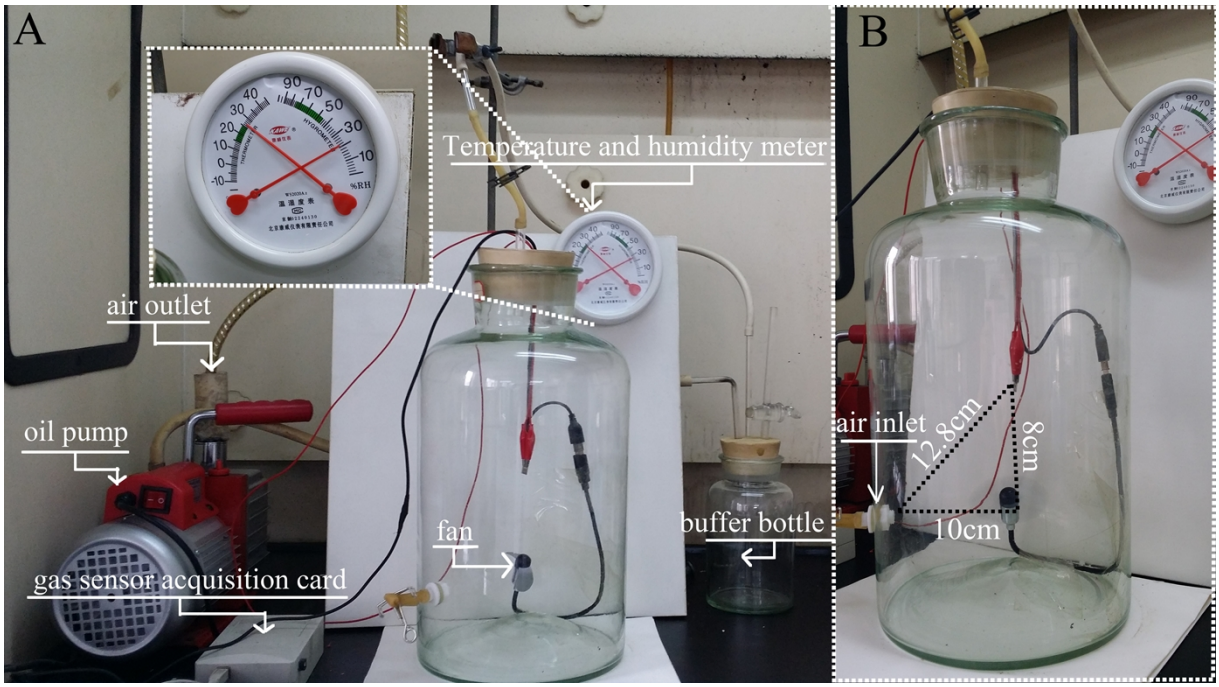

Fig. S1 (A) The images of the test chamber and (B) The distance from the injection point from the surface of the sensor

The test chamber is shown in Fig. S1. The volume of the test chamber (V) is 10.31L. The injected gas volume and concentration of the NO_x are listed in Table S1. As shown in Fig.1B, the distance from the injection point from the surface of the sensor is about 12.8 cm. The electrode is located in the central of the test chamber over the fan. When the NO_x was injected into the test chamber, gas molecules were uniformly dispersed in the chamber by using the fan.

Table S1 Volume and concentration of the injected gas

Injected volume(V_0)	The concentration of the NO_x (V_0/V)
1000 μL	97.0 ppm
500 μL	48.5 ppm
300 μL	29.1 ppm
100 μL	9.70 ppm
50 μL	4.85 ppm
30 μL	2.91 ppm
10 μL	0.97 ppm

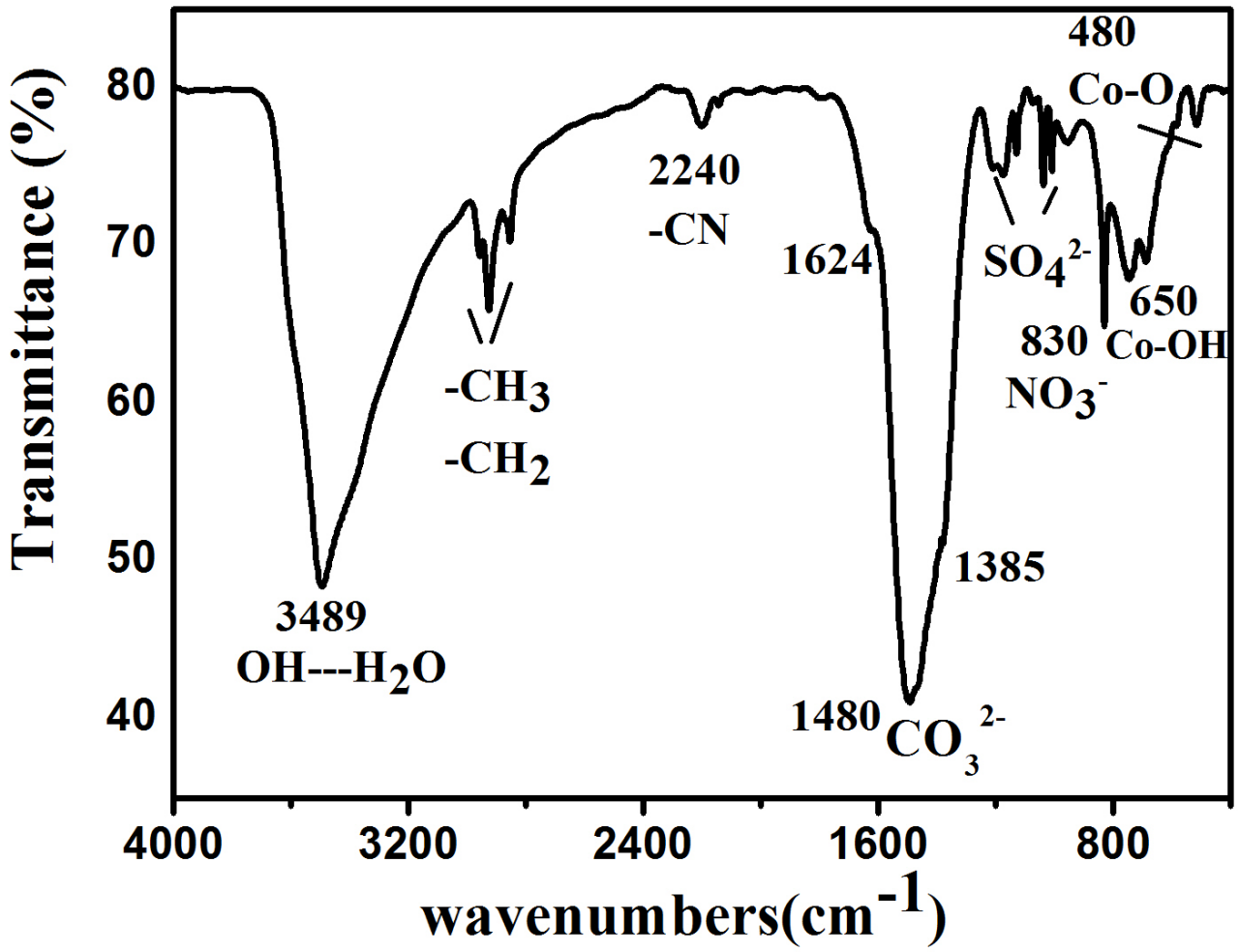

Fig. S2 The FT-IR spectra of the pure α-$Co(OH)_2$

Table S2 The data of FT-IR spectrum for the samples

Wavenumber (cm^{-1})	3645	3489	2958, 2927, 2856,	2239	1600	1480 1487	1386	1130, 1037, 1009	640	480
Functional group	-OH	$OH---H_2O$	$-CH_3$, $-CH_2$ (DBS^-)	C≡N (OCN^- or CNO^-)	C=C (benz-ene)	CO_3^{2-}	NO_3^-	SO_4^{2-} (DBS^-)	Ni-OH Co-OH	Ni-O Co-O

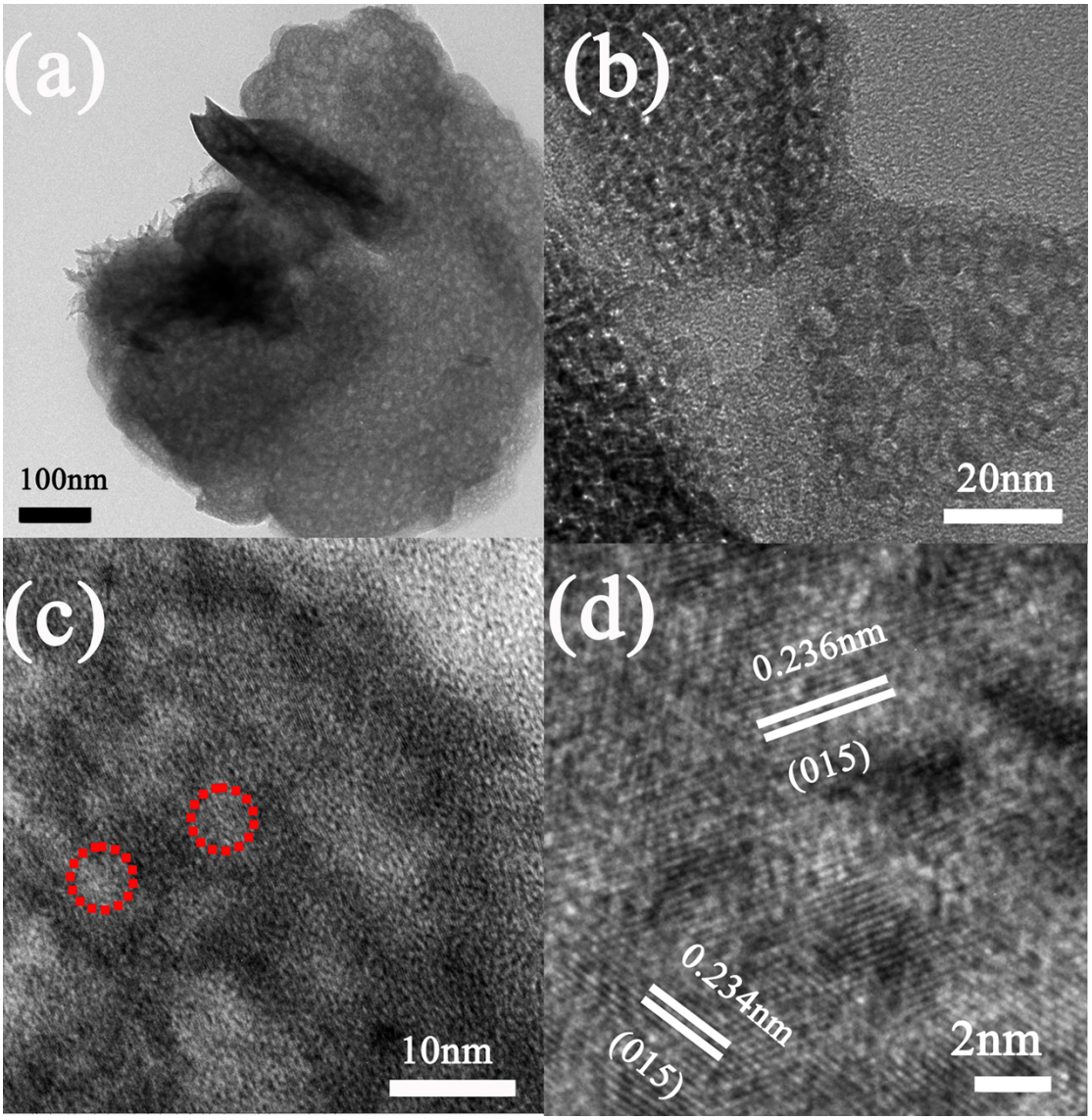

Fig. S3 (a) Low magnification TEM image of hierarchical NCDH-40; (b) TEM image of mesoporous NCDH-40 nanosheet edge, (c), (d) HRTEM images of part of mesoporous multilayer NCDH-40 nanosheets, the (015) plane of α-$Ni(OH)_2$ can been seen.

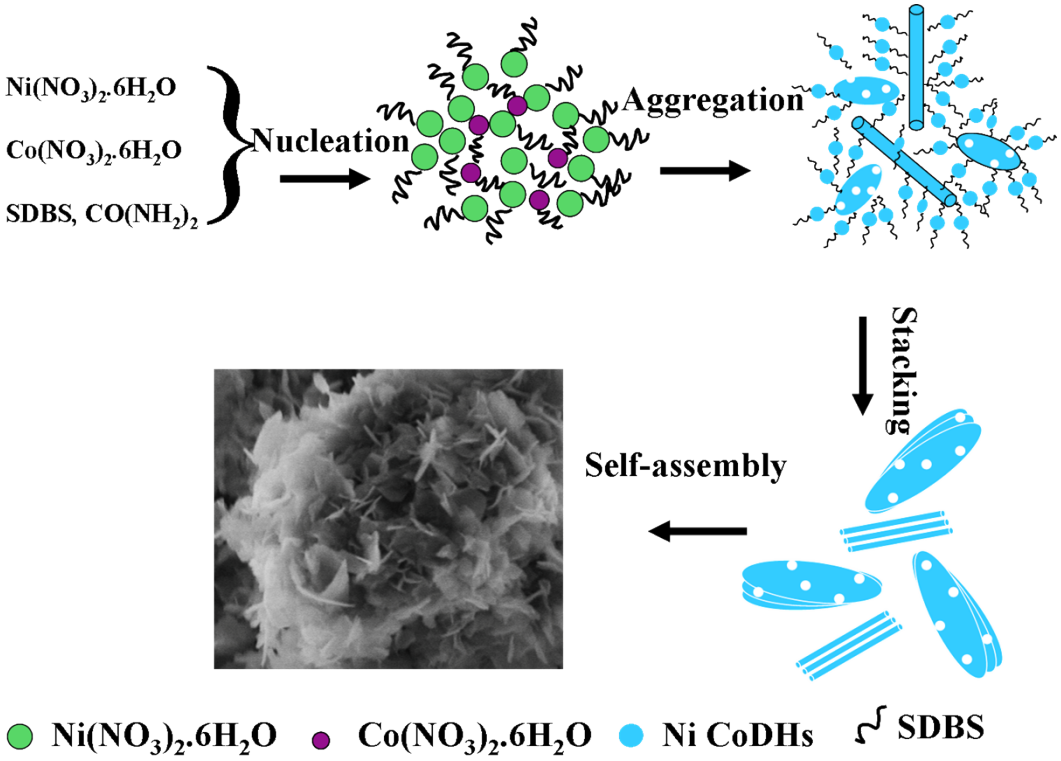

Fig. S4 Schematic illustration of the formation mechanism of NCDHs with highly porous and hierarchical nanostructures.

Table S3 Gas response results of NCDH-20 sensor to NO_x at RT in air (RH: 26%)

NO_x Concentration (ppm)	97	48.5	29.1	9.7	4.85	2.91	0.97
Sensitivity (%)	70	62	44	27	16	10	6
Response time (s)	0.6	1.3	1.3	2	8	9	10