Electronic Supplementary Material (ESI) for RSC Advances.

3D porous α-$Ni(OH)_2$ nanostructure interconnected with carbon black as high-performance gas sensing material for NO_2 at room temperature

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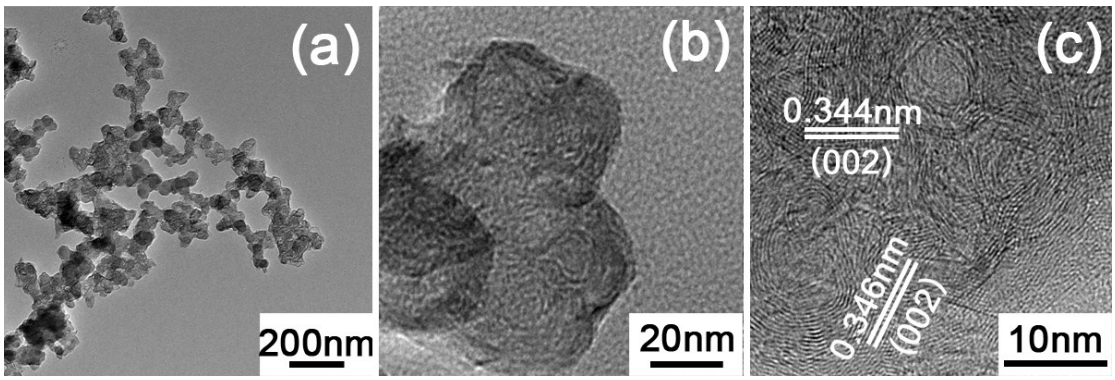

Fig. S1 TEM/HRTEM images of Carbon black.

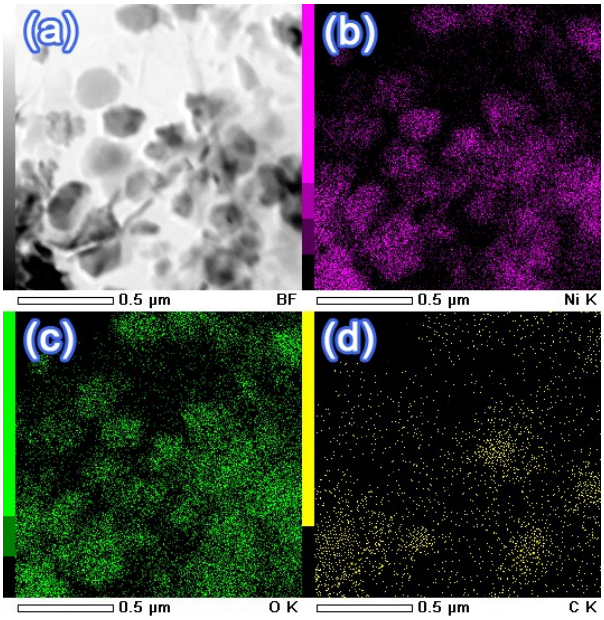

Fig.S2. STEM image/EDX mapping of the NiCB20: (a) Bright field image; (b), (c) and (d) corresponding to the Ni, O and C elemental mapping, respectively.

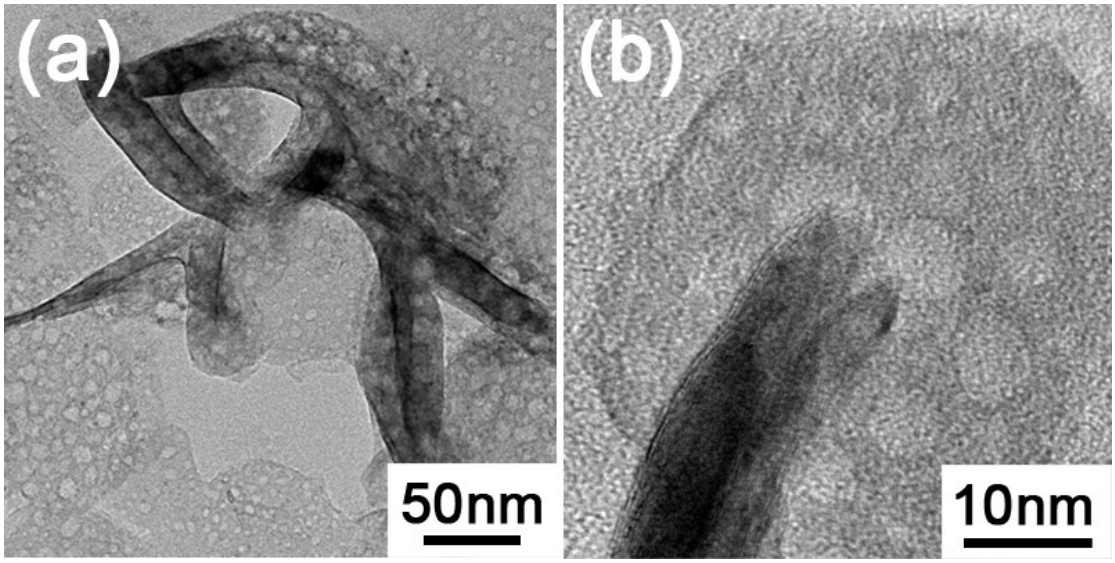

Fig. S3 TEM images of porous α-$Ni(OH)_2$ nanosheets.

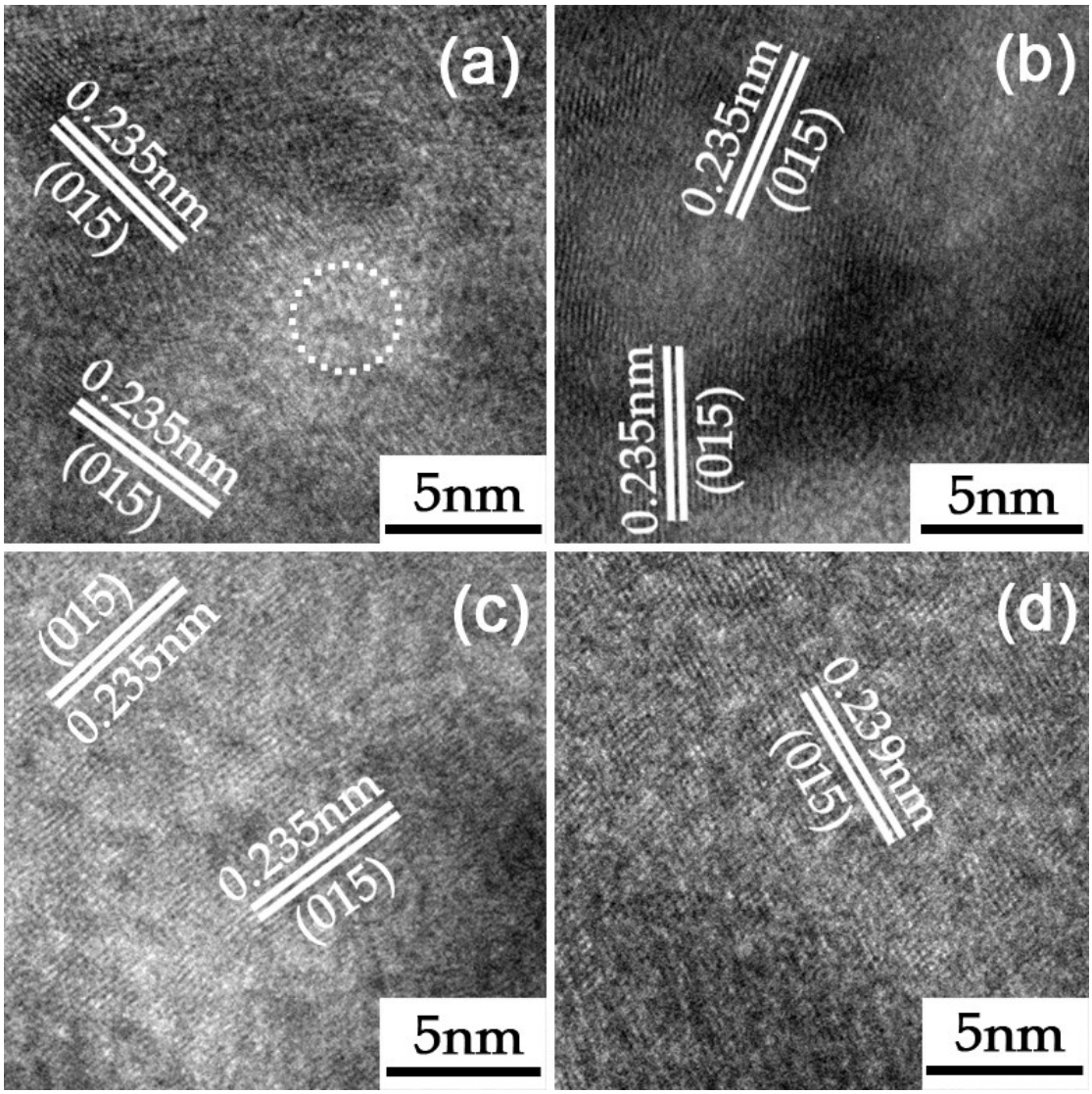

Fig. S4 HRTEM images of α-$Ni(OH)_2$ nanosheet of Fig. S2(b).

Table S1 The data of FT-IR spectrum for the samples

Wavenumber (cm^{-1})	3644	3498	2957, 2927, 2855,	2239	1602	1480 1487	1378	1130, 1037, 1009	640	481
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	Ni-O

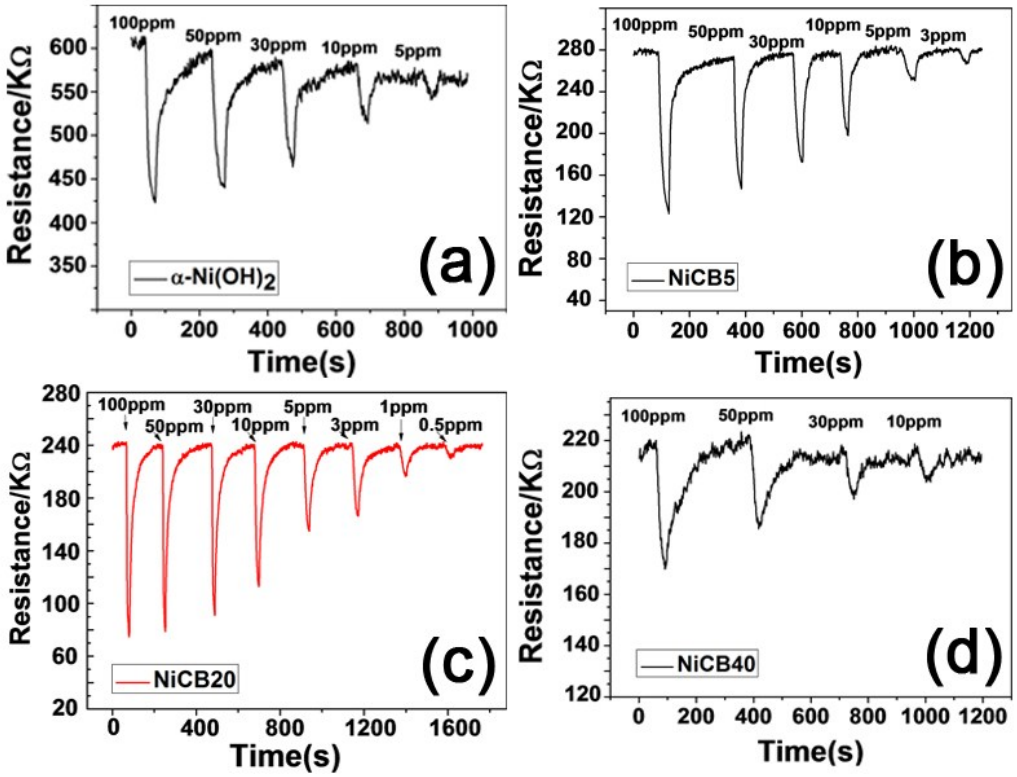

Fig.S5 the resistance transients curve of the sample

Table S2 The response-recovery results of the four samples to NO_2 at room temperature (RT: 22 °C, RH: 26%)

Concentrations		100ppm	50ppm	30ppm	10ppm	5ppm	3ppm	1ppm	0.5ppm
α-$Ni(OH)_2$	Sensitivity (%)	31.1	26.4	21.5	12.1	6.4			
	Response time (s)	8	11.3	12.7	14	15.7			
NiCB5	Sensitivity (%)	55.2	49.9	41.8	32.6	12.8	6.4		
	Response time (s)	7.3	10	13.3	14	15.3	18.3		
NiCB20	Sensitivity (%)	62.5	61.2	56.6	47.5	29.1	24.1	10.2	4.7
	Response time (s)	2	5	5.3	10	12.7	13.3	14	16.7
NiCB40	Sensitivity (%)	21.1	16.6	9.2	6.9				
	Response time (s)	11.3	14	15.3	16.7				

Table.S3 The response data of NiCB20 with single cycle times

Concentrations		100ppm	10ppm	1ppm	0.5ppm
NiCB20	Response time (s)	2.2	8.1.	15.7	18.3
	Response (%)	61.8	45.3	11.5	5.8

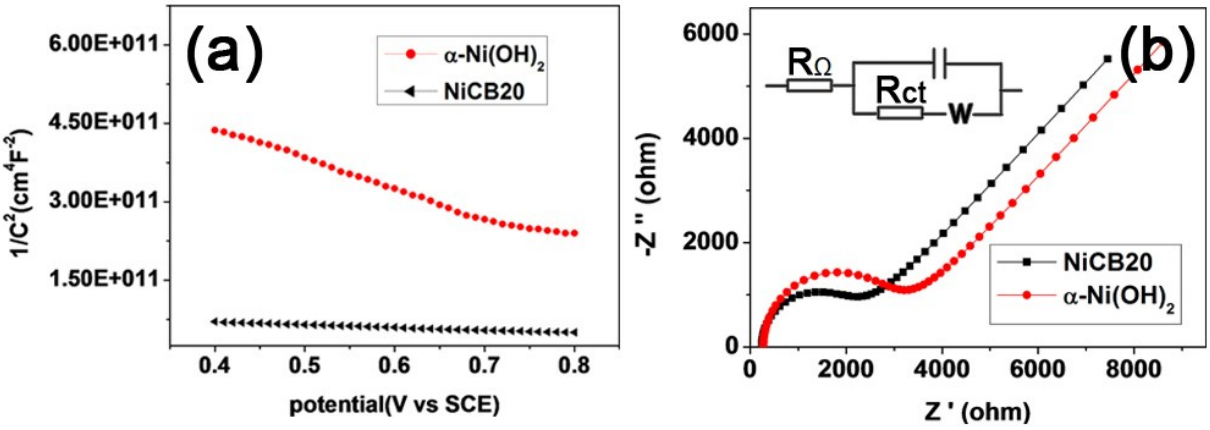

Fig. S6 (a) The Mott-Schottky curves of α-Ni(OH)$_2$ and NiCB20; (b) The EIS curves of α-Ni(OH)$_2$ and NiCB20 samples. The left inset is the corresponding equivalent circuit model.

Table S4 The fitted impedance parameters of α-Ni(OH)$_2$ and NiCB20 samples

Samples\ parameters	R_Ω	C	R_{ct}
α-Ni(OH$_2$	579.5	5.57×10^{-6}	2740
NiCB20	439.0	2.712×10^{-6}	1517