

## Supporting Information

### **One-step synthesis of hierarchical Ni-Fe-Al layered double hydroxide with excellent sensing properties for NO<sub>x</sub> at room temperature**

Dahai Hong<sup>a</sup>, Jiawei Zhang<sup>b</sup>, Afrasiab Ur Rehman<sup>a</sup>, Lihong Gong<sup>c</sup>, Jiao Zhou<sup>a</sup>, Kan Kan<sup>a</sup>, Li li<sup>a,b\*</sup>, Keying Shi<sup>a, c\*</sup>

<sup>a</sup> *Key Laboratory of Functional Inorganic Material Chemistry, School of Chemistry and Material Science, Heilongjiang University, Harbin, 150080, P. R. China.*

<sup>b</sup> *Key Laboratory of Chemical Engineering Process & Technology for High-efficiency Conversion, School of Chemistry and Material Science, Heilongjiang University, Harbin 150080, P. R. China.*

<sup>c</sup> *Key Laboratory for Photonic and Electronic, Ministry of Education. Modern experiment center, Harbin Normal University, Harbin 150025, P. R. China.*

Corresponding author. Tel.: +86 451 86609141; +86 451 86604920

E-mail: llwjhlju@sina.cn, shikeying2008@163.com

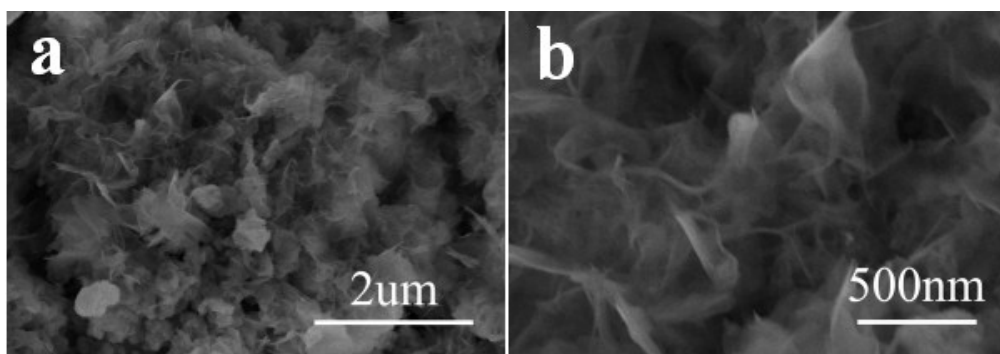


Fig. S1. (a, b) TEM images of pure NA-LDHs.

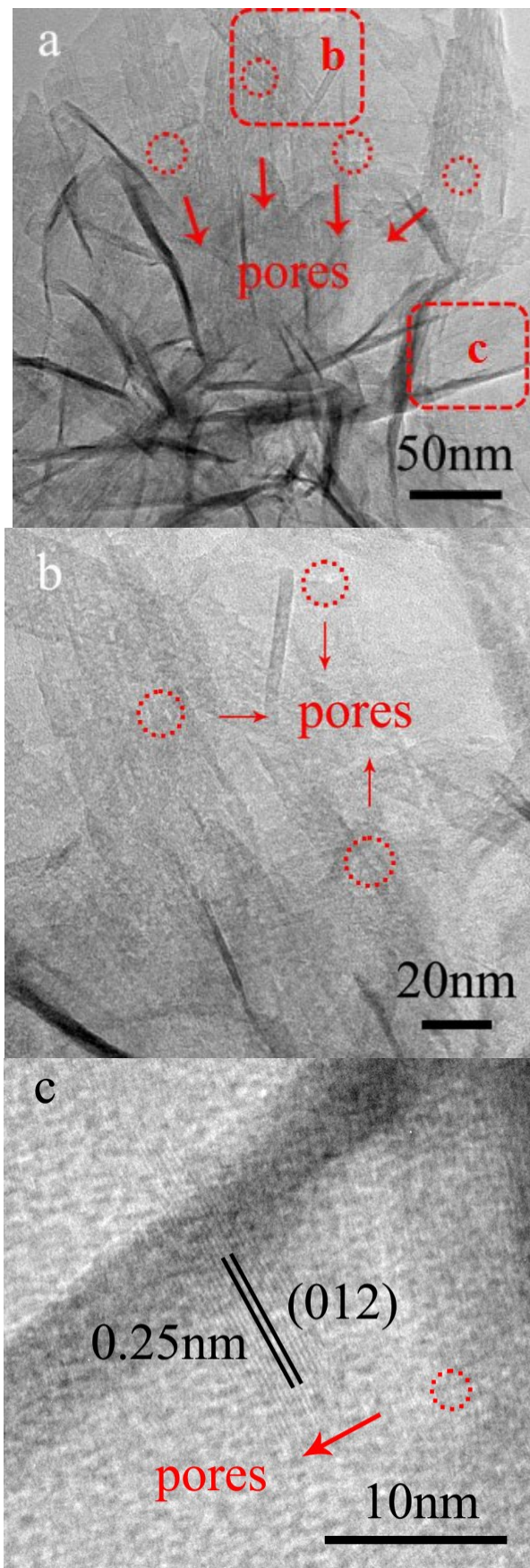


Fig. S2 TEM images of NFA 1-1

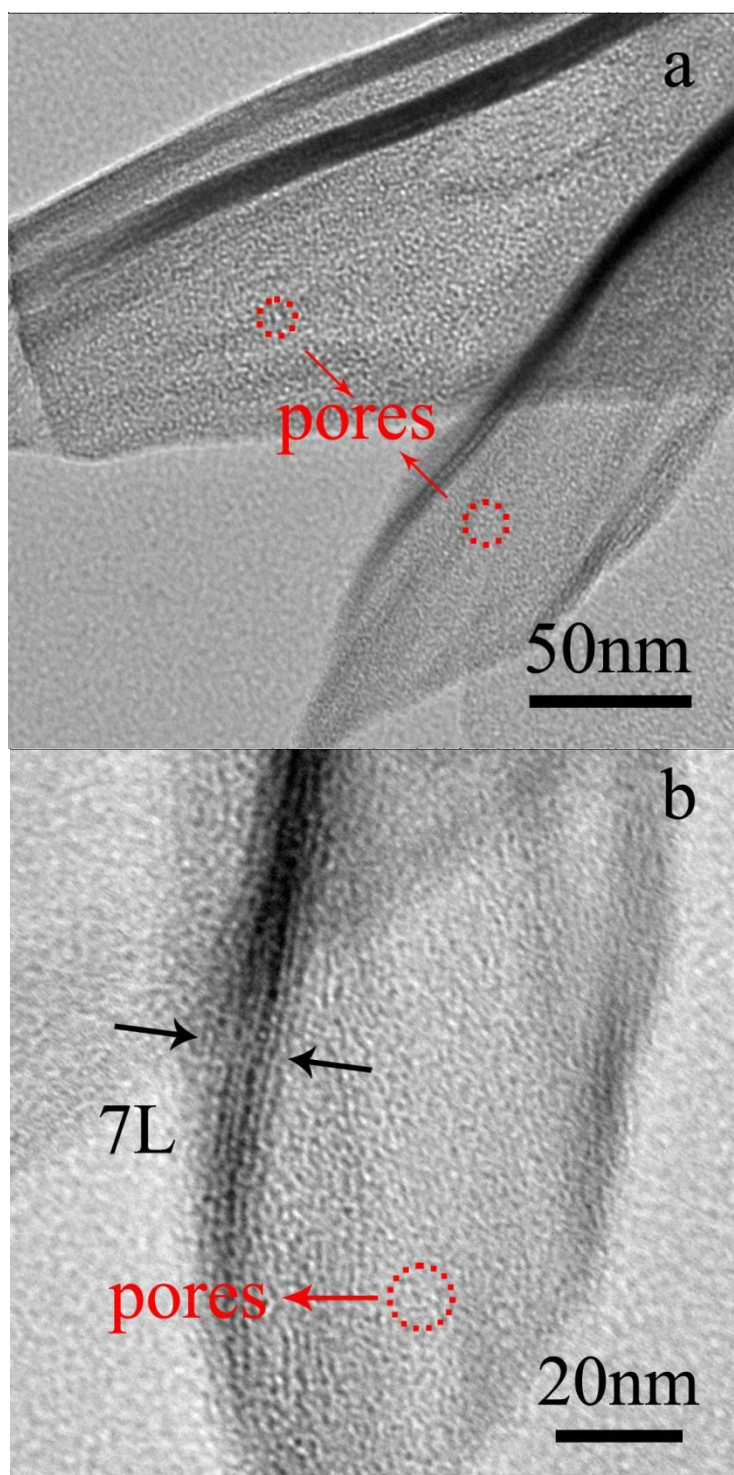


Fig. S3 (a, b) TEM images of NFA 1-1

(High magnification TEM of Fig. 3A : see blue box)

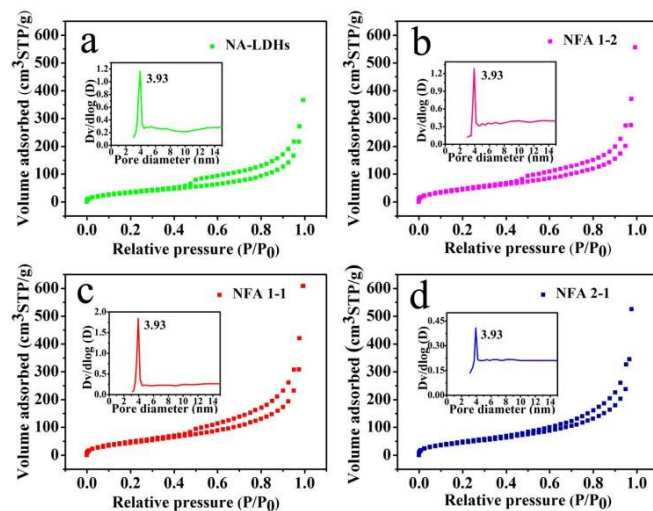


Fig. S4 a,b,c and d is Nitrogen adsorption-desorption isotherms and pore size distribution curve of NA-LDHs NFA 1-2 NFA 1-1 and NFA 2-1 respectively.

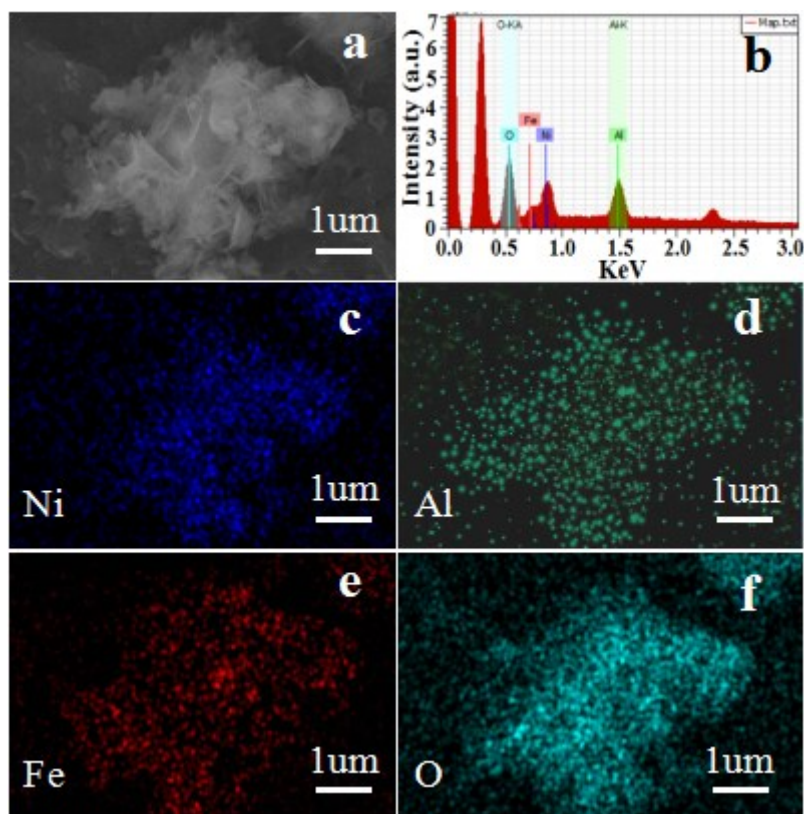


Fig. S5 STEM image/EDS mapping of NFA 1-1 sample. (a) bright field image, (b) EDS spectra, (c, d, e, f) corresponding to Ni, Al, Fe and O elemental mapping, respectively.

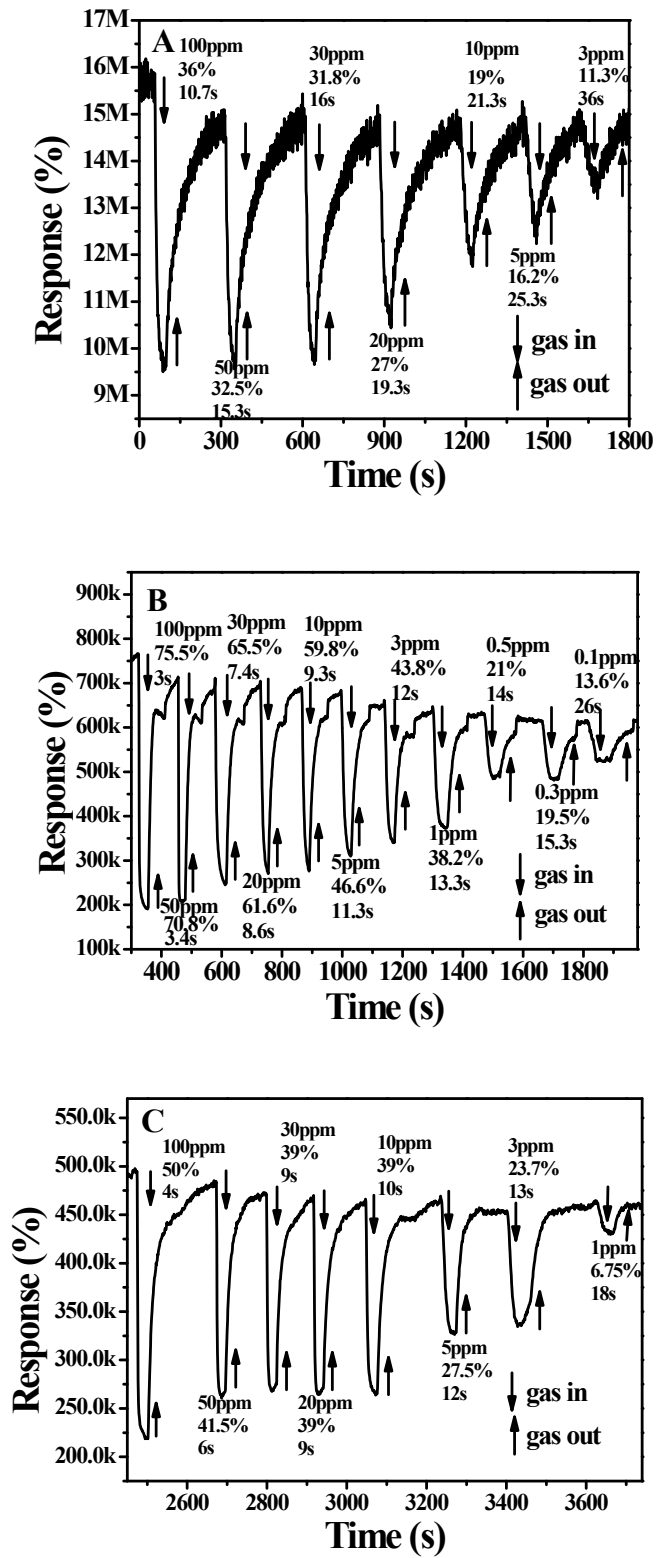


Fig. S6 Dynamic response curves of sensors to 0.1-100 ppm NO<sub>x</sub> at room temperature in air. (A) NA-LDHs. (B) NFA 1-2 and (C) NFA 2-1

Table S1. Sensitivity results of NFA 1-1 sensor to NO<sub>x</sub> at room temperature in air

	100	50	30	20	10	5	3	1	0.5	0.3	0.1
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Sensitivity (%)	82	71.3	69.5	65.5	62	55.1	46.4	43.4	28.2	26.3	18
Time (s)	2.6	3.3	7.3	8	9	10	11.3	12.6	14.6	15.3	19.3

Table S2. Fitted impedance parameters of samples

Samples	$R_{\Omega}$ ( $\Omega$ )	$C$ ( F cm <sup>-2</sup> )	$R_{ct}$ ( $\Omega$ )
NA-LDHs	64.84	$4.37 \times 10^{-6}$	5769
NFA 1-2	62.87	$3.041 \times 10^{-6}$	925.4
NFA 1-1	60.91	$1.939 \times 10^{-6}$	329.2
NFA 2-1	71.36	$3.242 \times 10^{-6}$	1618

Here,  $R_{\Omega}$  indicates the uncompensated bulk resistance of the electrolyte, separator and electrode, where  $R_{ct}$  is attributed to the charge-transfer resistance at the active material interface and  $C$  is the constant phase angle element, involving double layer capacitance.