Supplementary Information

Two-dimensional NiO nanosheets with enhanced room temperature NO_2 sensing performance via Al doping

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Humidity test measurements

Humidity tests were carried out with a saturated salt solution method.[1] As shown in Fig. S10 (a) are the home-made system for the test. Sensors are placed in the relative humidity (RH) controlled environments which are achieved using saturated salt solutions of LiCl, $CaCl_2$, $Mg(NO_3)_2$, NaCl, KCl and KNO_3, and the RH at room temperature are approximately 11, 31, 54, 75, 84 and 95%, respectively .[2,3]

Table S1 Element contents of pure NiO, 12%-Al-NiO, and 20%-Al-NiO

Sample	Element	XPS Method (at %)	EDS Method (at %)
Pure NiO	O	58.74	51.84
	Ni	41.26	48.16
12%-Al-NiO	O	55.76	54.56
	Al	5.73	4.65
	Ni	38.51	40.79
20%-Al-NiO	O	62.34	56.39
	Al	7.21	6.96
	Ni	30.45	36.65

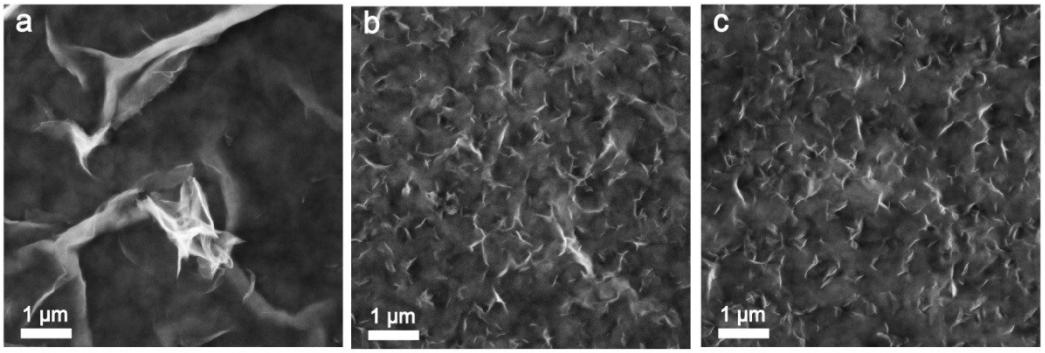

Fig. S1 SEM images of as-prepared precursor before anneal for (a) pure $Ni(OH)_2$, (b) 12%-Al-$Ni(OH)_2$, and (c) 20%-Al-$Ni(OH)_2$.

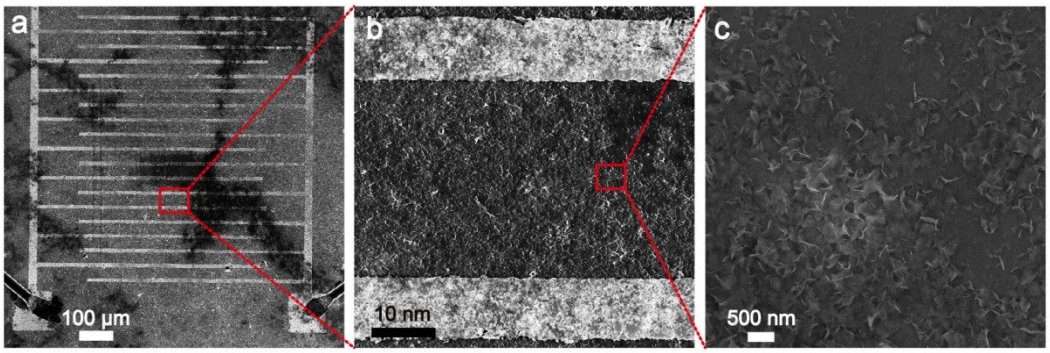

Fig. S2 (a) SEM images of 20%-Al-NiO on interdigital electrodes and (b-c) magnified image of the interdigital electrode gap.

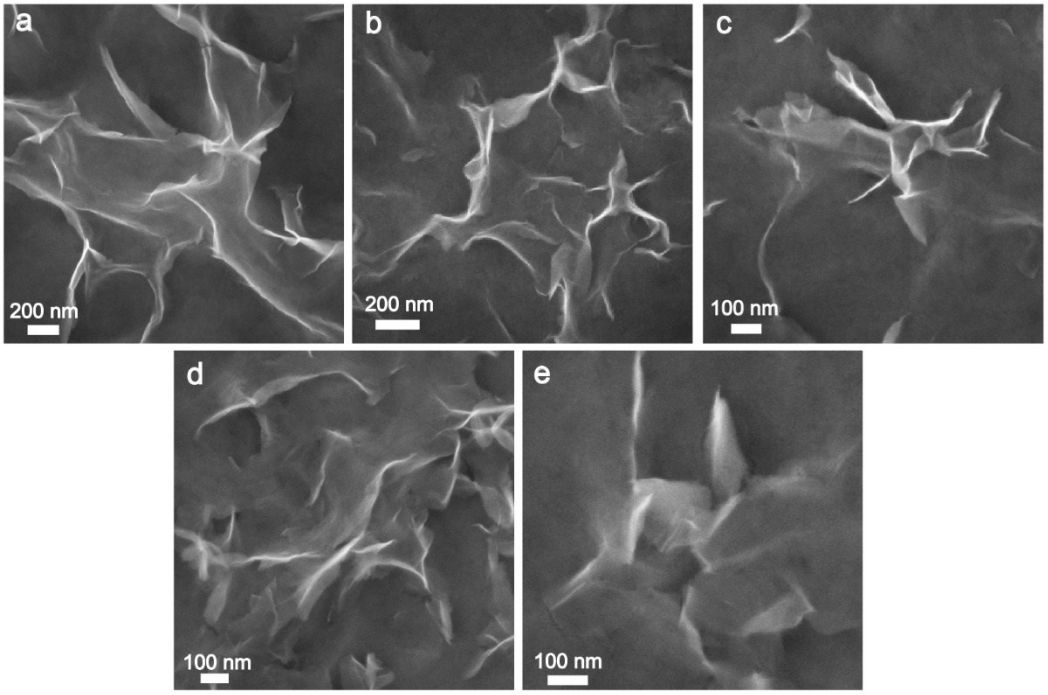

Fig. S3 SEM images of (a) 1%-Al-NiO, (b) 5%-Al-NiO, (c) 10%-Al-NiO, (d) 12%-Al-NiO, and (e) 15%-Al-NiO.

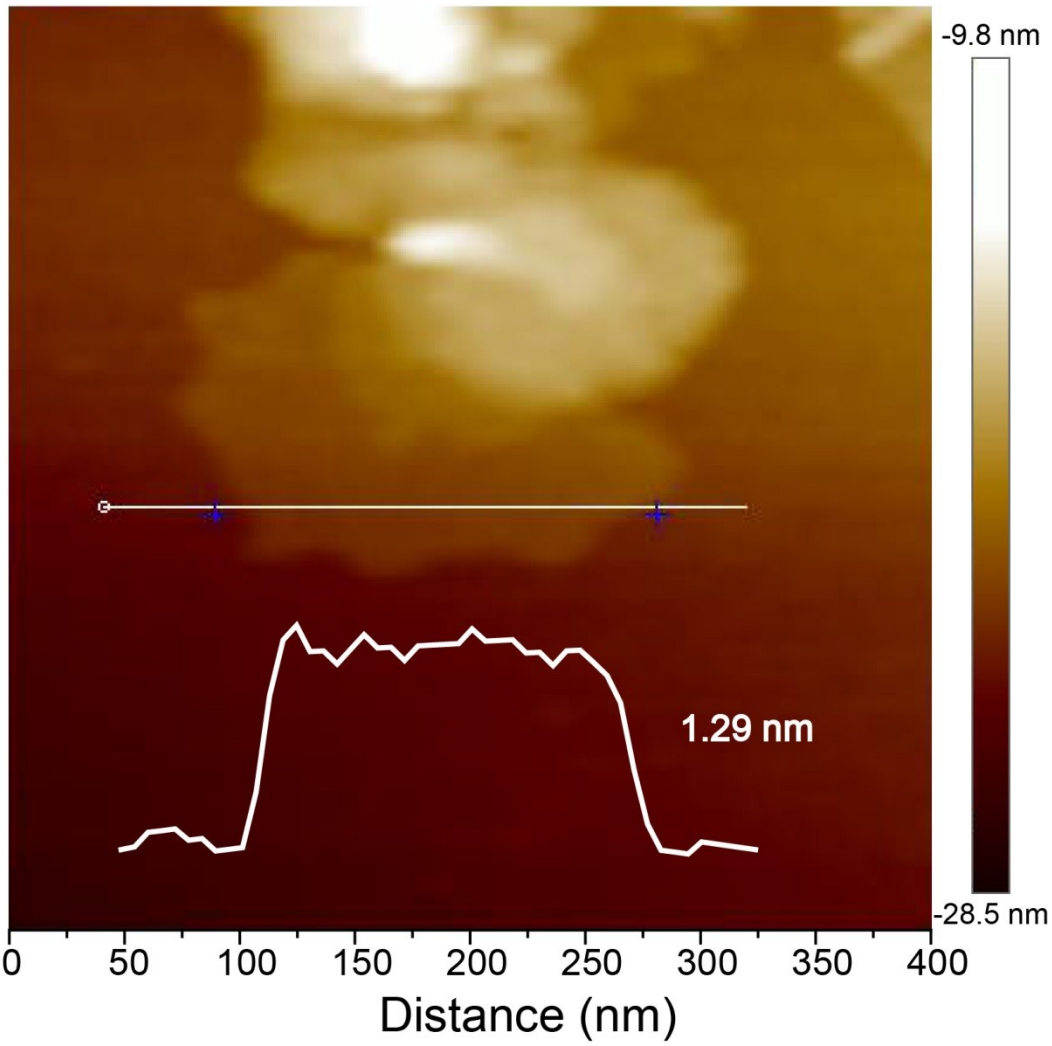

Fig. S4 AFM image and corresponding thickness analysis of 20%-Al-NiO.

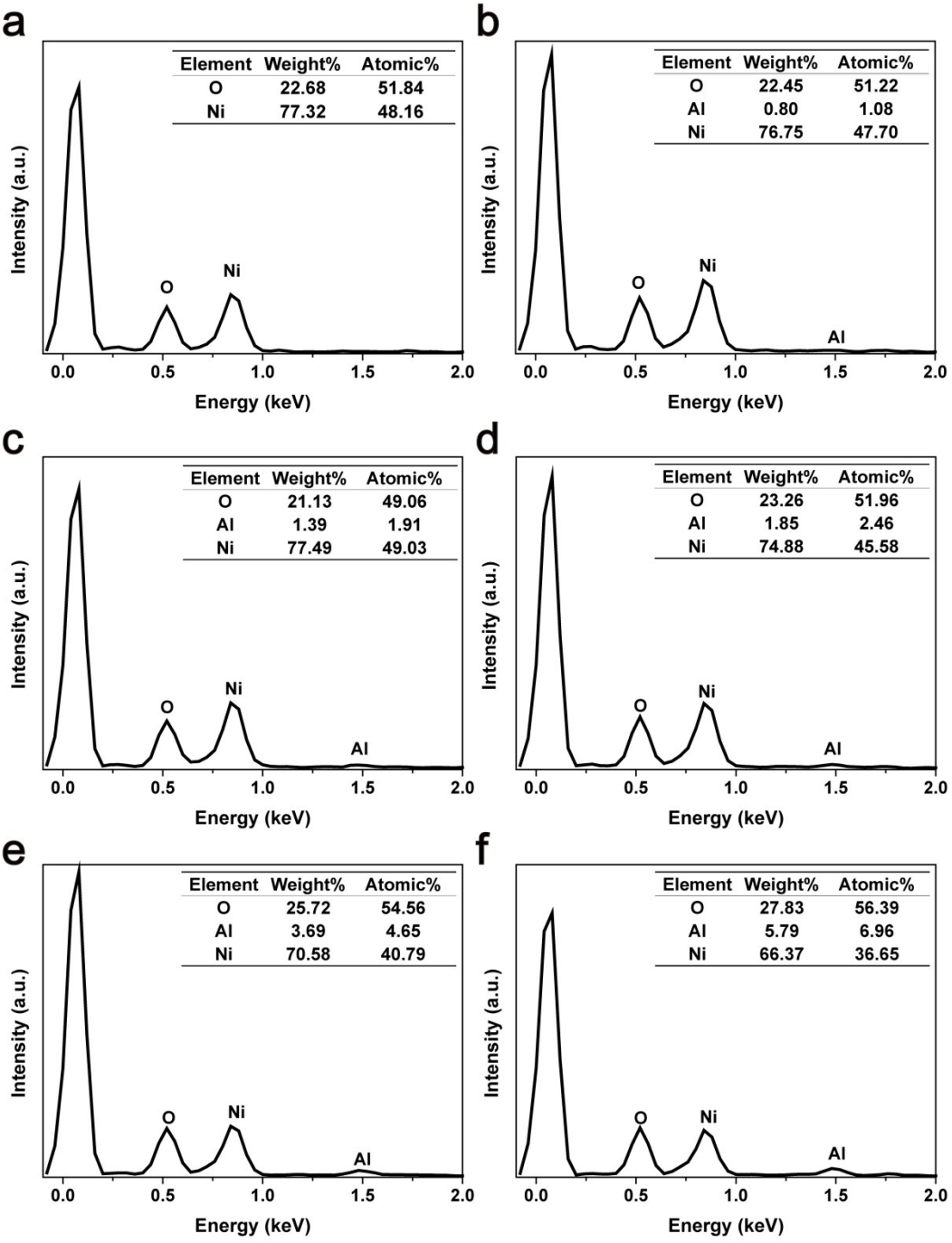

Fig. S5 EDS spectra of (a) pure NiO, (b) 1%-Al-NiO, (c) 5%-Al-NiO, (d) 10%-Al-NiO, (e) 12%-Al-NiO, and (f) 20%-Al-NiO.

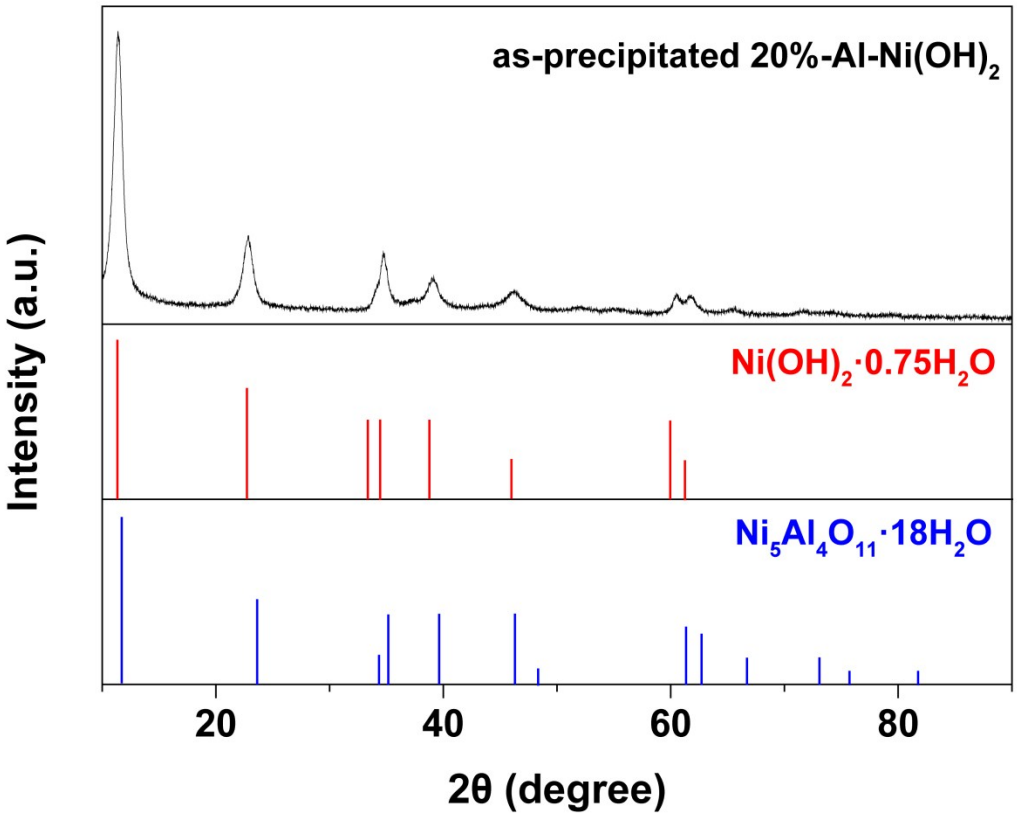

Fig. S6 XRD patterns of as-precipitated 20%-Al-$Ni(OH)_2$.

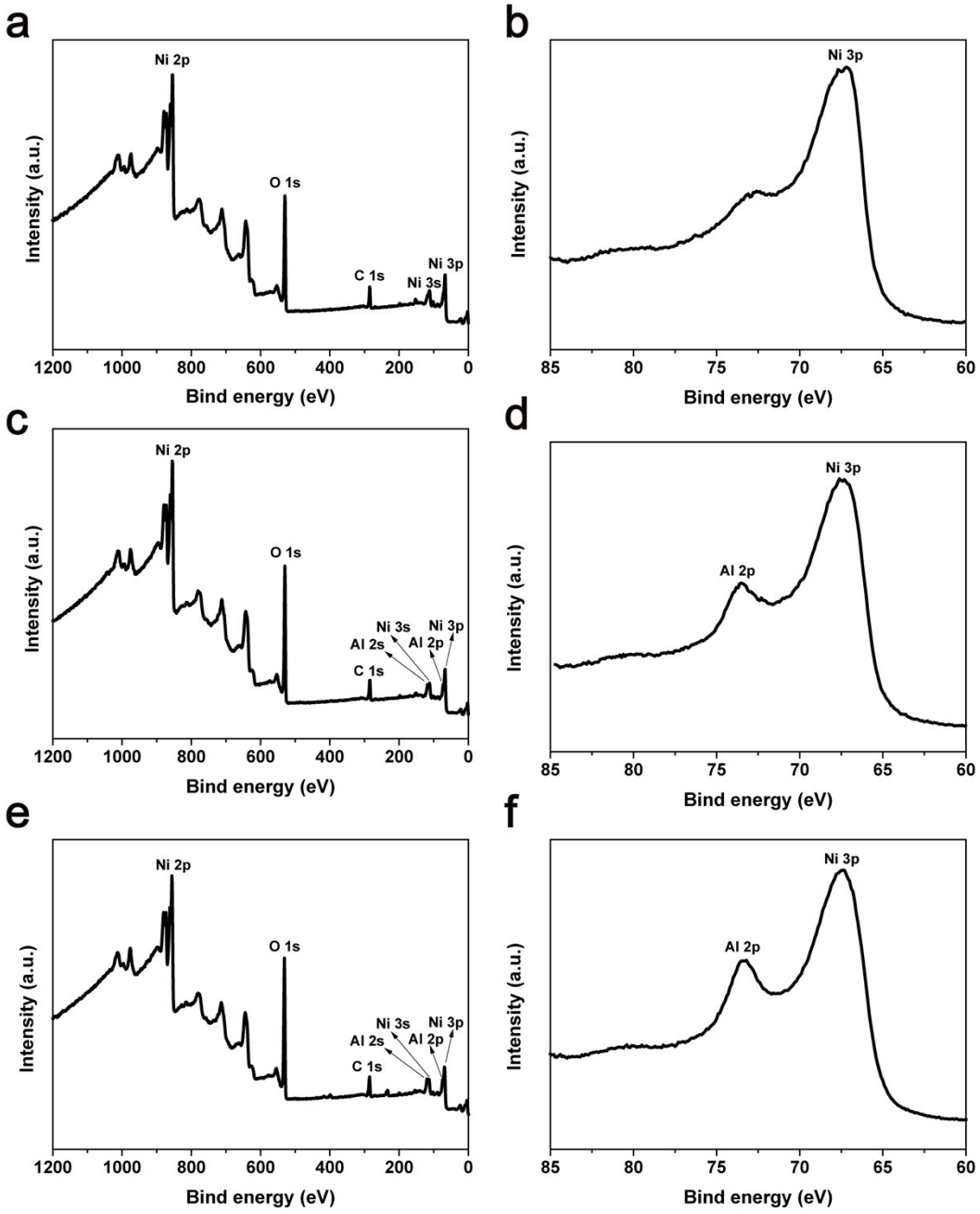

Fig. S7 XPS spectra of pure NiO, 12%-Al-NiO, and 20%-Al-NiO. Survey scan of (a) pure NiO, (c) 12%-Al-NiO, and (e) 20%-Al-NiO. Ni 3p and Al 2p spectra of (b) pure NiO, (d) 12%-Al-NiO, and (f) 20%-Al-NiO.

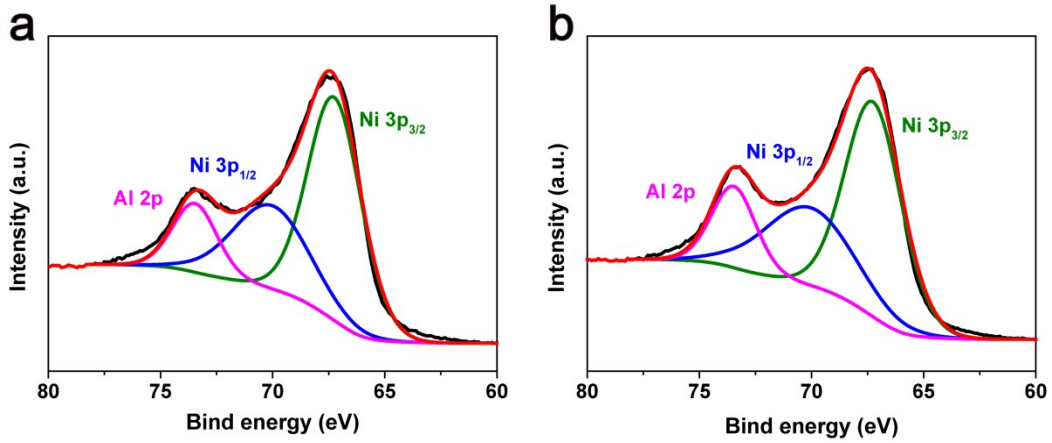

Fig. S8 Fig. Deconvoluted XPS spectra of Al 2p and Ni 3p. (a) 12%-Al-NiO. (b) 20%-Al-NiO.

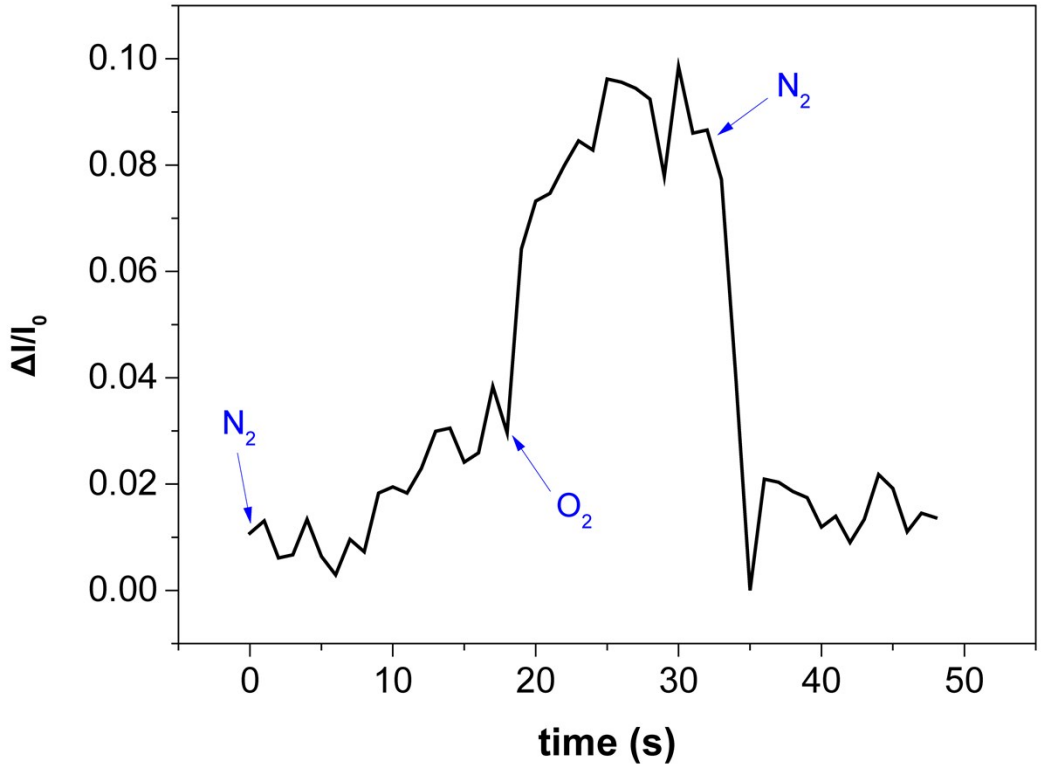

Fig. S9 The selectivity of 20%-Al-NiO to O_2 using N_2 as background gas and air as test gas.

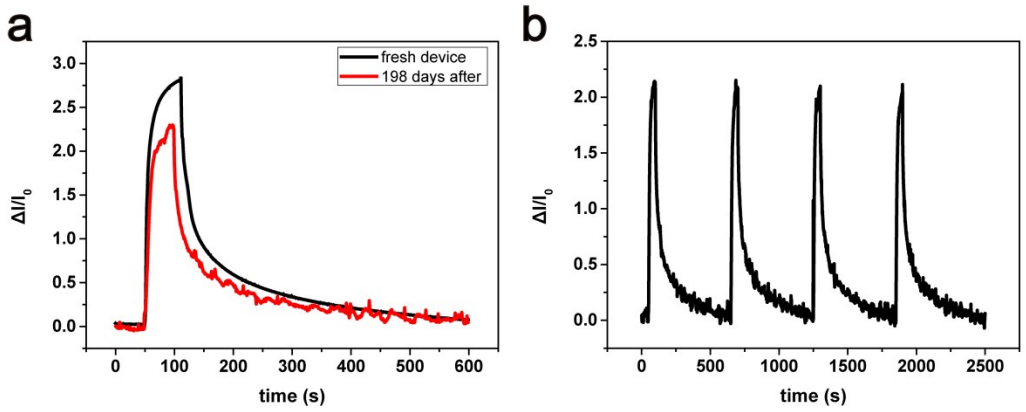

Fig. S10 The long-term stability and the repeatability of 20%-Al-NiO. (a) Sensitivity tests at concentration of 10 ppm NO_2 for fresh device and after 198 days. (b) Cycle test curve at concentration of 10 ppm NO_2 for 20%-Al-NiO after 198 days.

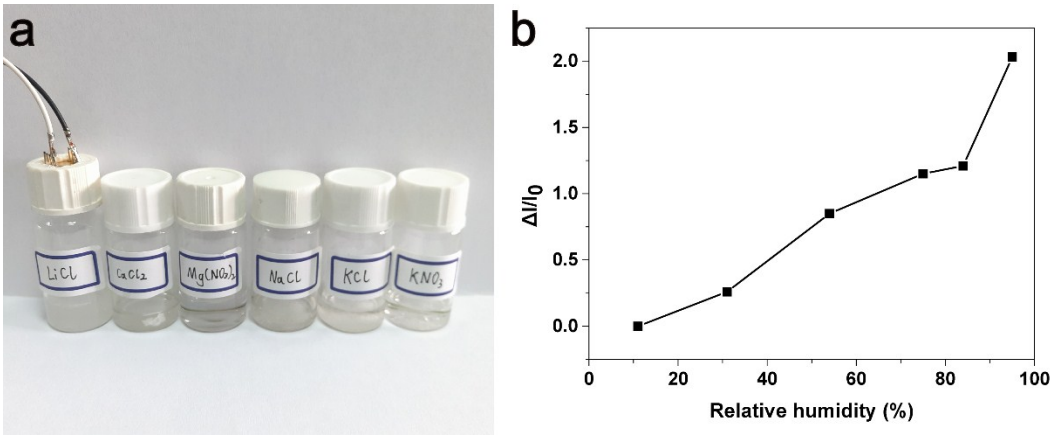

Fig. S11 (a) Devices used in the humidity tests with saturated salt solutions of LiCl, $CaCl_2$, $Mg(NO_3)_2$, NaCl, KCl and KNO_3. (b) The influence of humidity on 20%-Al-NiO.

References

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