Supporting Information

Controlled synthesis of ultrathin MoS_2 nanoflowers for highly enhanced NO_2 sensing at room temperature

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The setup for gas sensing measurement is illustrated in Fig. S1, in which we employed three mass flower controllers (MFC) for the gas mixing

In the current work, the total gas flow rate was set to 400 sccm and the standard NO_2 gas with concentration of 100 ppm balanced in nitrogen was used. To obtain the desired NO_2 concentrations we mixed the the NO_2 standard gas with press air using MFC-1 and MFC-2 with different flow rates as shown in Table. S1.

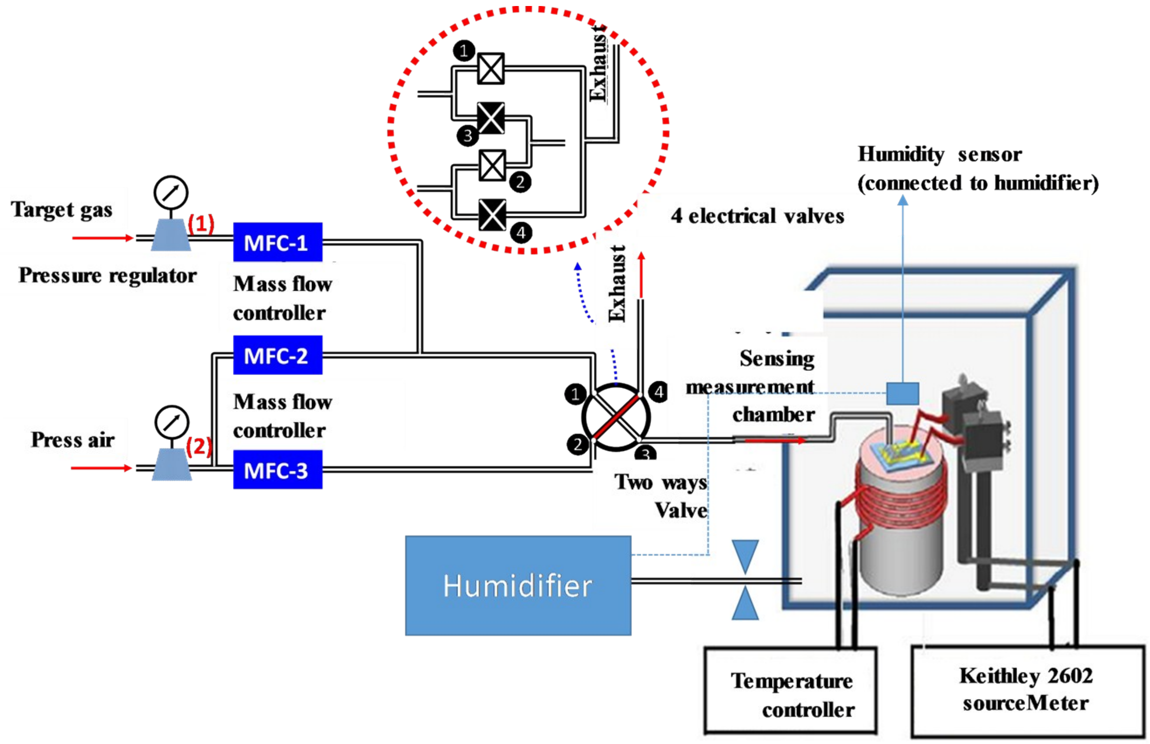

Figure S1. Schematic diagram of the gas sensing measurement setup

Table S1. NO_2 gas concentration range obtained by using mass flower controllers

MFC-3 (sccm)	MFC-2 (sccm)	MFC-1 (sccm)	Concentration (ppm)
400	396	4	1
400	390	10	2.5
400	380	20	5
400	360	40	10

The specific surface areas of the MoS_2 grown for different times were measured by using BET method by N_2 adsorption isotherm at the relative pressure (P/P_o) range of 0.05–0.3. The N_2 adsorption quantities of the synthesized MoS_2 nanostructures under different growth times of 24, 36, 48, and 60 h as a function of relative pressure are shown Figs. S2(a), (b), (c), (d), respectively.

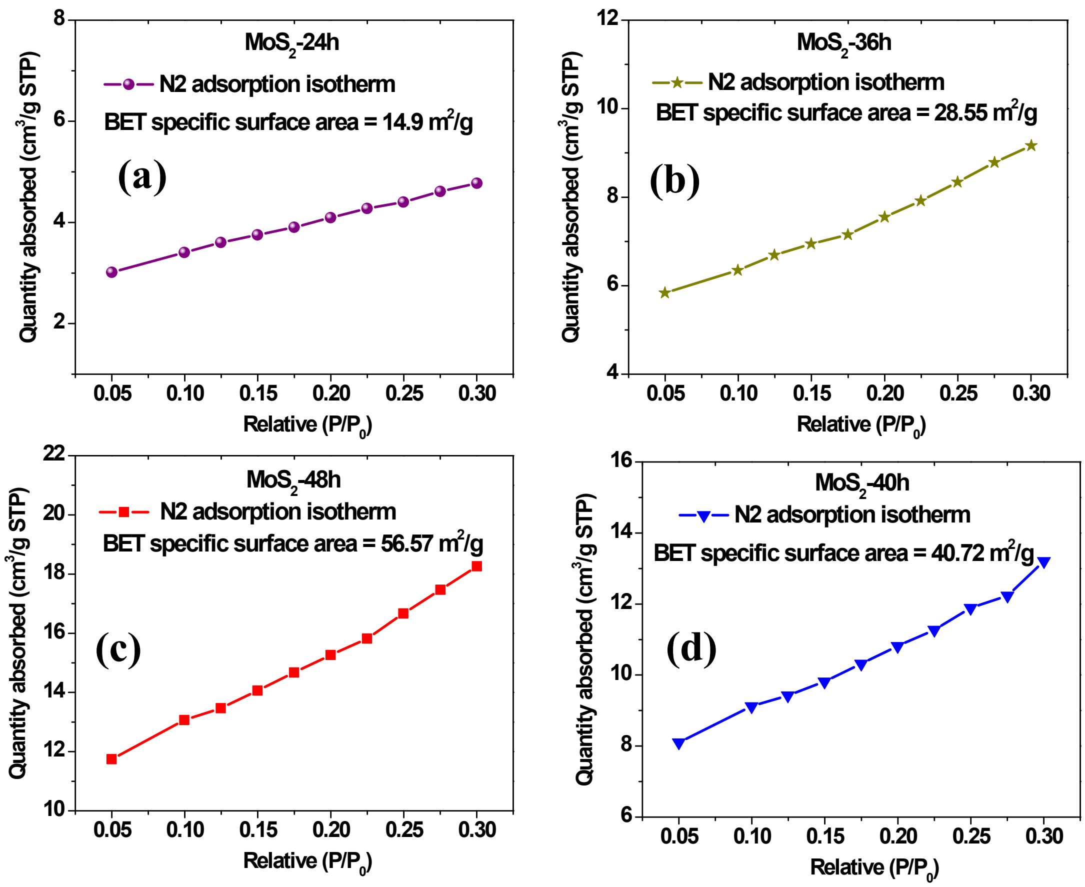

Figure S2. N_2 adsorption quantities of the MoS_2 nanostructure grown for (a) 24 h, (b) 36 h, (c) 48 h, and (d) 60 h as a function of relative pressure.

Figs. S3(a)-(d) reveal the transient resistances of the sensor based on the MoS_2 grown for 24 h to 1−10 ppm NO_2 at room temperature (RT), 50, 100, and 150 °C, respectively. The data show similar behavior compared to that of the sensor based on the MoS_2−24h sample. Namely, the resistance of the sensor decreased with increasing the temperature, indicating the semiconducting characteristics of the synthesized MoS_2. Upon an exposure to oxidizing NO_2 gas, the sensor's resistance decreased, confirmed the *p*-type semiconducting behavior. Fig. S3(e) summarizes the gas response values of the sensor based on the MoS_2–24h as a function of the NO_2 concentration. Results reveal highest gas response of the sensor to NO_2 gas reached at room temperature.

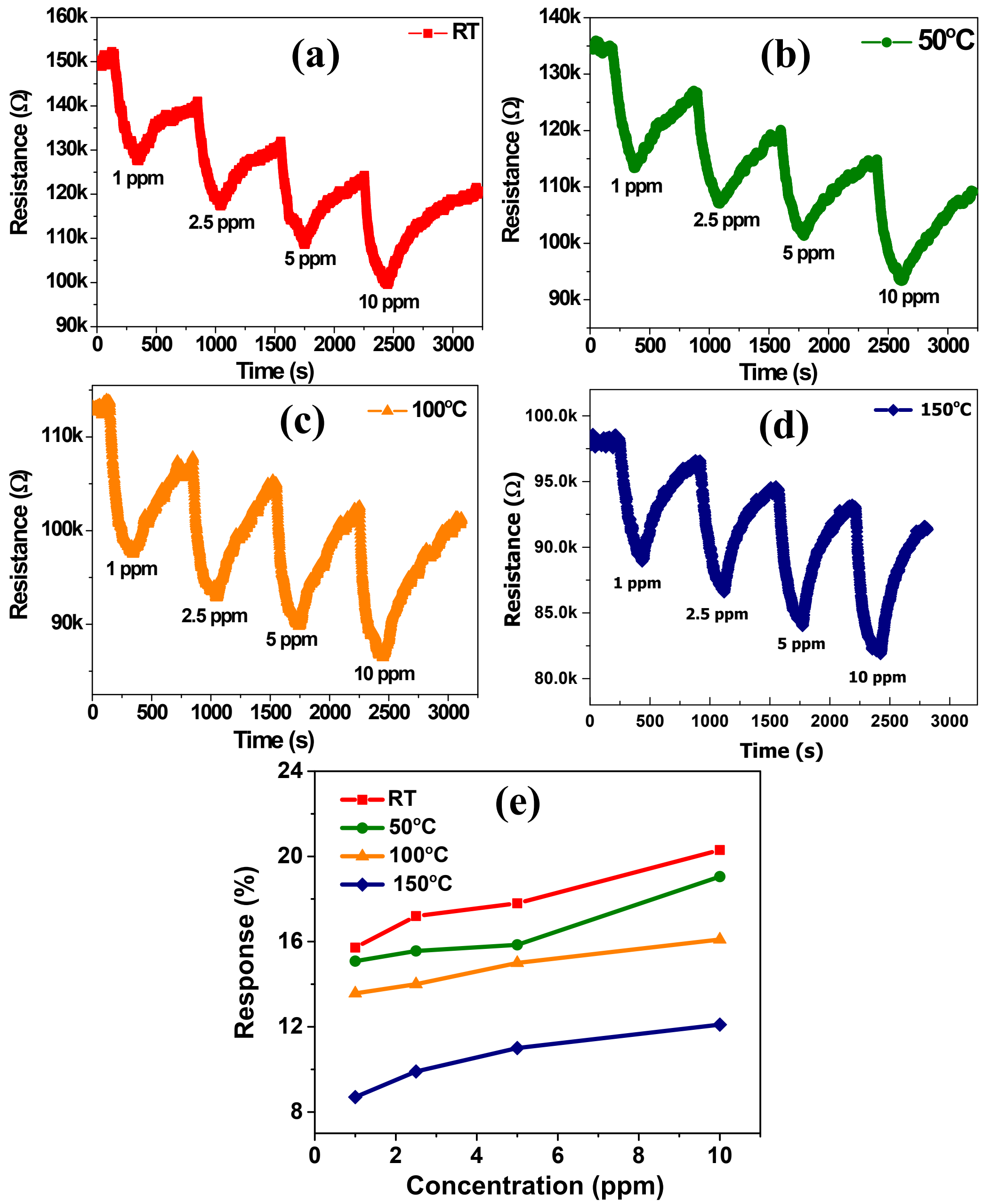

Figure S3. (a)–(d) Transient resistances of the sensor based on the MoS_2 grown for 24 h to 1–10 ppm NO_2 at RT, 50, 100, and 150 °C, respectively. (e) Gas response of the sensor as a function of NO_2 gas concentration at different temperatures.

Similarly, Figs. S4 and S5 show the NO_2 sensing results of the sensors based on the MoS_2–36h and the MoS_2–60h samples, respectively. Highest response of both samples to NO_2 gas are also obtained at room temperature.

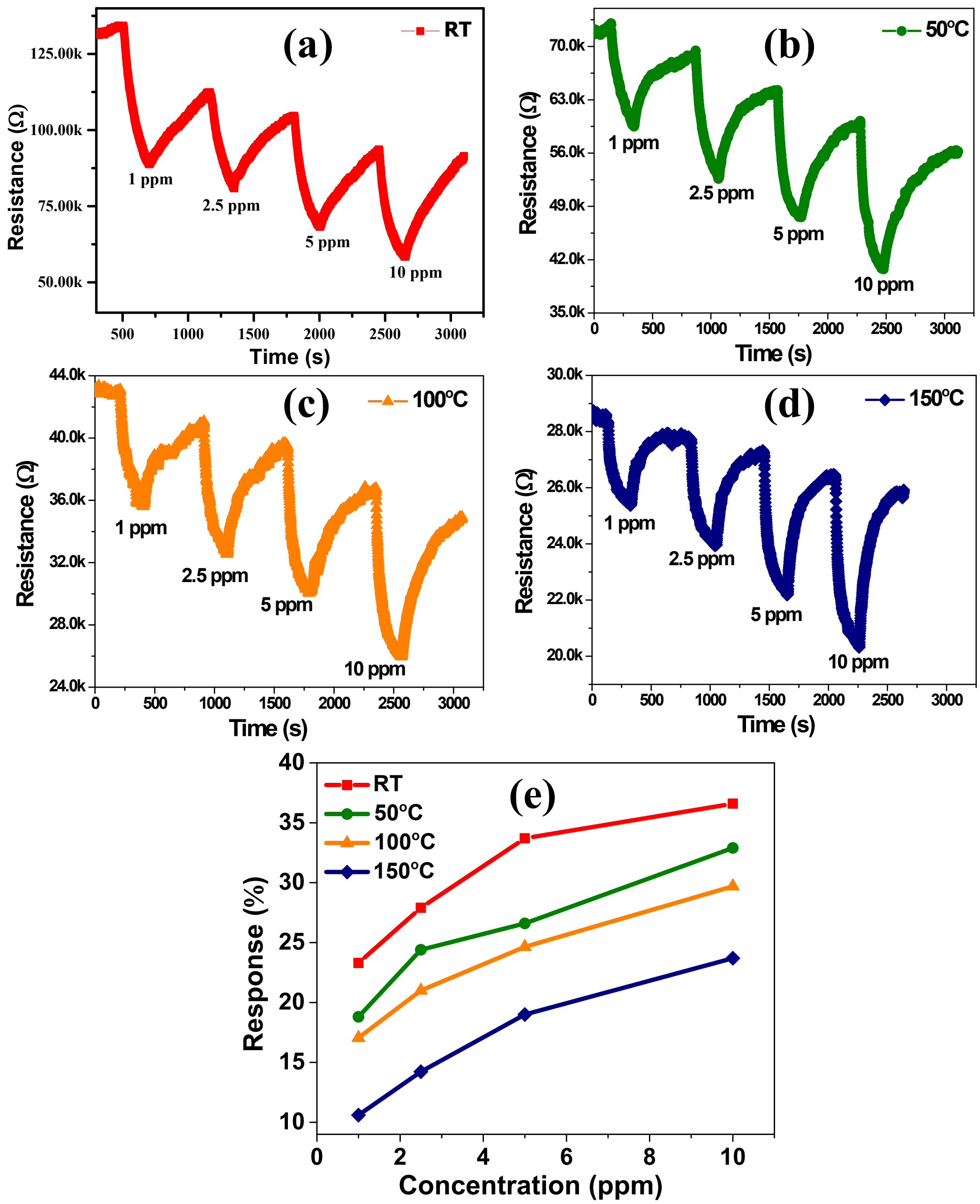

Figure S4. (a)−(d) Transient resistances of the sensor based on the MoS_2 grown for 36 h to 1−10 ppm NO_2 at RT, 50, 100, and 150 °C, respectively. (e) Gas response of the sensor as a function of NO_2 gas concentration at different temperatures.

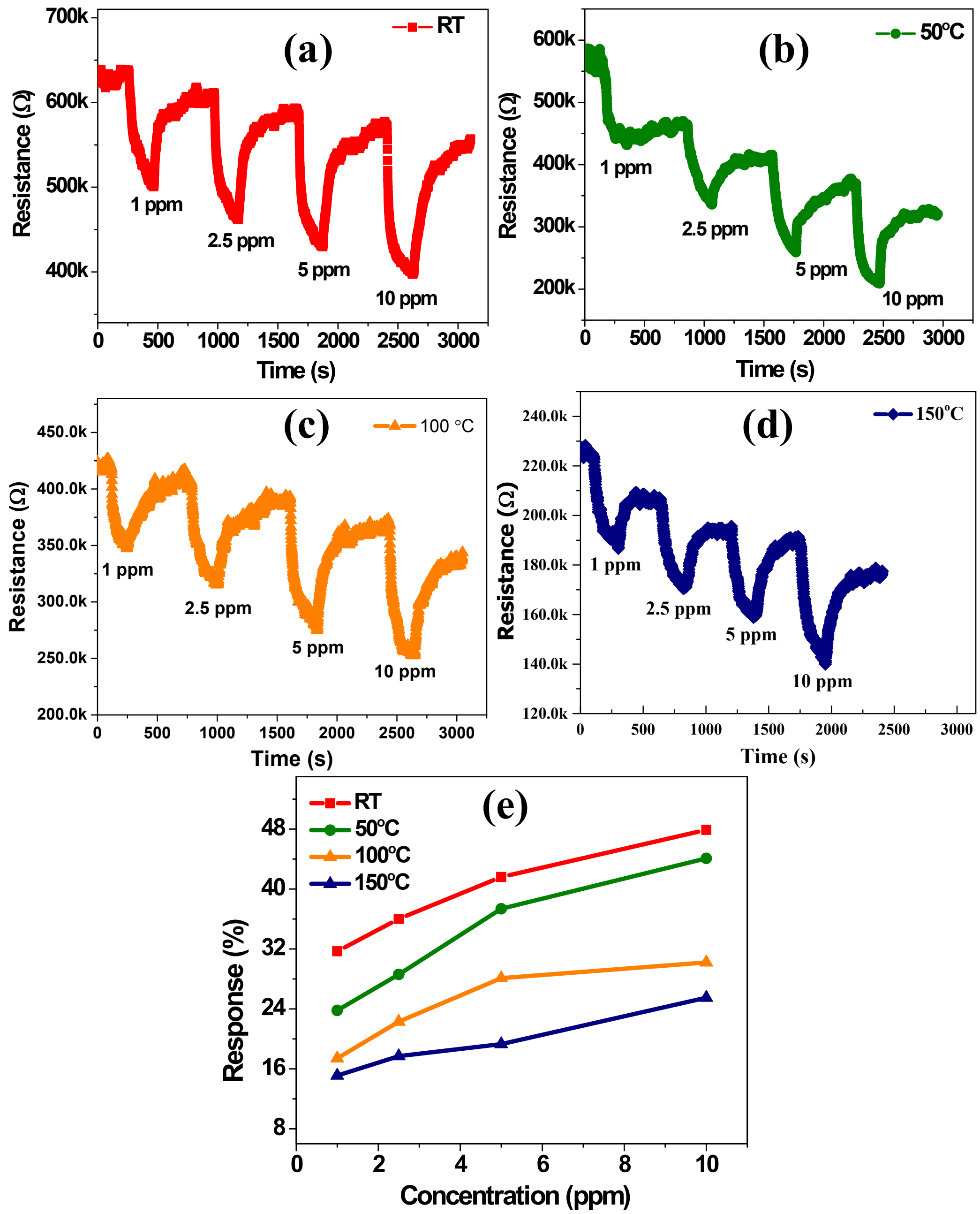

Figure S5. (a)–(d) Transient resistances of the sensor based on the MoS_2 grown for 36 h to 1–10 ppm NO_2 at RT, 50, 100, and 150 °C, respectively. (e) Gas response of the sensor as a function of NO_2 gas concentration at different temperatures.

The gas selectivity of the sensor based on the MoS2-48h was tested to various gases of both oxidizing and reducing gases of different concentrations at RT. Figs. S6 (a)-(e) exhibit the transient resistances of the sensor to NH_3, CO, H_2, CH_4, and SO_2 at RT. While Fig. S6 (f) shows the NO_2 response of the MoS_2-48h sensor at RT as a function of the relative humidity.

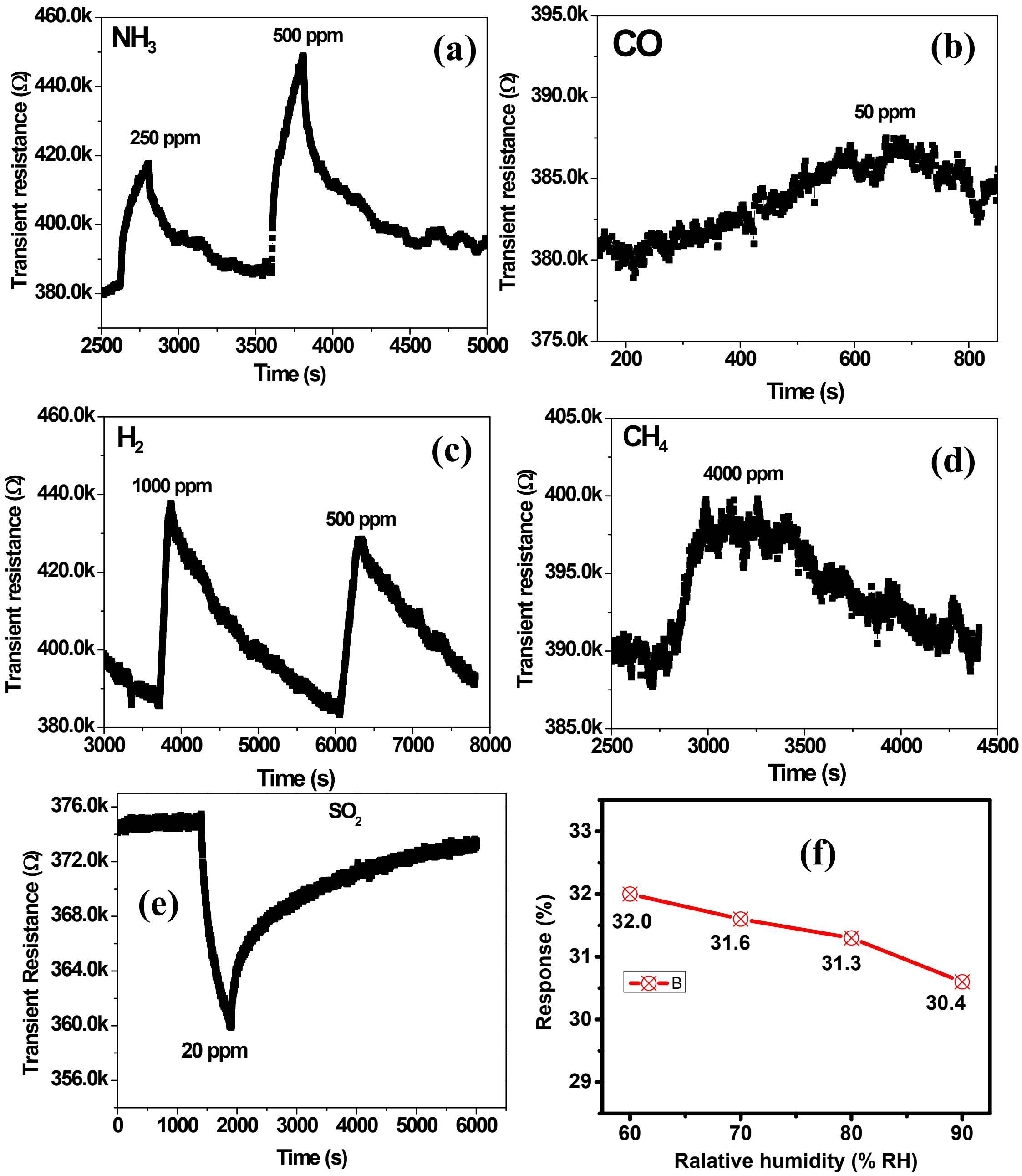

Figure S6. (a)-(e) The transient resistances of the sensor to NH_3, CO, H_2, CH_4, and SO_2 at RT. (f) NO_2 gas response of the MoS2-48h sensor at RT as a function of the relative humidity.