Electronic Supplementary Information

High sensitive and selective formaldehyde gas sensor using molecular imprinting technique based on Ag-LaFeO$_3$

Yumin Zhang$^{ab}$, Qingju Liu*$_a$, Jin Zhang$^{ab}$, Qin Zhu$^{ab}$ and Zhongqi Zhu$^{ab}$

$^a$Yunnan Key Laboratory for Micro/nano Materials & Technology, Yunnan University, 650091 Kunming, China. Email: qjliu@ynu.edu.cn

$^b$Department of Materials Science and Engineering, School of Physical Science and Technology, Yunnan University, 650091 Kunming, China
Sensitivity testing:

The export voltage of the sensor was measured by using a conventional circuit (Fig. S1f) in which the element was connected with an external resistor in series at a circuit voltage of 5 V. According to Figure 1f, the electrical resistance of sensor can be obtained as follows:

$$R = \frac{5-V_0}{V_0} \cdot R_L,$$  \hspace{1cm} (1)

where $R$ is the resistance of the sensor, $R_L$ is the constant load resistance unchanged with the surrounding gas partial pressure, and $V_0$ is the sensor export voltage. For p-type semiconductor, the gas response ($\beta$) was defined as the ratio of the electrical resistance in gas ($R_g$) to that in air ($R_a$):

$$R_g = \frac{5-(V_0)_{\text{gas}}}{(V_0)_{\text{gas}}} \cdot R_L,$$  \hspace{1cm} (2)

$$R_a = \frac{5-(V_0)_{\text{air}}}{(V_0)_{\text{air}}} \cdot R_L,$$  \hspace{1cm} (3)

$$\beta = \frac{R_g}{R_a},$$  \hspace{1cm} (4)

where $(V_0)_{\text{air}}$ is the export voltage in air, and $(V_0)_{\text{gas}}$ is in gases. The gas sensing properties were examined in a chamber through which air or a sample gases were allowed to flow at a rate of 160 cm$^3$ min$^{-1}$. The electrical response of the Ag-LaFeO$_3$ sensor was measured with an automatic test system, controlled by a personal computer (Fig. S1e).
Fig. S1 a) Structure of ceramic tube; b-c) Photographs of a sensing device, b) front view, c) side view; d) Test clip with multiple sensing devices; e) WS-30A gas sensor tester; f) Schematic drawing of gas sensor testing circuit.

Fig. S2 Relationship between sensitivity and operating temperature of a) the MINs to 1 ppm formaldehyde gas and b) the compounds to 0.5 ppm formaldehyde gas.
Fig. S3 A schematic diagram of the proposed reaction mechanism of sensors to formaldehyde: a) in air, b) in formaldehyde.

Fig. S4 Relationship of sensitivity and different concentration of formaldehyde, a) Sample-B and b) Sample-C.