Supplementary Materials

Heterojunction composite of Bi_2Se_3 nanosheets and MoO_3 nanobelts for high-performance triethylamine sensor

Xiangyun Tan[a], Li Wang[a], Xi Chen[a], Haoliang Zhang[a], Si Chen[a], Libing Qian[b], Zhiyuan Chen[b], Chunqing He[a,*]

[a]*Key Laboratory of Nuclear Solid-State Physics Hubei Province, School of Physics and Technology, Wuhan University, Wuhan, 430072, China*

[b]*Hubei Key Laboratory of Radiation Chemistry and Functional Materials, School of Nuclear Technology and Chemistry & Biology, Hubei University of Science and Technology, Xianning, 437100, China*

[*] Corresponding author.
E-mail address: hecq@whu.edu.cn (C. He).

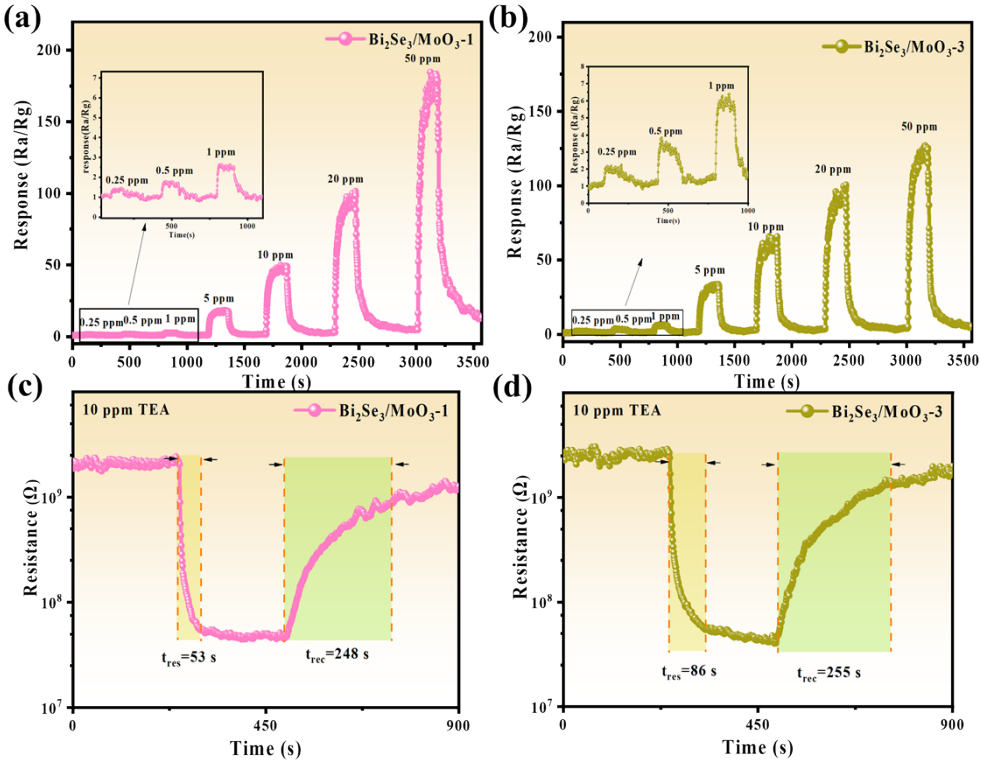

Figure S1 (a,b) Dynamic response and recovery curves of Bi_2Se_3/MoO_3-1 and Bi_2Se_3/MoO_3-3 sensor. (c,d) Response/recovery time curve of Bi_2Se_3/MoO_3-1 and Bi_2Se_3/MoO_3-3 sensor at 240 ℃.

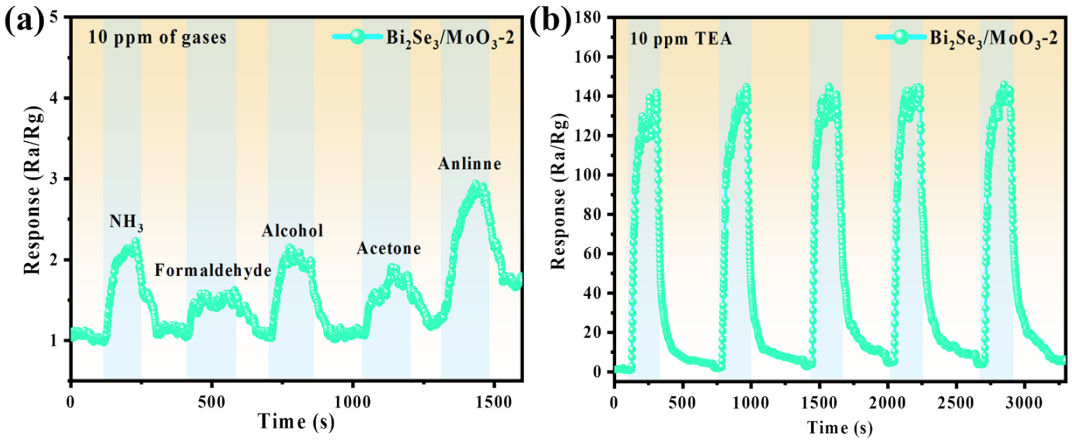

Figure S2 (a) The dynamic response/recovery curve of Bi_2Se_3/MoO_3-2 to 10 ppm various gases at 240 ℃. (b) The reproducibility of Bi_2Se_3/MoO_3-2 sensor after 30 days.

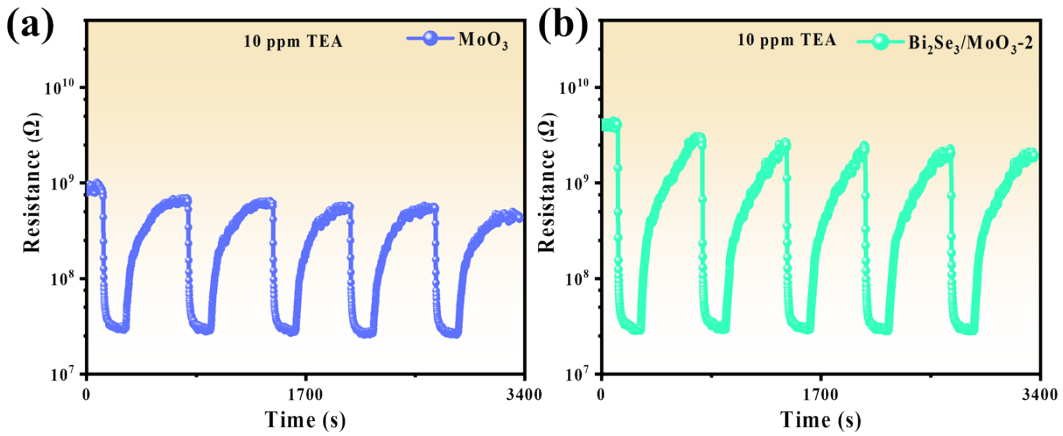

Figure S3 Dynamic resistance curves of (a) MoO_3 and (b)Bi_2Se_3/MoO_3-2 sensors for 10 ppm TEA at 240 °C.

In this experiment, liquid TEA, acetone, ethanol, aniline, ammonia, and formaldehyde were quantitatively injected into a heated plate in the test chamber (18L) using a micro-syringe to prepare the corresponding gas species. All sensor characteristics were tested in air with a relative humidity (RH) of 35%. The concentrations of the testing gas (C, ppm) were achieved through a static liquid gas distribution method, which was calculated by **Eq. (1)**:

$$V_l = \frac{V \times C \times M}{22.4 \times d \times p} \times 10^{-9} \times \frac{273 + T_r}{273 + T_b} \quad (1)$$

where ρ (g/mL^{-1}) is the density of the testing gas, V_2 (L) is the volume of the test chamber, M (g/mol^{-1}) is the molecular weight of the testing gas, M(g) is the molecular mass of the liquid, d(g/cm^3) is the density of the liquid, T_r represents the room temperature (°C), and T_b represents the temperature inside the test chamber (°C).

The limit of detection (LoD) of TEA gas is studied by linear extrapolation of the response sensitivity as a function of TEA concentration LoD. **The calculating formula of the LoD:**

$$\mathrm{LOD_{ppm}}=\frac{3S}{K}=\frac{3}{K}\sqrt{\frac{\sum_{i=1}^{n}(X_i-\bar{X})^2}{n}} \quad (2)$$

where **S** refers to the root mean square of the baseline before target gas exposure, and **K** is the slope of the fitting line.

In Bi_2Se_3/MoO_3-2 work, S=0.02751, K=14.92051, LOD=5.5 ppb.

In MoO_3 work, S=0.06256, K=3.13271, LOD=59.9 ppb.

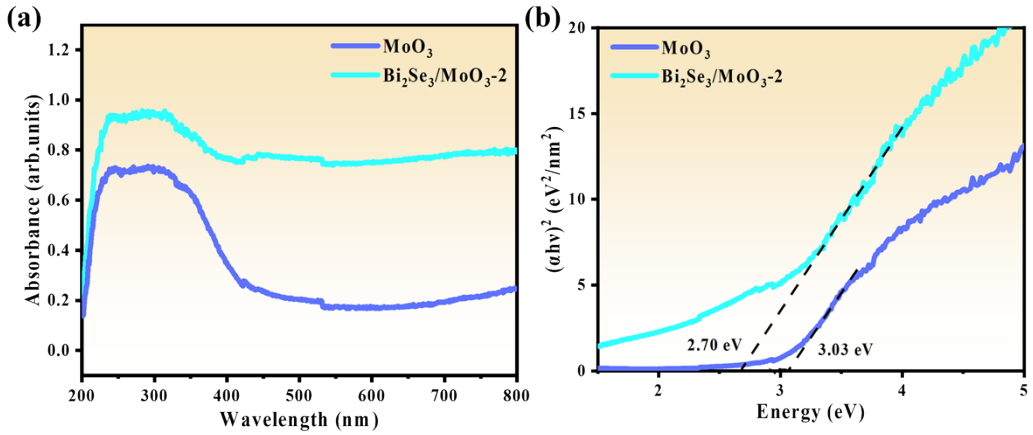

Figure S4 (a) UV-vis diffuse reflectance spectra and (b) the plot of $(\alpha h\upsilon)^2$–$(h\upsilon)$ of MoO_3 and $BiSe_3/MoO_3$-2.

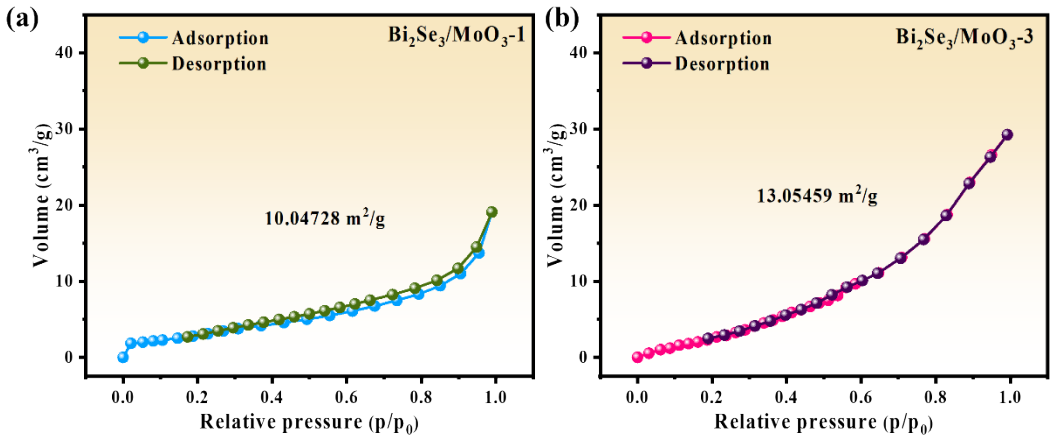

Figure S5 (a,b) Nitrogen adsorption/desorption isotherms of Bi_2Se_3/MoO_3-1 and Bi_2Se_3/MoO_3-3.