chemosensors

MDPI

Supplementary Material

Quantum Dots-Sensitized High Electron Mobility Transistor (HEMT) for Sensitive NO_2 Detection

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Calculation of the Electron Mobility

The electron mobility can be calculated as follows:

$$\mu_{\mathrm{n}} = \frac{L}{WC_{\mathrm{i}}V_{\mathrm{DS}}} \cdot \frac{\partial I_{\mathrm{D}}}{\partial V_{\mathrm{G}}} \quad \text{(S1)}$$

where W and L are the width and length of the gate, μ_n is the electron mobility, C_i is the capacitance per unit area of the $Al_{0.3}Ga_{0.7}As$ barrier. The aspect ratio of the channel is L/W = 40/200 = 0.2, the capacitance per unit area for the 25 nm $Al_{0.3}Ga_{0.7}As$ barrier was calculated to be 4.26×10^{-3} F/m^2, and $\frac{\partial I_{\mathrm{D}}}{\partial V_{\mathrm{G}}}$ is the slope of the transfer characteristic curve in the linear region shown in Figure S2. The electron mobility was calculated to be 4.86×10^3 cm^{2}V^{-1}s^{-1} using Equation (S1).

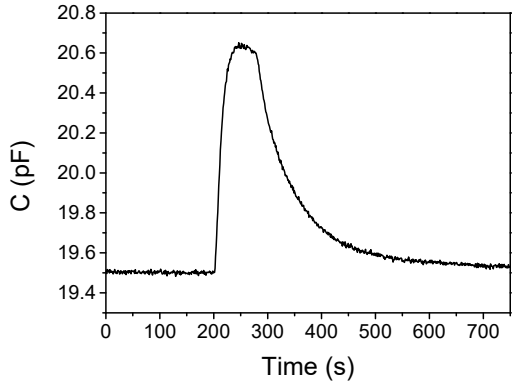

Figure S1. The gate-drain capacitance, C_{GD}, in response to 5 ppm NO_2.

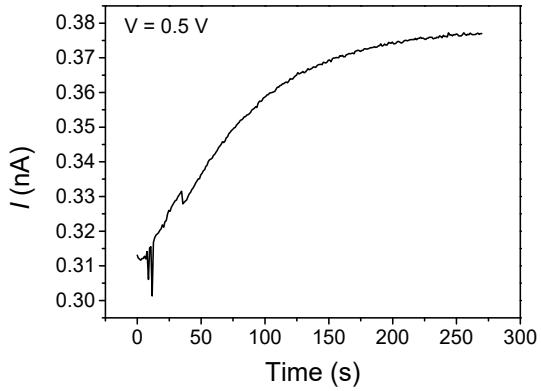

Figure S2. Leakage current test of the PbS CQD film.

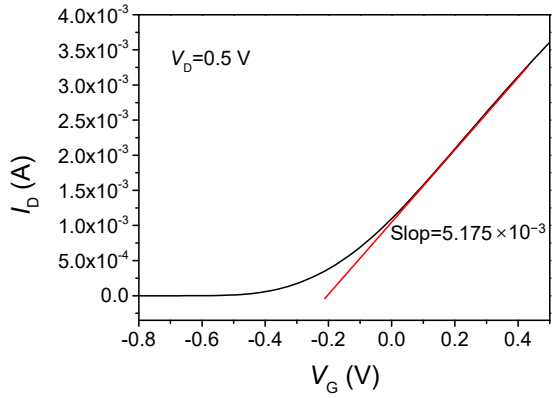

Figure S3. I_D-V_G curve of the GaAs HEMT.

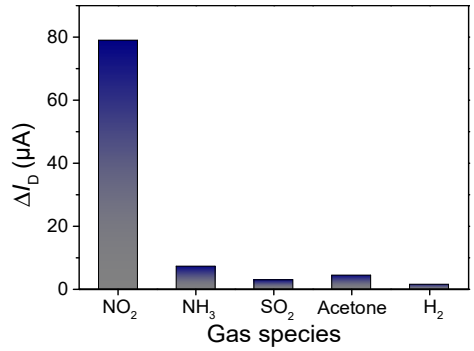

Figure S4. Response of the sensor to different target gases at room temperature.

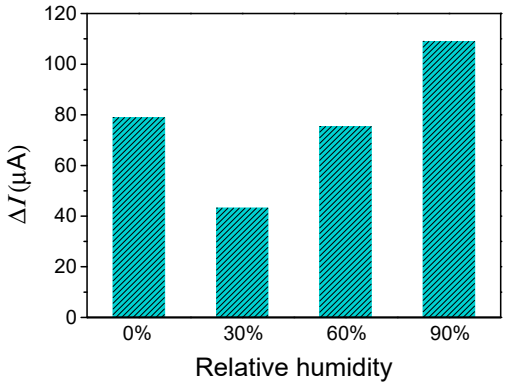

Figure S5. The sensor's response to 1.25 ppm NO_2 was tested under relative humidity ranging from 0 to 90%.