

Supplementary Materials

ZnS Quantum Dot Based Acetone Sensor for Monitoring Health-Hazardous Gases in Indoor/Outdoor Environment

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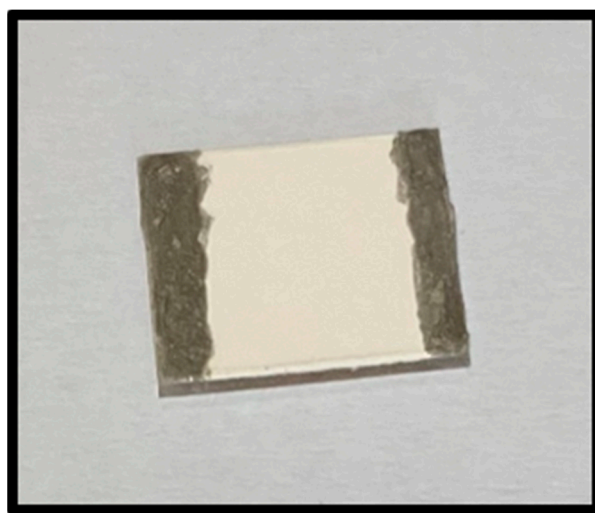


Figure S1. Digital image of the ZnS QDs sensor.

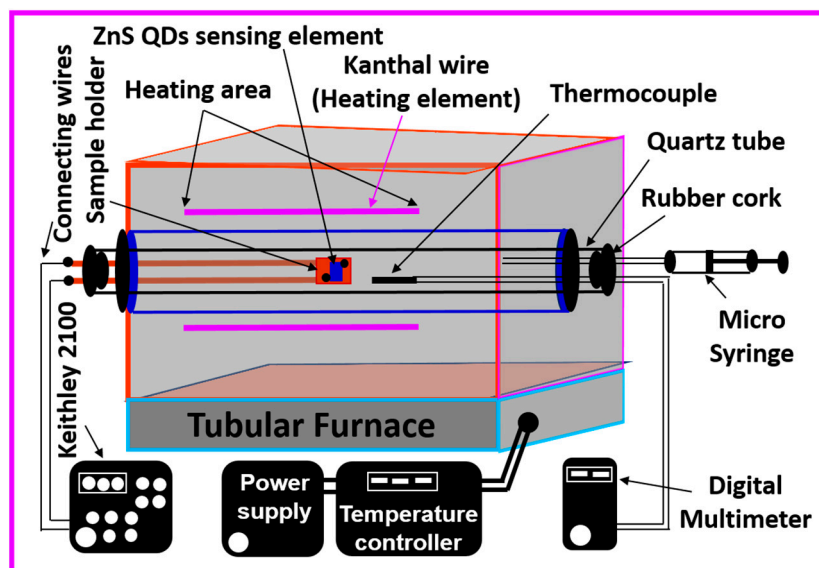


Figure S2. Schematic view of static gas sensing setup.

The theoretical detection limit of the ZnS QDs acetone sensor is calculated at 175 °C using the following relation Equation S1 [1];

$$DL = 3 \frac{rms_{noise}}{k} \quad (S1)$$

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where k is the slope of logarithm plot [Fig. S3], and rms_{noise} is the root-mean-square deviation on the baseline, as discussed in Equation S2;

$$rms_{noise} = \sqrt{\frac{\sum (y - y_i)^2}{N}} \quad (S2)$$

where y is the baseline data points, y_i is the average of baseline data points, and N is the number of data points (here, we took five data points).

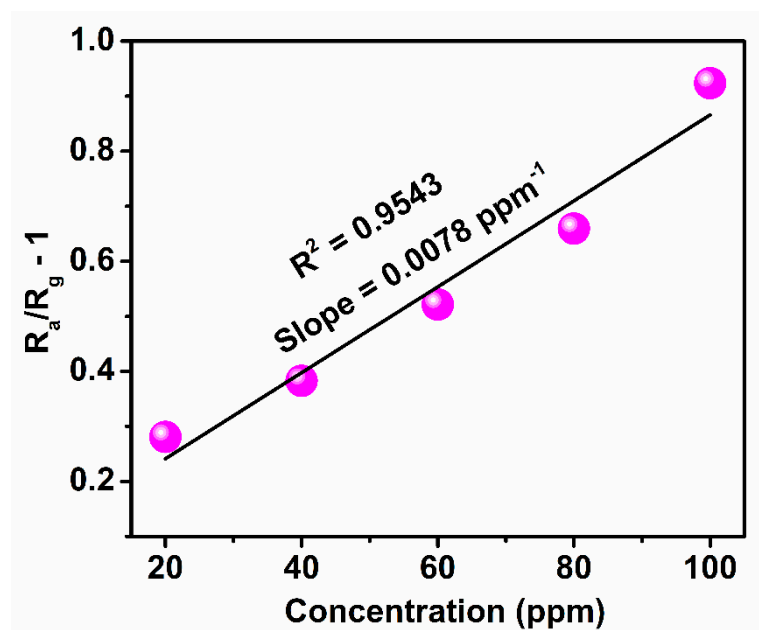


Figure S3. Response vs. concentration plot of the ZnS QDs acetone sensor.

Table S1. Comparative study of the acetone gas sensor based on ZnS nanostructures and metal-oxide nanomaterials.

| Sensing Materials | Operating Temperature (°C) | Acetone (ppm) | Sensitivity | Response Time | Recovery Time | Detection limit | Stability / Selectivity | Ref. |
|--|----------------------------|---------------|-------------|---------------|---------------|-----------------|------------------------------|-----------|
| ZnS QDs | 175 | 100 | 92.4 % | 5.5 s | 6.7 s | 1.2 ppm | 89.1% (30 days) / 91.1 % | This work |
| ZnS nanowires | 320 | 100 | 21.2 | ~ 30 s | ~ 45 s | -- | -- / 21.1 | 2 |
| Au-ZnS | 260 | 100 | 84.4 % | -- | -- | -- | -- / -- | 3 |
| ZnO@ZnS core/shell | 300 | 500 | ~ 9.6 | ~ 10 s | ~ 16 s | -- | Cycling for 550 s /- | 4 |
| Cr ₂ O ₃ -ZnS | 300 | 200 | ~ 11 | -- | -- | -- | -- / -- | 5 |
| 20Nb-WO ₃ | 325 | 1 | ~ 16 | ~ 7 s | ~ 625 s | -- | ~ 14.3 (18 days) / 22.3 | 6 |
| TiO ₂ /α-Fe ₂ O ₃ | 300 | 300 | ~ 34 | ~ 22 s | ~ 86 s | -- | ~ 23 (30 days) / 23 | 7 |
| NiO/ Zn ₂ SnO ₄ | 300 | 100 | ~ 50 | ~ 1 s | ~ 60 s | < 100 ppb | ~ 5 cycles for 1000 s / 49.6 | 8 |
| Co ₃ O ₄ | 200 | 100 | ~ 8.61 | ~ 43 s | ~ 92 s | -- | ~ 8.5 (10 days) / 8.61 | 9 |
| SnO ₂ /ZnSnO ₃ | 290 | 300 | ~ 53 | ~ 5 s | ~ 115 s | -- | ~ 31 (30 days) / 32 | 10 |

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