Electronic supplementary information

Excellent gas sensing and optical properties of single-crystalline cadmium sulfide nanowires

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The schematic structure of the CdS NWs gas sensor was shown in Fig. S1. The obtained paste containing CdS was coated on the ceramic tube with a pair of gold electrodes to form a sensing film, and there were two Pt lead wires attaching to those electrodes to be used as electrical contacts. Ni–Cr resistance wire was used as a heater and the sensor work temperature can be controlled by the currents passed through the wire.

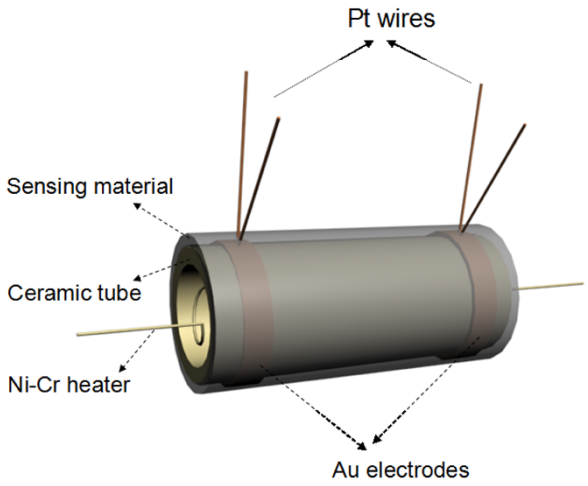

Fig. S1 Schematic structure of the CdS NWs gas sensor.

The low concentration ethanol gas is prepared by two steps. Take 2 ppm ethanol gas for example:
Firstly, 2.39 μl ethanol liquid was injected into a glass bottle (1 L) full of air using a microinjector. Then, the liquid vapored and fully mixed with the air, forming gas mixture which contained ethanol gas with high concentration (1000 ppm). Secondly, 2 ml of the obtained gas mixture was added into another glass bottle (1 L) which is also full of air. In this way, ethanol gas with a concentration as low as 2 ppm was obtained.

The flow diagram of the CdS NWs-based PD fabrication is shown in Fig. S2. Firstly, the planar-interdigitated Au electrodes were deposited on the quartz substrate by magnetron sputtering method after a standard photolithography process. Both the finger width and the separation distance between the electrodes were 30 μm, and the total active area A was 0.886 mm^2. Secondly, some CdS

NWs were dispersed in a suitable amount of water to form a yellow suspending liquid through sonication. Finally, a few drops of the resulting suspensions were dropped onto the Au electrodes and a CdS NWs-based PD was obtained after the water evaporated. The surface of substrate is very smooth and water evaporates easily, so the contact of between CdS NWs and Au electrodes is good.

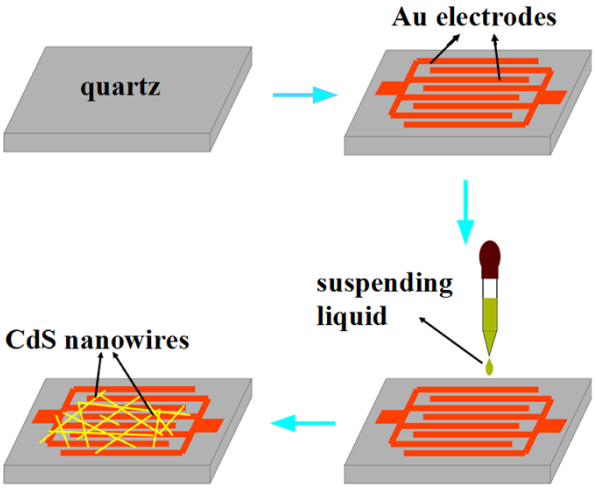

Fig. S2 The flow diagram of the CdS NWs-based PD fabrication.

In order to determine the optimum operating temperature, the sensitivity of the CdS NW-based gas sensors to 100 ppm ethanol gas in air were tested as a function of operating temperature. The results are shown in the following Fig. S3. We found that the sensitivity of the gas sensor varied with operating temperature. The response first increased with temperature, up to 206 °C, and then gradually decreased. The device exhibits the highest sensitivity value towards ethanol of about 14.9 at 206 °C. 206 °C was, therefore, determined to be the optimum operating temperature.

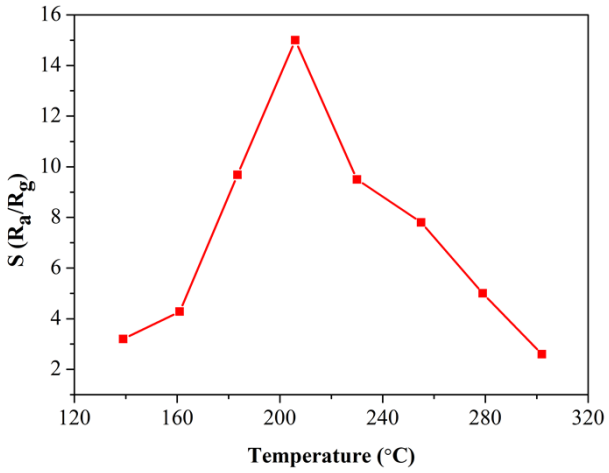

Fig. S3 Sensor sensitivity vs. operating temperature of the synthesized CdS NW gas sensor.