Supplementary Information for

H_2S detection at low temperatures by Cu_2O/Fe_2O_3 heterostructure ordered array sensors

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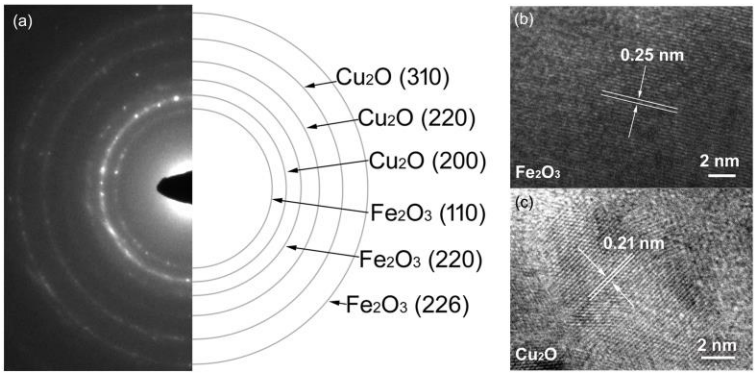

Fig. S1. (a) SAED pattern of Cu_2O/Fe_2O_3 heterostructure ordered arrays, the diffraction rings are corresponding to Cu_2O and Fe_2O_3. (b) and (c) are HRTEM images of Fe_2O_3 and Cu_2O.

The selected area electron diffraction (SAED) pattern of Cu_2O/Fe_2O_3 heterostructure ordered arrays (Fig. S1a) demonstrates a typical ring structure characteristic for polycrystalline materials and agrees well with the structure of Cu_2O and Fe_2O_3. The atomic planes (200), (220), (310) of Cu_2O and (110), (220), (226) of Fe_2O_3 can be fully indexed. The high resolution transmission electron microscopy (HRTEM) images of Cu_2O/Fe_2O_3 heterostructure ordered arrays was characterized and supplied in Fig. S1b and c. The spacings of the fringes were measured to be 0.25 nm for Fe_2O_3 and 0.21 nm for Cu_2O, corresponding to the (110) plane of Fe_2O_3 and the (200) plane of Cu_2O. The results well agree with the SAED.

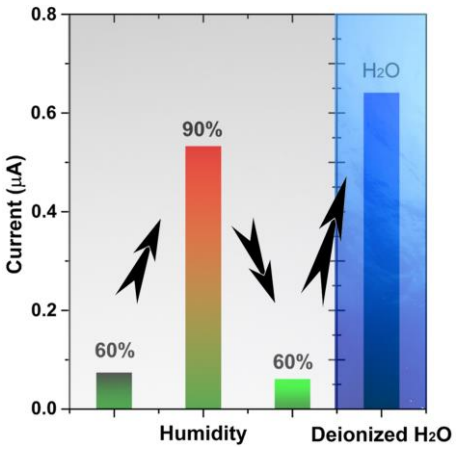

Figure S2. The conductance change of the sensor based on Cu_2O/Fe_2O_3 heterostructure ordered array as humidity increases from 60% to 90% and falls back to 60%, as well as the sueface of the sensor covered by deionized H_2O. The bias voltage is 20 V.

During the H_2S sensing test, the humidity of analyte H_2S was kept in range of 50 ±10%. To evaluate the influence of humidity on H_2S sensing, a series of humidity sensing based on Cu_2O/Fe_2O_3 heterostructure ordered array were done within a relative humidity of 60%-90% under a bias voltage of 20 V at room temperature, as well as deionized water condations.

During the testing process, the humidity in the test chamber was pre-adjusted to 60%, then the sensor was put in and tested. Upon completion of testing, the sensor was removed to the atmospheric environment (humidity: ~50%). The repeat tests were carried out when the humidity adjusted to 90% and 60%, respectively. Finally, the response to deionized water of the same sensor was characterized.

As shown in Fig. S2, the conductance increases slightly as the humidity varying from 60% to 90%, and the conductance restore to initial state as the humidity falls back to 60%. Even the surface of the sensor is covered by deionized water, the conductance still keep the same order of magnitude with that of 60% humidity. Therefore, we can conclude that the response of the sensor to humidity within a range of 40-60% is limitied. This is to say that the conductance change of the sensor caused by the varying humidity could be ignored compared with the response of H_2S.