Supplementary Materials

ZnO structures with surface nanoscale interfaces formed by Au, Fe_2O_3, or Cu_2O modifier nanoparticles: characterization and gas sensing properties

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S1. Results – Material characterization

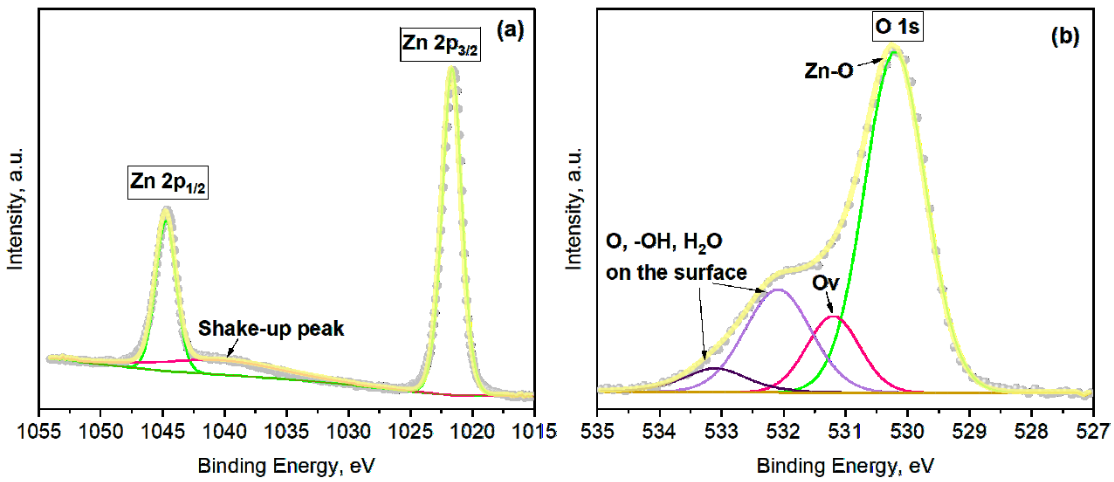

Figure S1. (a) Zn 2p, and **(b)** O 1s core levels XPS spectra for non-modified ZnO film. Grey dots represent the raw data, the solid yellow line corresponds to the envelope/fitting curve, and the other colored curves to the deconvoluted components.

The Zn 2p core-level spectrum recorded on non-modified ZnO film showed good agreement with the literature [1], proving the presence of Zn^{2+} state of zinc, with two main peaks at 1021.6 eV and 1044.7 eV that corresponds to the Zn $2p_{3/2}$ and Zn $2p_{1/2}$ peaks (**Figure S1a**), respectively, with the binding energy separation of 23.1 eV. Additional peak located at 1040.2 eV is related to the shake-up peak.

The O 1s XPS spectrum (**Figure S1b**) presents an asymmetric curve as reported earlier in the literature [2]. After the deconvolution, four different components are determined that indicate the presence of different oxygen species. The component centered at 530.2 eV is attributed to O^{2-} ions in the Zn-O bonding. The component at 531.2 eV is associated to O^- and O_2^- ions in the oxygen-deficient regions – oxygen vacancies. The components at 532.1 eV and 533.1 are connected to the presence of weak bonds from the physical or chemical adsorbed oxygen, hydroxides, and H_2O on the surface of ZnO film [3] [4] [5] [6].

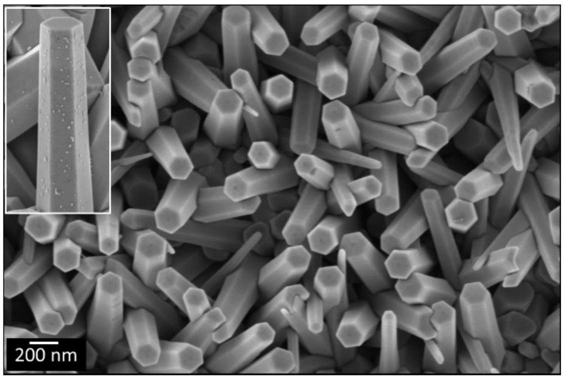

Figure S2. SEM images of the Ag@ZnO structured film (the inset shows a magnified image of a single Ag-modified ZnO rod).

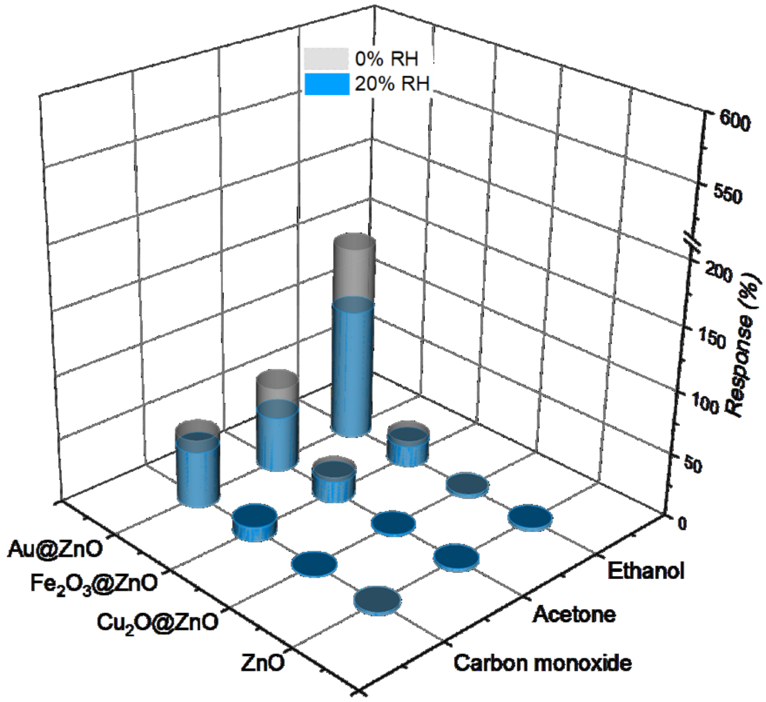

Figure S3. Responses towards 80 ppm of ethanol, acetone, carbon monoxide for the ZnO, Au@ZnO, Fe_2O_3@ZnO, and Cu_2O@ZnO sensors at 0% and 20% RH.

References:

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