Phosphonic Acid Modified ZnO Nanowire Sensors: Directing Reaction Pathway of Volatile Carbonyl Compounds

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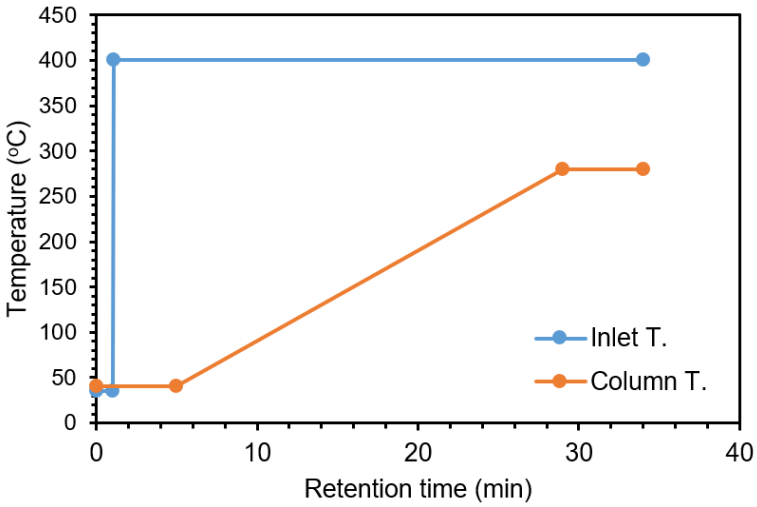

Figure S1. The temperature program for desorbed gas analysis by GC-MS.

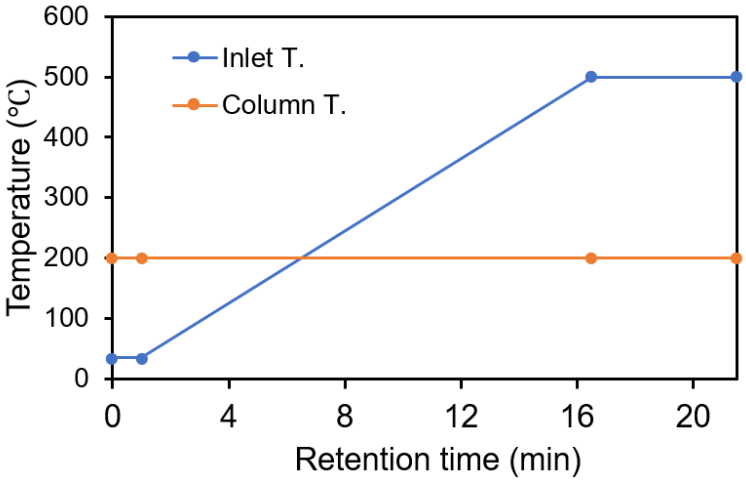

Figure S2. The temperature program for desorbed gas analysis by TPD/MS.

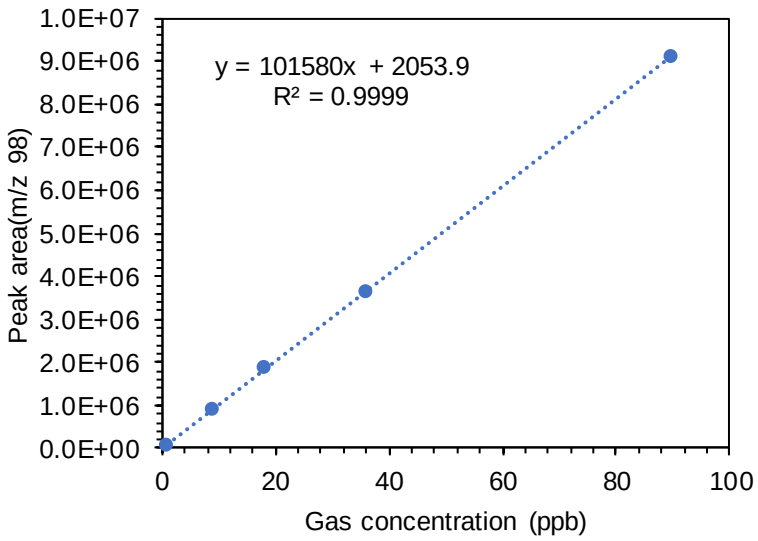

Figure S3. Nonanal concentration calibration by gas chromatograph mass spectroscopy (GC-MS).

The detailed calibration method is presented as follows. Firstly, different concentration of nonanal solutions (0.1mM, 1mM, 2mM, 4mM, 10mM, solvent: methanol) were utilized. Then 4 μL of the above solution was injected into the inlet chamber of GC-MS. The integral area of the peak m/z: 98 was be utilized to calculate nonanal concentration. Figure S3 plotted the integral area of the peak m/z: 98 that varied with nonanal concentration. For the bubbling nonanal gas, 10 mL nonanal gas was collected and injected into GC-MS to get the peak area. Then, according to the obtained calibration curve, the concentration of the nonanal bubbling gas can be quantitatively measured.

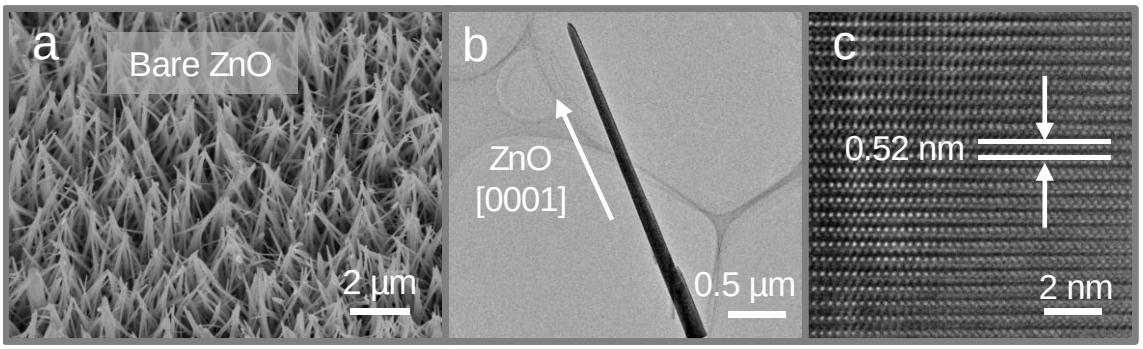

Figure S4. (a) A SEM image of ZnO nanowire grown by the hydrothermal method. (b) TEM images of ZnO nanowire. (c) A high-resolution TEM (HR-TEM) image of ZnO nanowire.

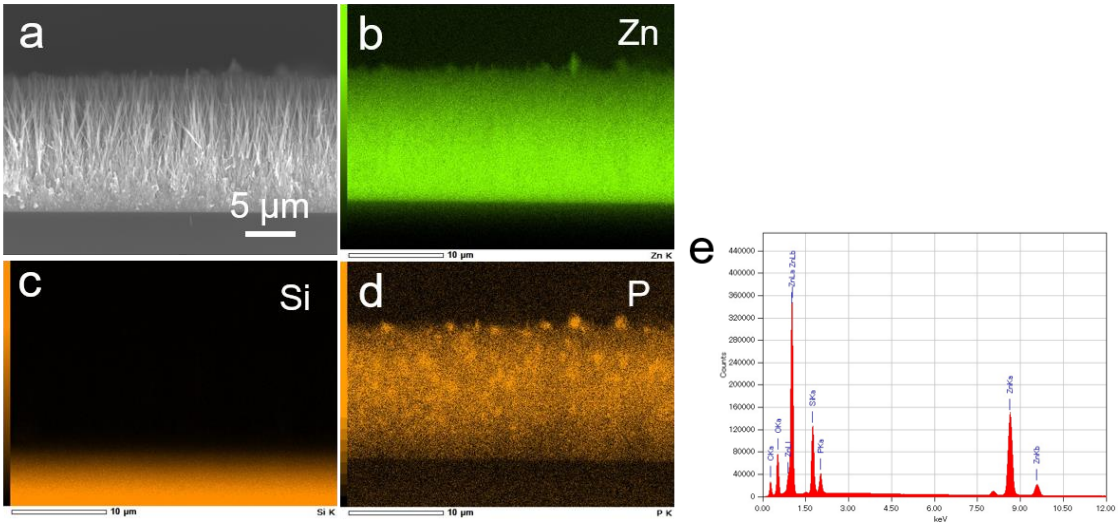

Figure S5. (a) SEM image of the MPA-modified ZnO nanowire array. (b-d) EDS elemental mapping images. (e) The spectrum of 1.0 mM MPA modified ZnO nanowires array (cross section).

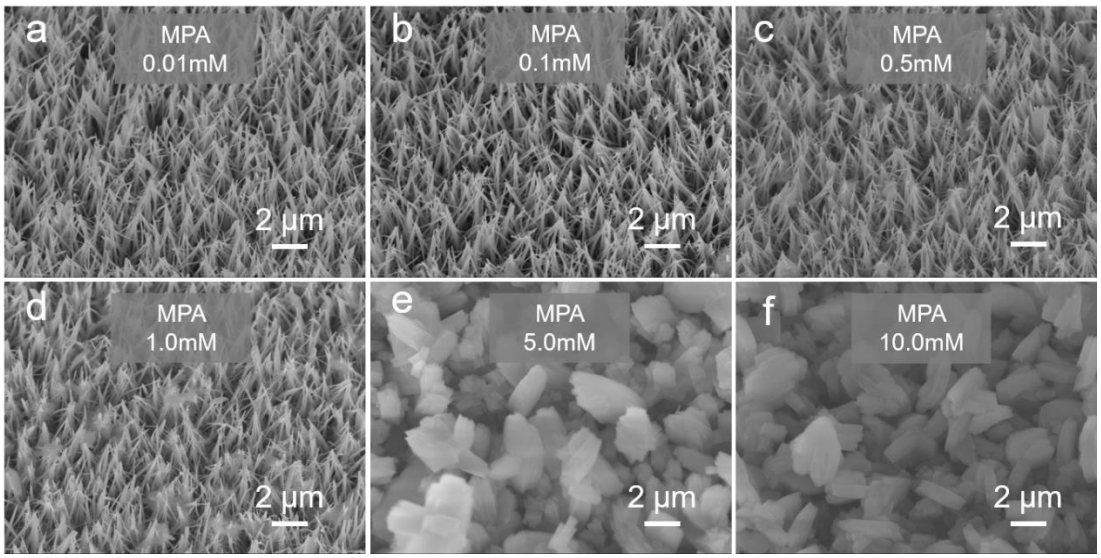

Figure S6. SEM images of ZnO nanowire arrays after immersed in (a) 0.01 mM, (b) 0.1 mM, (c) 0.5 mM, (d) 1.0 mM, (e) 5.0 mM, and (f) 10.0 mM of MPA solutions.

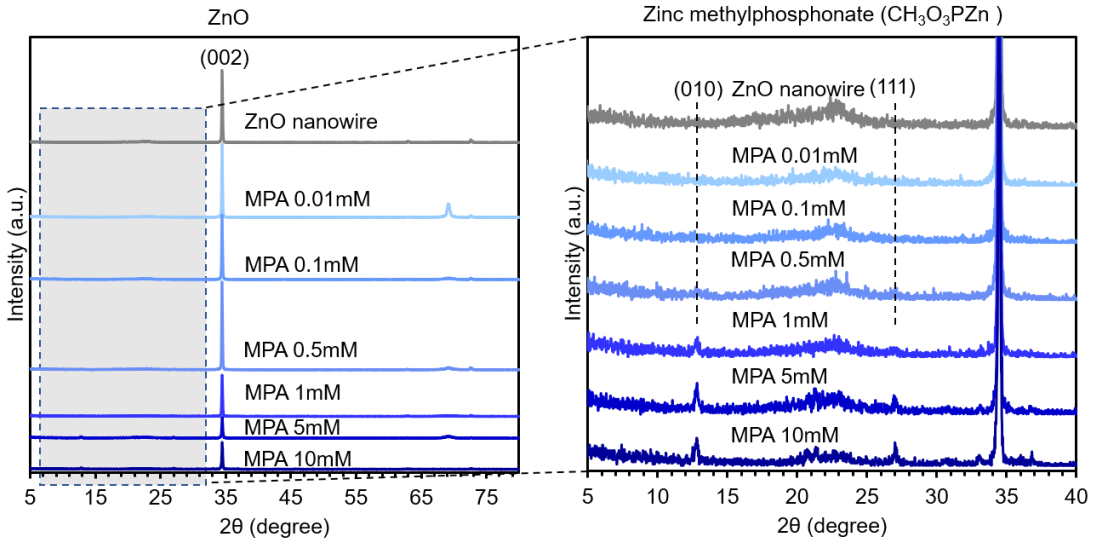

Figure S7. XRD profiles of of ZnO nanowire arrays immersed in various concentration of MPA solutions.

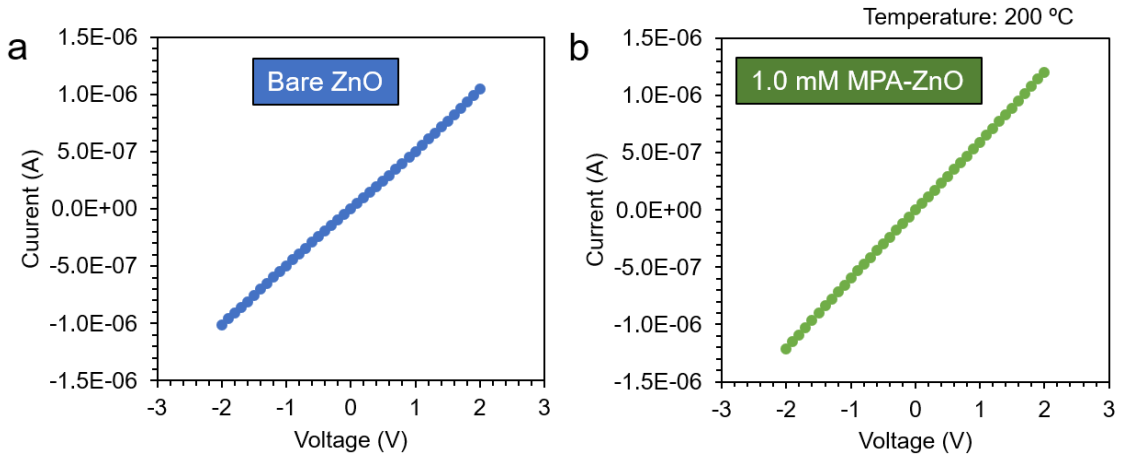

Figure S8. I-V curves of (a) bare ZnO devices, and (b) MPA modified ZnO nanowire devices (1.0 mM).

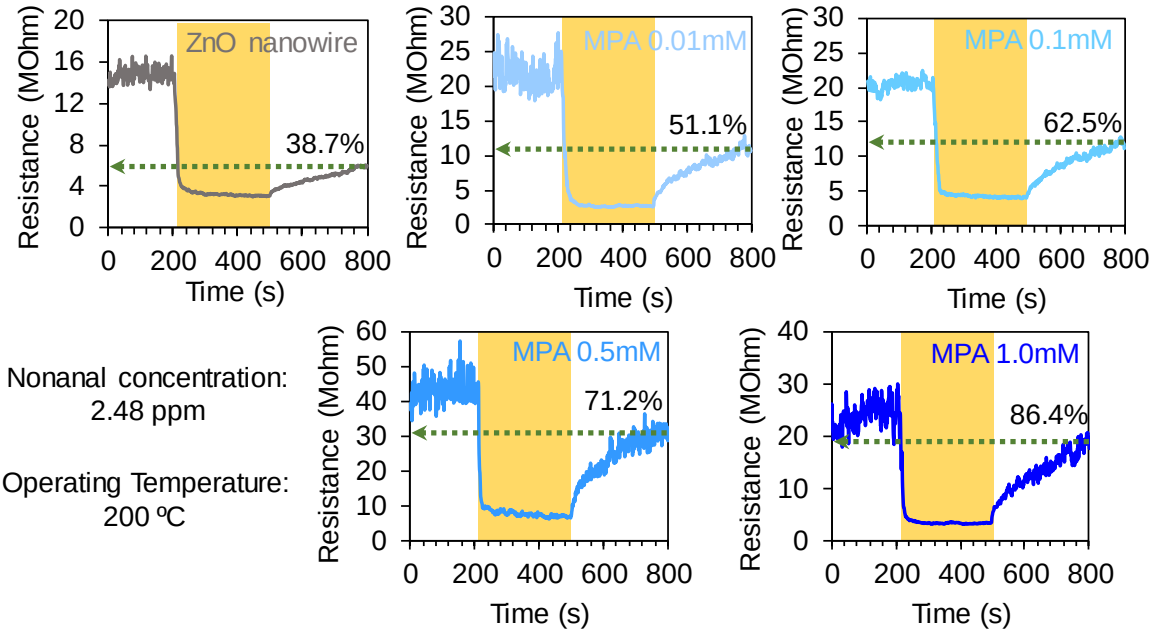

Figure S9. Resistance traces of the sensor devices under alternating flow of pure N_2 (white region) and 2.48 ppm nonanal in N_2 (yellow region), for ZnO nanowires modified by MPA in various concentration conditions (0.01–1.0 mM). The percentage noted in each figures are recovery rates. Recovery rate is defined as the ratio of the resistance value against the original resistance value after the sample was exposed to nonanal for 200 sec and then exposed to pure N_2 flow for 250 sec.