# Supporting Information

# Ultra-Sensitive Room-Temperature Operable Gas Sensors using p-Type Na:ZnO Nanoflowers for Diabetes Detection

*Rawat Jaisutti[1,2,†], Minkyung Lee[3,†], Jaeyoung Kim[3], Seungbeom Choi[3], Tae-Jun Ha[4], Jaekyun Kim[5], Hyoungsub Kim[2], Sung Kyu Park[6,\*], and Yong-Hoon Kim[2,3,\*]*

[1]Department of Physics, Faculty of Science and Technology, Thammasat University, Pathum Thani, Thailand

[2]School of Advanced Materials Science and Engineering, Sungkyunkwan University, Suwon, Korea

[3]SKKU Advanced Institute of Nanotechnology (SAINT), Sungkyunkwan University, Suwon, Korea

[4]Department of Electronic Materials Engineering, Kwangwoon University, Seoul, Korea

[5]Department of Photonics and Nanoelectronics, Hanyang University, Ansan, Korea

[6]School of Electrical and Electronic Engineering, Chung-Ang University, Seoul, Korea

**\*Corresponding authors**:

E-mail: yhkim76@skku.edu

E-mail: skpark@cau.ac.kr

Table S1. Hall-effect measurement data of Na:ZnO NFs performed under a magnetic field of

1.5 T at room temperature.

| Sample number | Resistivity ($\times 10^4$ $\Omega$-cm) | Hole concentration ($cm^{-3}$) | Mobility ($cm^2$ $V^{-1}s^{-1}$) |
|---|---|---|---|
| #1 | 1.52–2.71 | $2.49\times10^{16}$–$6.72\times10^{17}$ | 0.09–1.87 |
| #2 | 0.97–1.89 | $5.32\times10^{16}$–$7.51\times10^{17}$ | 0.23–2.35 |
| #3 | 1.28–2.14 | $3.48\times10^{16}$–$5.95\times10^{17}$ | 0.15–2.08 |

Table S2. Compositional analysis data for Na:ZnO NFs characterized by XPS.

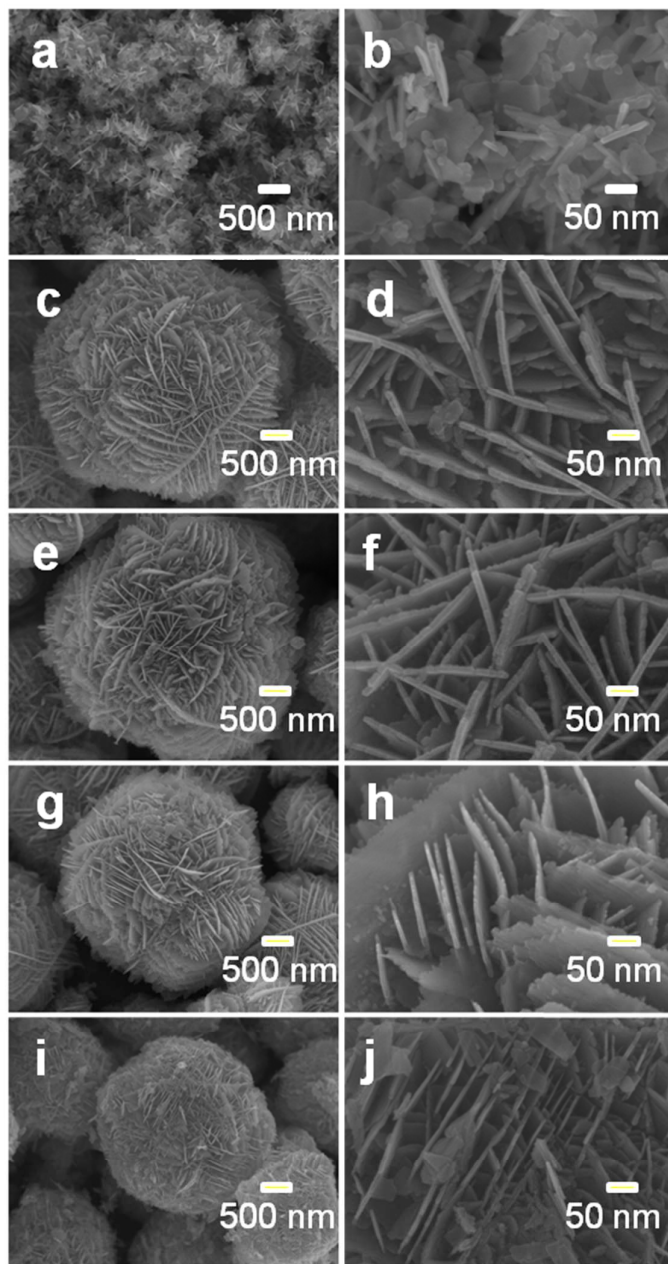| Elements | C 1s | Na 1s | Zn 2p | O 1s |
|---|---|---|---|---|
| at.% | 12.94 | 0.67 | 40.96 | 45.43 |

**Figure S1.** FESEM images of the Na:ZnO NFs synthesized with different $M_{NaCi}/M_{ZnAc}$ ratios: (a–b) 0, (c–d) 0.3, (e–f) 1.2 , (g–h) 2.4, and (i–j) 4.8.
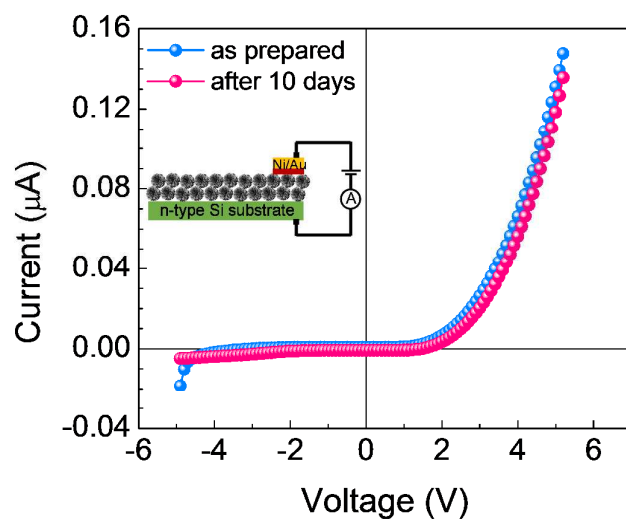
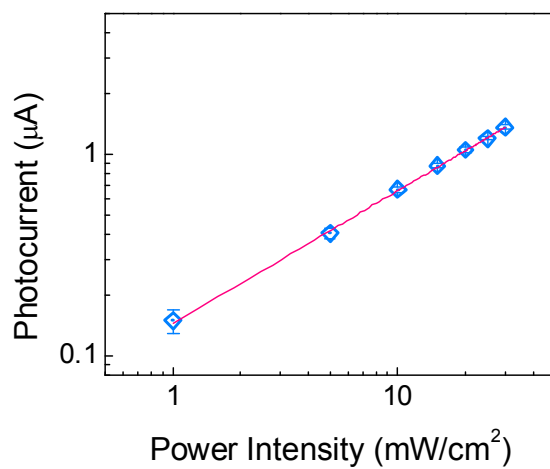**Figure S2**. *I-V* characteristics of p-type Na:ZnO NF/n-type Si heterojunction devices.



**Figure S3.** Power-law relationship of $I_{ph}$ with $P_L$ of a Na:ZnO NF sensor, $I_{ph} \propto P_L^{0.66}$.
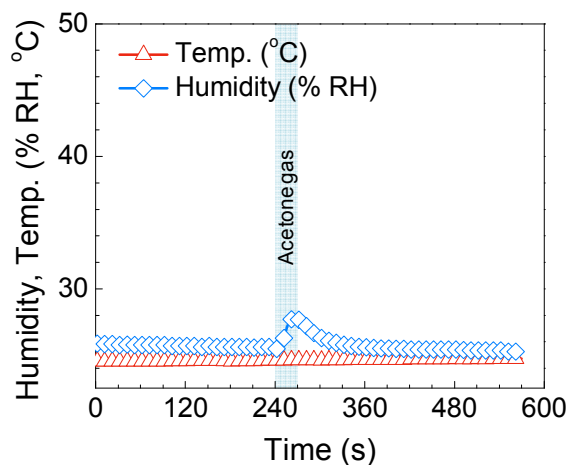
**Figure S4.** The relative humidity (*%RH*) and temperature variation inside the sensing chamber during the operation of a Na:ZnO NF sensor exposed to 100 ppm acetone gas (UV intensity of 5 mW cm$^{-2}$).
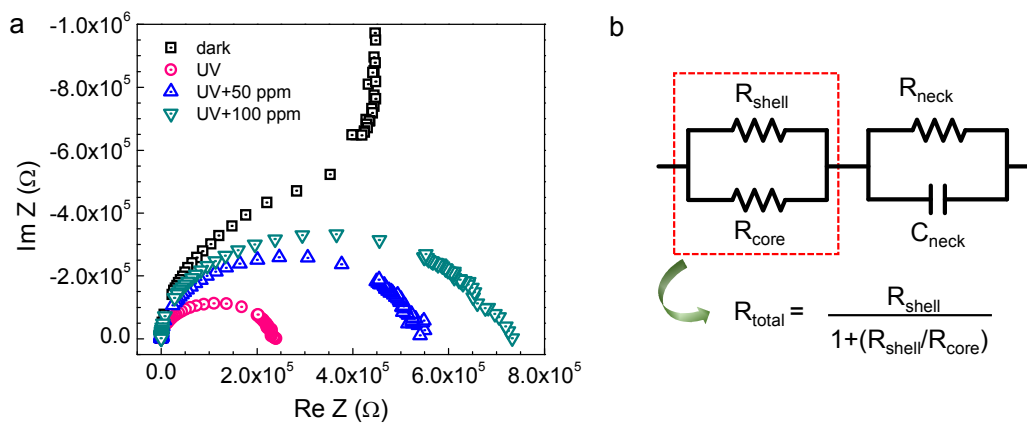


**Figure S5.** (a) AC impedance spectroscopy data, and (b) an RC model for the Na:ZnO NF gas sensor. The $R_{shell}$, $R_{core}$ and $R_{neck}$ represent the resistance of shell, core and neck of NFs, respectively. Also, the $C_{neck}$ represents the capacitance of neck between the inter-grain NFs.