SUPPORTING INFORMATION

SURFACE-CATALYZED ZINC OXIDE NANORODS AND INTERCONNECTED TETRAPODS AS EFFICIENT METHANE GAS SENSING PLATFORMS

Abbey Knoepfel, Bed Poudel*, and Sanju Gupta*

Department of Materials Science and Engineering, Pennsylvania State University, University Park, PA 16802 (USA)

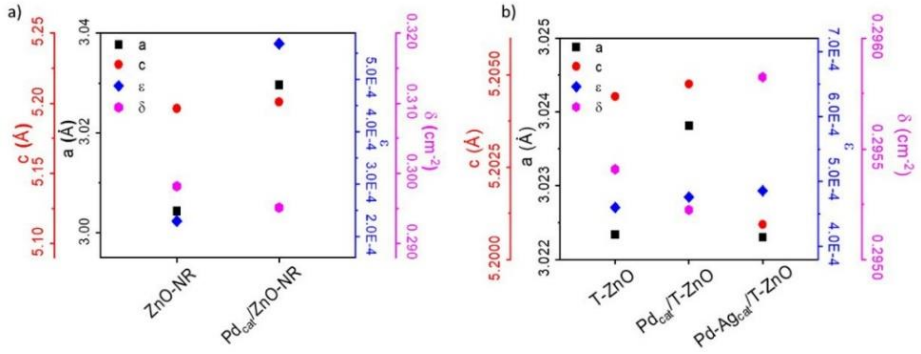

Figure S1. Calculations from the obtained XRD spectra in Fig. 1: (a) Lattice constants, *c* and *a*, lattice strain, *ε*, and dislocation density, *δ*, of ZnO-NR and Pd$_{cat}$/ZnO-NR; (b) Lattice constants, *c* and *a*, lattice strain, *ε*, and dislocation density, *δ*, of T-ZnO, Pd$_{cat}$/T-ZnO, and Pd-Ag$_{cat}$/T-ZnO.

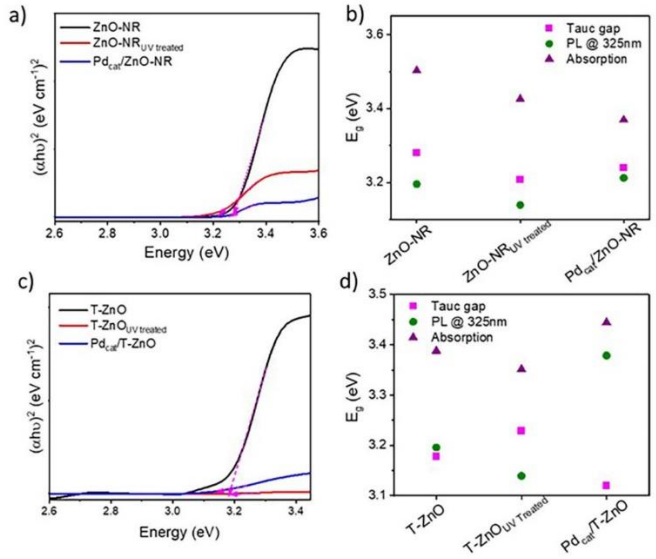

Figure S2. (a) Tauc plots of ZnO-NR, ZnO-NR$_{UV\ treated}$, and Pd$_{cat}$/ZnO-NR; (b) Comparison of bandgap values, E_g, determined from UV-visible spectra, photoluminescence spectra, and Tauc plot of ZnO-NR, ZnO-NR$_{UV\ treated}$, and Pd$_{cat}$/ZnO-NR; (c) Tauc plots of T-ZnO, T-ZnO$_{UV\ treated}$, and Pd$_{cat}$/T-ZnO; (d) Comparison of bandgap values, E_g, determined from UV-visible spectra, photoluminescence spectra, and Tauc plot of T-ZnO, T-ZnO$_{UV\ treated}$, and Pd$_{cat}$/T-ZnO.

Corresponding author. Email: sbg5644@psu.edu; bup346@psu.edu

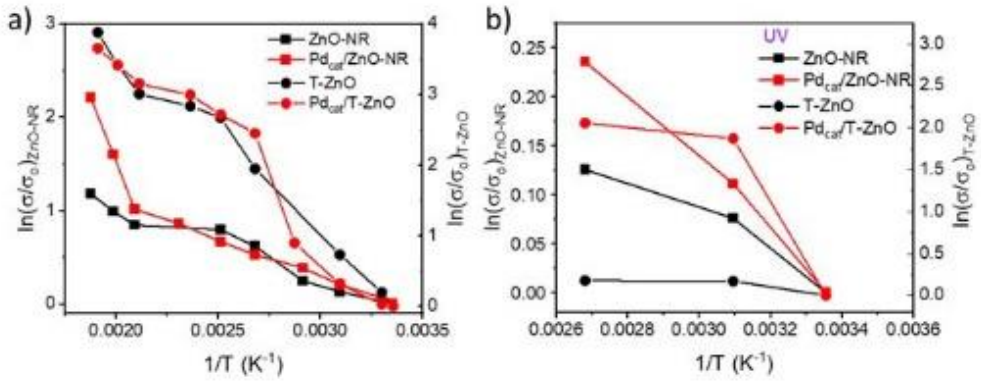

Figure S3. Conductivity measurements as a function of temperature in air for ZnO-NR and T-ZnO with and without Pd catalyst: (a) Conductivity in dark chamber; (b) Conductivity under UV excitation in chamber (λ = 365 nm).

Table S1. Activation energy determined from conductivity measurements as a function of temperature in air for ZnO-NR and T-ZnO with and without Pd catalyst in the dark and under UV excitation (λ = 365 nm).

Sample	E_A (eV) UV OFF	E_A (eV) UV ON
ZnO-NR	0.31	0.024
Pd_{cat}/ZnO-NR	0.24	0.06
T-ZnO	0.51	0.10
Pd_{cat}/T-ZnO	0.54	0.09

Corresponding author. Email: sbg5644@psu.edu; bup346@psu.edu

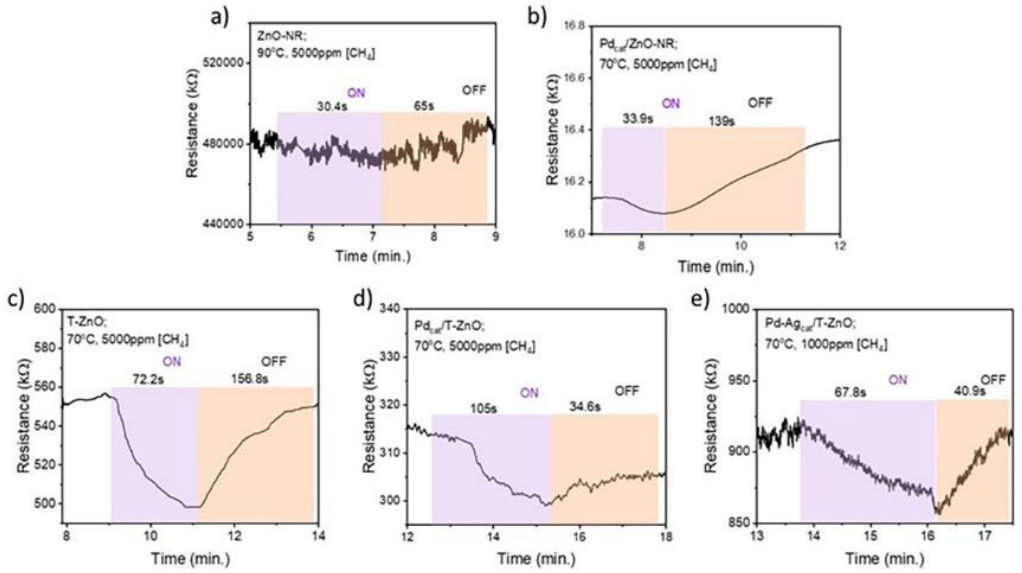

Figure S4. Low temperature dynamic resistance curves for response/recovery times when exposed to CH_4 for (a) ZnO-NR; (b) Pd_{cat}/ZnO-NR; (c) T-ZnO; (d) Pd_{cat}/T-ZnO; (e) Pd-Ag_{cat}/T-ZnO films.

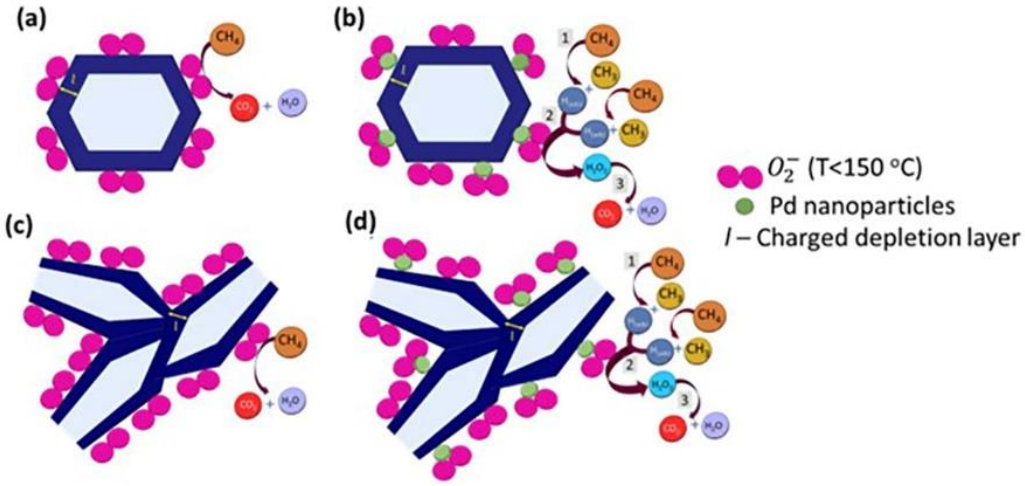

Figure S5. Proposed mechanistic chemical pathways for low temperature (<150 °C) thermal excitation for unmodified and Pd-decorated films: (a) ZnO-NR, b) Pd_{cat}/ZnO-NR, c) T-ZnO, d) Pd_{cat}/T-ZnO sensors.

Corresponding author. Email: sbg5644@psu.edu; bup346@psu.edu