Electronic Supplementary Material (ESI) for Journal of Materials Chemistry

Supporting Information

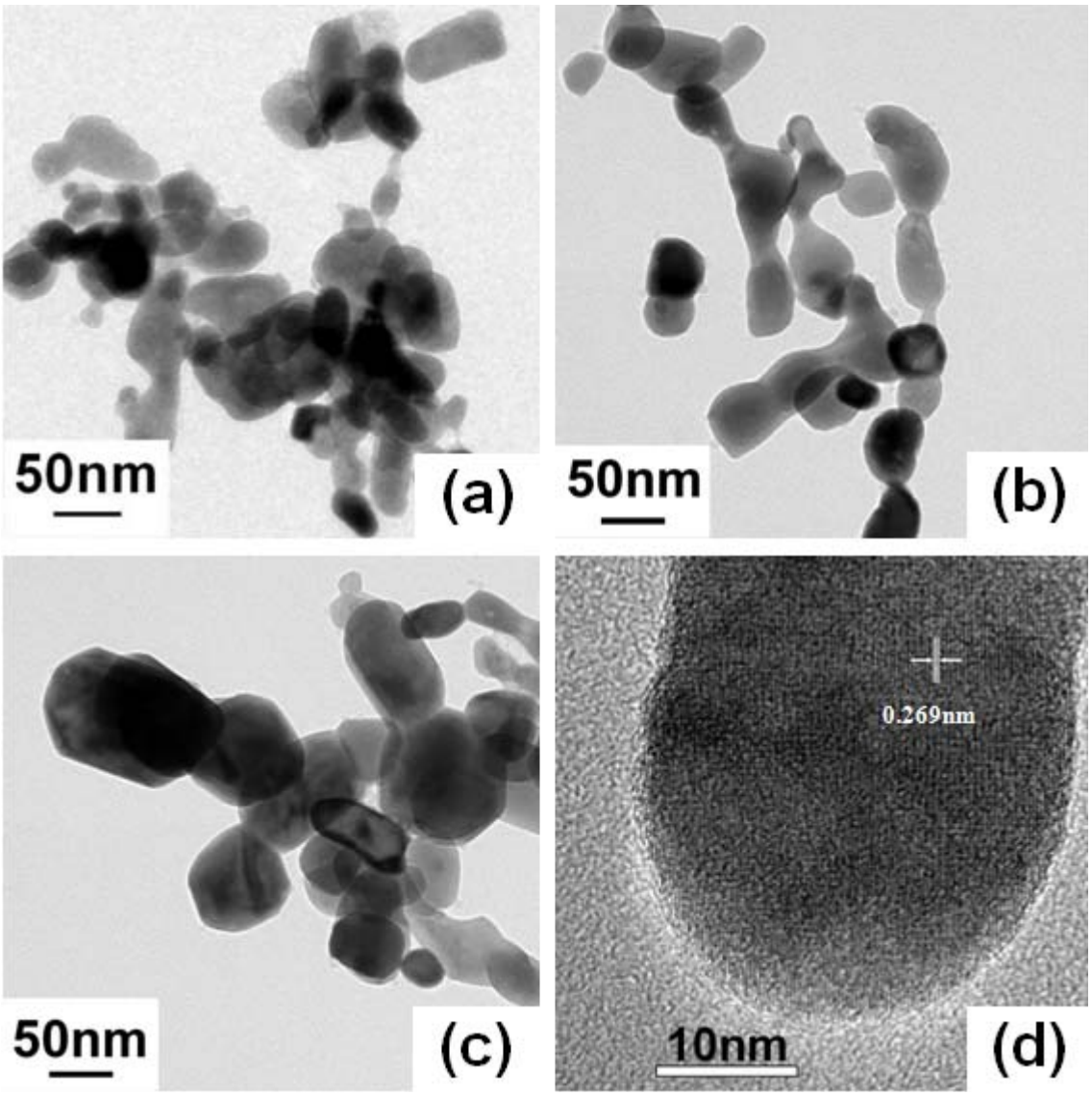

Figure S1. TEM micrographs of WO_3 nanowires for different W sputter deposition times: (a) 10 s, (b) 20 s, and (c) 60 s. (d) High-resolution TEM micrographs showing a single crystalline grain (of (a)).

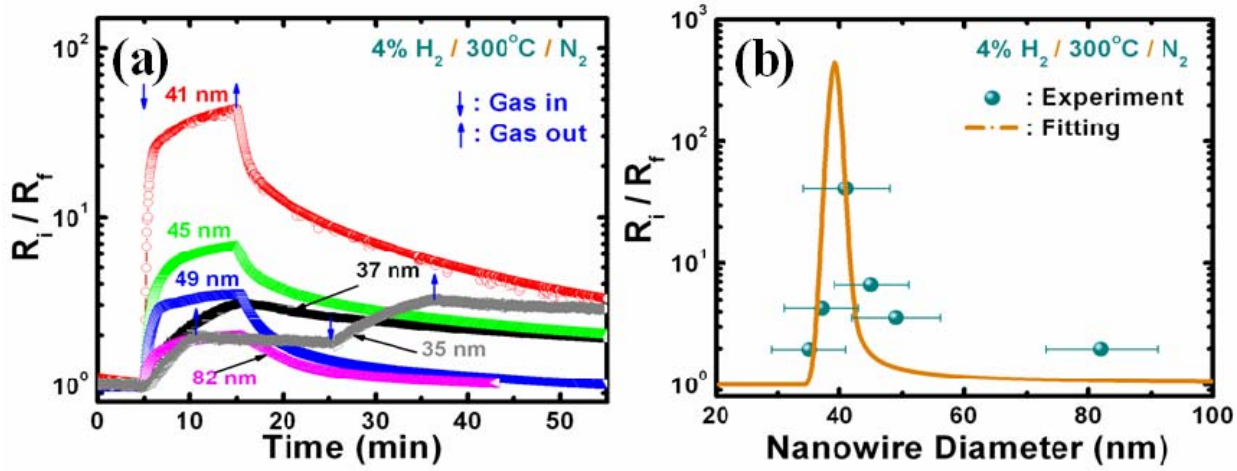

Figure S2. Summary of sensing properties measured at 300 ºC for H_2 molecules diluted in N_2 to examine the size effect of the WO_3 nanowires. (a) Response of the sensors to 4% H_2 gas diluted in N_2. (b) is the summary of (e) with a fitted curve. The fitting parameters are $N_D = 1.1 \times 10^{18}$ cm^{-3}, $\alpha = 2 \times 10^4$, $V_s = 0.2$ V.

We also checked the size dependence using H_2 as a reducing gas. The response curves measured with 4% H_2 diluted in N_2 are shown in Fig. S2(a). We assumed a reaction between H_2 and oxygen ions adsorbed on the surface: $H_2 + O^-(ads) \rightarrow H_2O(g) + e^-(ox)$. The reaction returns electrons to the WO_3 nanowire by Δn_s and sets up a steady-state surface charge density n_s^f. Eq. (6) changes to $n_s^f = n_s^i - \Delta n_s$ for the reducing gases. The responses are summarized in Fig. S2(b), which basically reveals a similar size dependence of the NO molecules. A fitting is also drawn as a solid curve using the same fitting parameters as for NO gas except $N_D = 1.1 \times 10^{18}$ cm^{-3}. The same response peaking at the same diameter suggests that the response dependence on the wire diameter is a property determined by the sensor structure and is not related to the chemical properties of the gases.