Electronic Supplementary Material (ESI) for Journal of Materials Chemistry

Supporting Information

Highly Porous Metal Oxide Polycrystalline Nanowire Films with Superior Performance in Gas Sensors

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Figure SI-1 A photograph of an example sensor device.

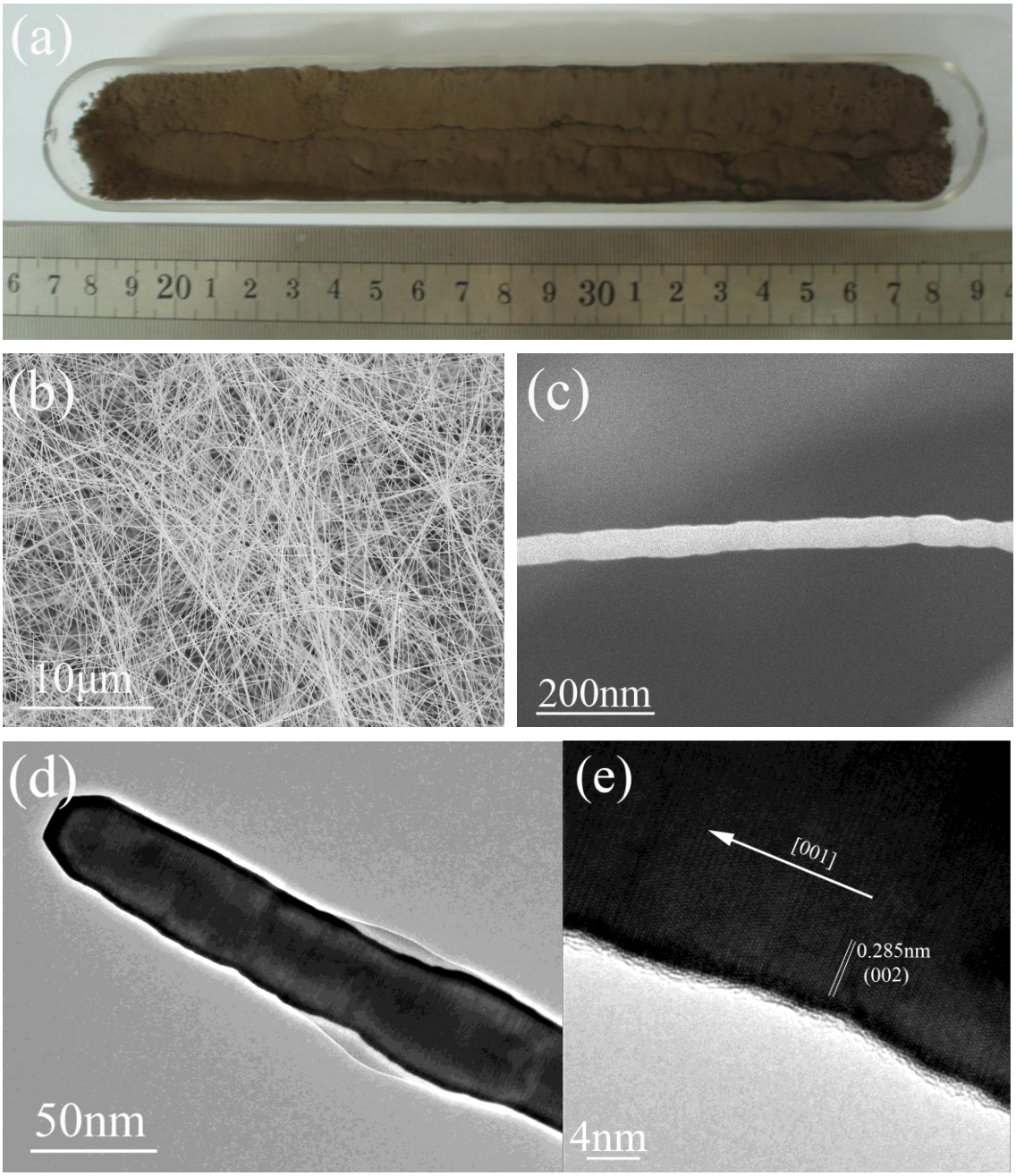

Figure SI-2 (a) Photograph of synthesized gram-scale InN nanowires; (b) SEM image of the as-synthesized InN nanowires; (c) enlarged SEM image of a single InN nanowire; (d) TEM image of a single InN nanowire; (e) HRTEM image of the single InN nanowire.

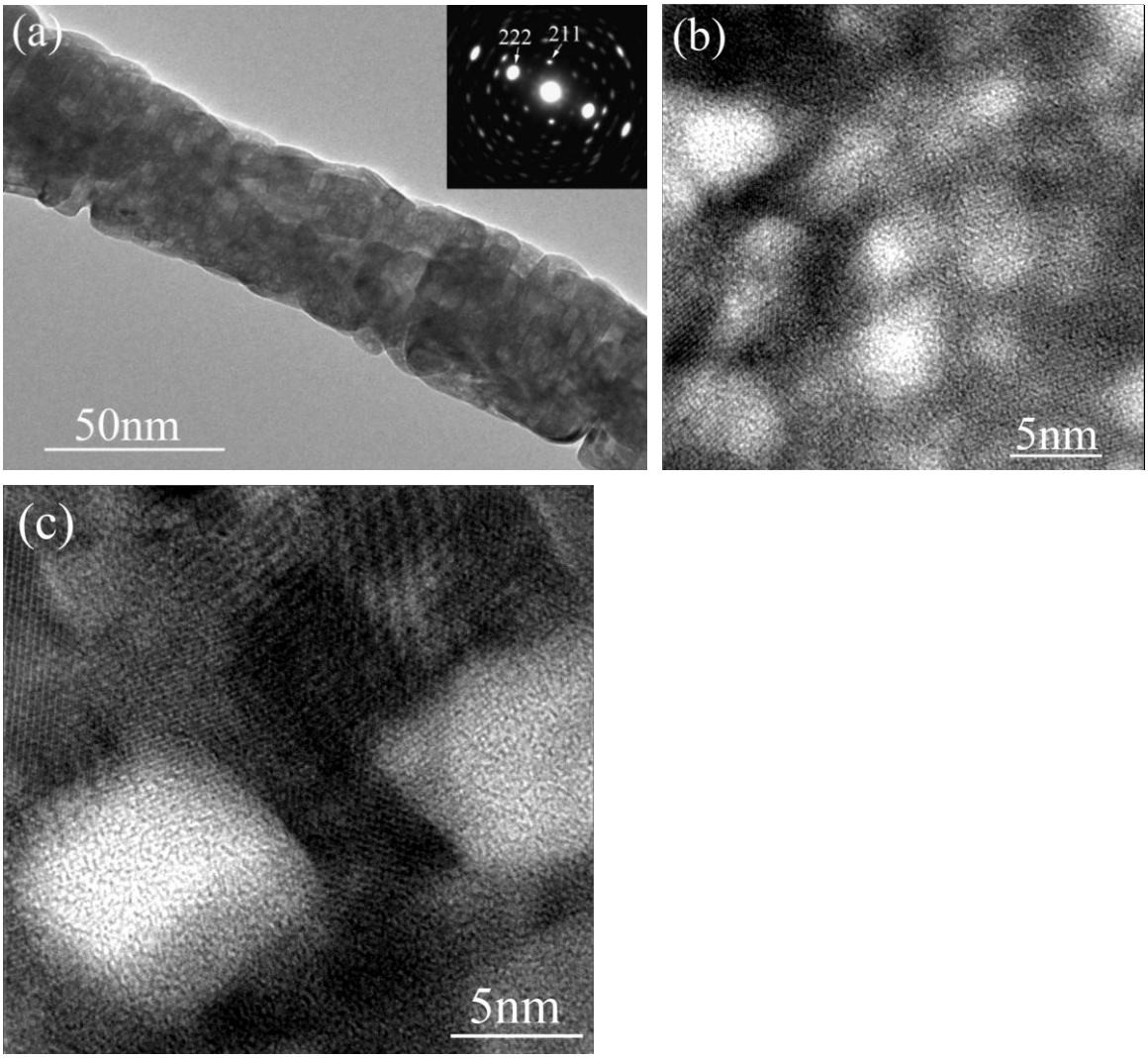

Figure SI-3 TEM image (a), SAED pattern (inset), HRTEM image (b) and (c) of a single porous In_2O_3 nanowire, showing its high density of ultra-fine nanopores.

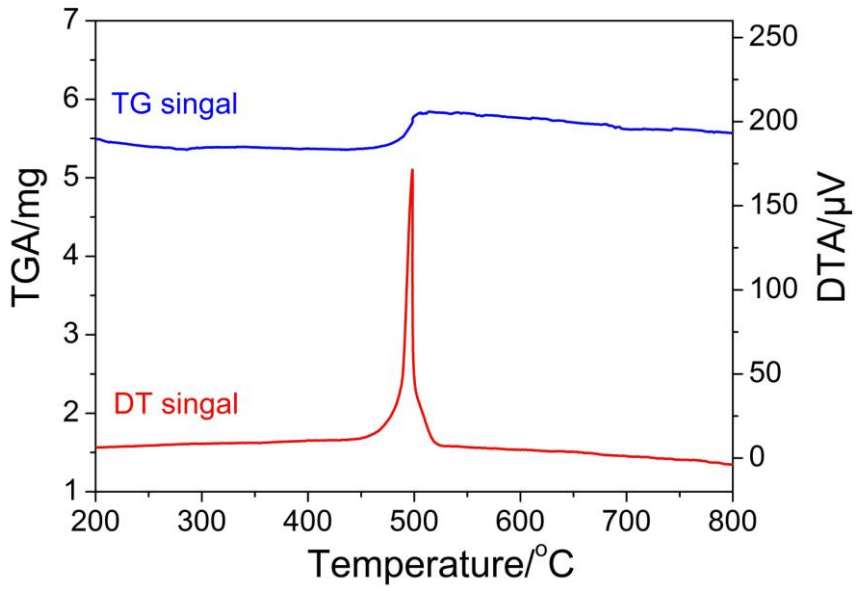

Figure SI-4 A typical DTA–TGA curve obtained for the InN precursor under air atmosphere.

Experimental details for synthesis of In_2O_3 octahedra

The synthesis of In_2O_3 regular octahedra was accomplished by a simple vapour-solid (VS) route. An alumina boat containing pure In powders (1-2 g, 200 meshes) was placed in the front of an alumina boat was placed in the middle of a horizontal quartz tube furnace. In the first step, the quartz tube was pumped, and then filled with argon and re-pumped. After repeating the operation three times, the quartz tube was full of argon atmosphere. Then, the quartz tube was heated to 650℃ in one hour under an argon flow of 30 standard cubic centimeters per minute (sccm). After the temperature reached 650℃, the argon flow was turned off, and an oxygen flow of 1 sccm was introduced into the quartz tube to react with the In vapor for half an hour. Then, the oxygen flow was turned off, and the furnace was naturally cooled under an argon flow of 30 sccm.

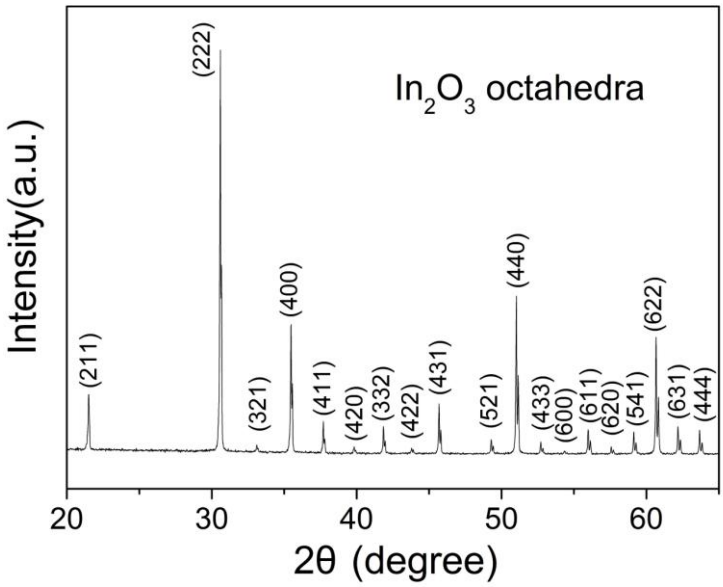

Figure SI-5. X-ray diffraction pattern (XRD) of the product can be well indexed to a cubic cell with *a* = *b* = *c* = 10.118 Å, in good agreement with the In_2O_3 standard data (ICDD-PDF 06-0416).

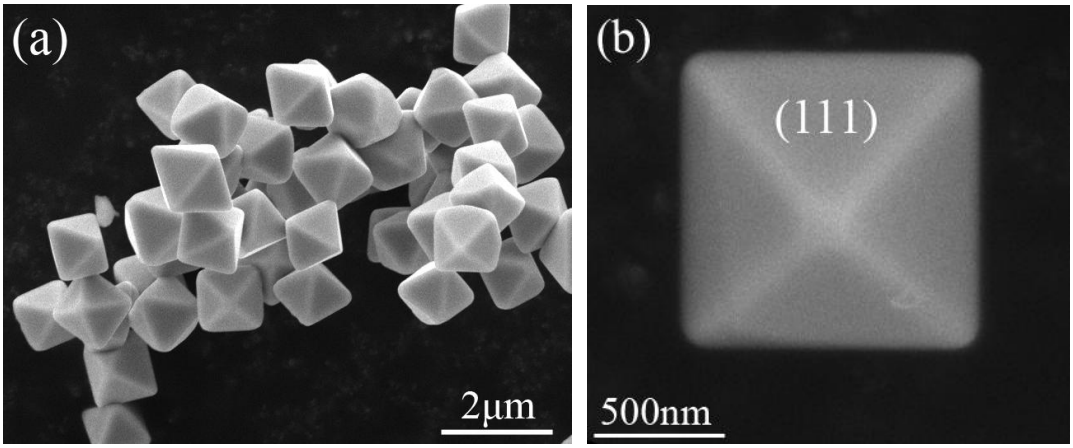

Figure SI-6. SEM images of In_2O_3 octahedra at different magnifications.

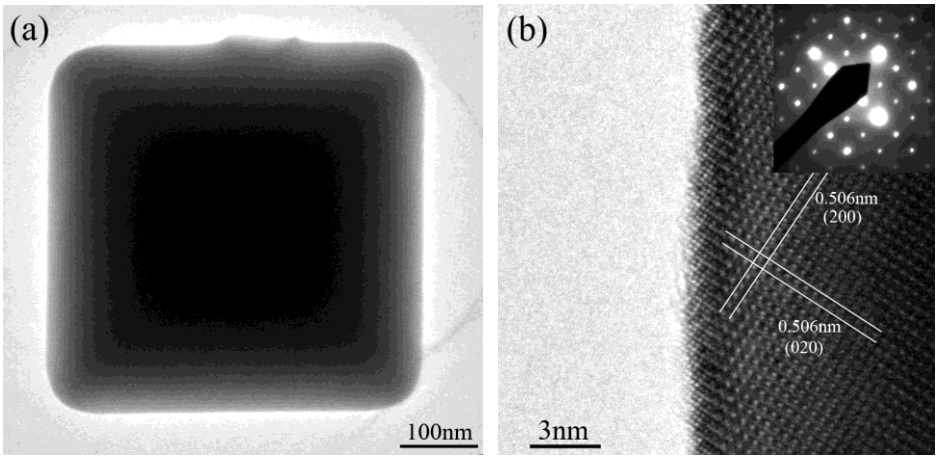

Figure SI-7. TEM image (a), HRTEM image (b) and SAED pattern (inset) of a single In_2O_3 octahedron.

Experimental details for synthesis of SnO_2 nanobelts

The synthesis of SnO_2 nanobelts was accomplished by a simple vapour-solid (VS) route. An alumina boat containing pure Sn powders (1-2 g, 200 meshes) was placed in the front of an alumina hollow tube 25 mm in (inner) diameter and 22 cm in length. The alumina hollow tube together with the alumina boat was placed in the middle of a horizontal quartz tube furnace. In the first step, the quartz tube was pumped, and then filled with argon and re-pumped. After repeating the operation three times, the quartz tube was full of argon atmosphere. Then, the quartz tube was heated to 900℃ in one hour under an argon flow of 30 standard cubic centimeters per minute (sccm). After the temperature reached 900℃, the argon flow was turned off, and an oxygen flow of 5 sccm was introduced into the quartz tube to react with the excess Sn vapor for half an hour. Then, the oxygen flow was turned off, and the furnace was naturally cooled under an argon flow of 30 sccm.

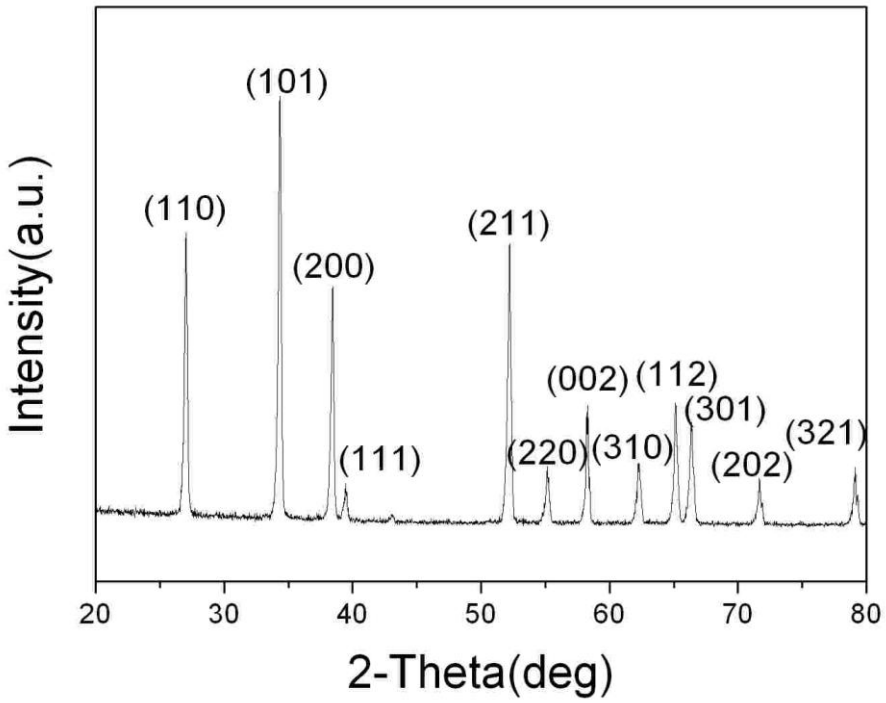

Figure SI-8. X-ray diffraction pattern (XRD) of the nanobelts shows that the product is SnO_2 in a rutile-type structure ($P4_2/mnm$).

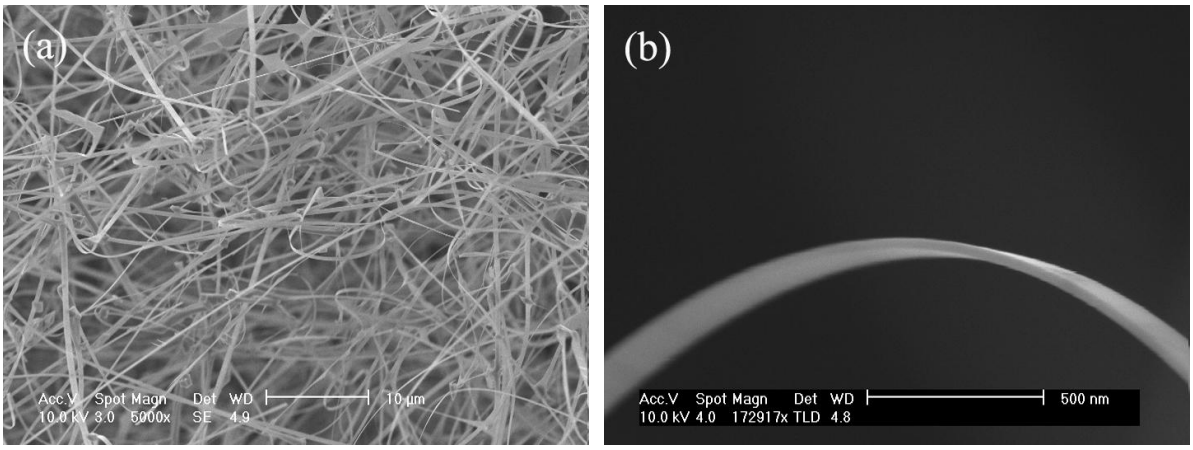

Figure SI-9. SEM images of SnO_2 nanobelts at different magnifications.

Ethanol gas concentration	2ppm	20ppm	50ppm	100 ppm
Response time	6s	4s	3s	5 s
Recovery time	7s	5s	4s	7 s

Table SI-1. The response and recovery times of porous In_2O_3 nanowire films towards different ethanol concentration

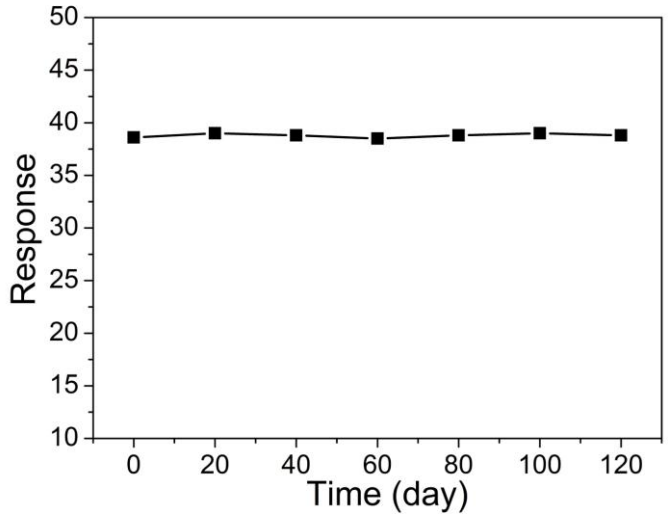

Figure SI-10. The long-term stability of porous In_2O_3 nanowire film sensors to 50 ppm ethanol gas at 260 °C

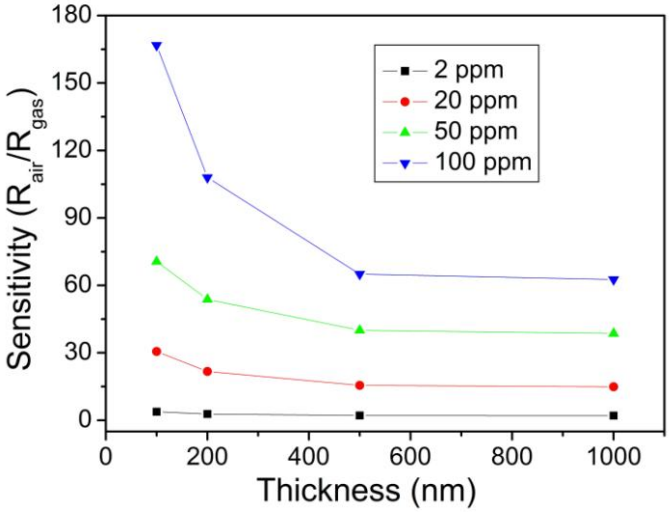

Figure SI-11. Variation of sensitivity of porous In_2O_3 nanowire film sensors with film thickness for different concentrations of ethanol vapor.

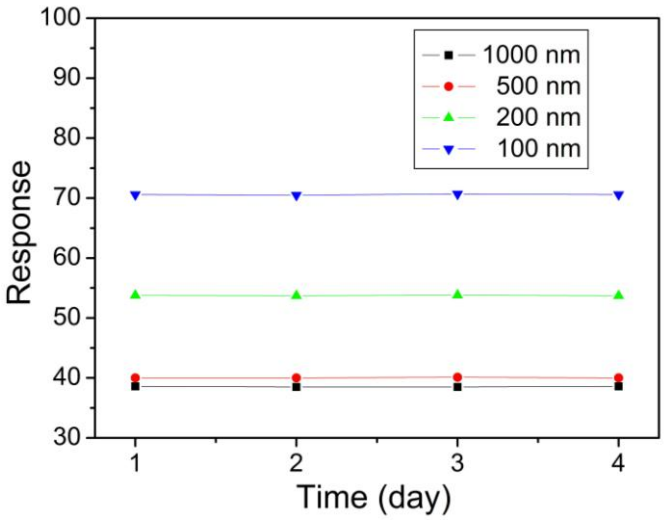

Figure SI-12. The stability of the response of porous In_2O_3 nanowire film sensors with different thickness to 50 ppm ethanol gas at 260 °C.