Supporting Information

Synthesis of Trapezohedral Indium Oxide Nanoparticles with High-Index \{211\} Facets and High Gas Sensing Activity

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1. Experimental detail

1.1 Materials

The synthesis of Trapezohedral Indium Oxide Nanoparticles was carried out using commercially available reagents. Indium (III) acetate (In(OOC\textsubscript{2}H\textsubscript{5})\textsubscript{3}), trioctylamine (TOA, 98%), oleic acid (OA, 90%) were purchased from Alfa Aesar.

1.2 Preparation of Trapezohedral In\textsubscript{2}O\textsubscript{3} Nanoparticles:

In a typical synthesis, 1.35 mL OA and 3.0 mL trioctylamine were mixed to form a transparent solvent at room temperature, then 0.1 g Indium (III) acetate were add to the solvent and thoroughly dissolved under intense ultrasonic treatment. The resulting white solution was transferred into a glass tube with a length of 40 cm and 2.0 cm in diameter, and was directly placed in a veridical tube furnace that was already preheated to 320 °C. After the reaction for 30 min, the tube was taken out from the hot tube furnace and instantly added with ethanol. Finally, white products were collected by high-speed centrifugation. And then the samples before gas sensing were calcined at 400 °C for 6 h.
1.3 Characterization. The composition and phase of the as-prepared products were acquired by the powder X-ray diffraction (XRD) pattern using a Panalytical X-pert diffractometer with CuKα radiation. The morphology and crystal structure of as-prepared products were observed by scanning electron microscopy (SEM, S4800), and high-resolution transmission electron microscopy (HRTEM, FEI Tecnai-F30) with an acceleration voltage of 300 kV. All TEM samples were prepared from depositing a drop of diluted suspensions in ethanol on a carbon film coated copper grid.

1.4 Gas sensing test on trapezohedral In$_2$O$_3$ Nanoparticles:

The gas-sensing tests were performed in a WS-30A measuring system (Zhengzhou Winsen Electronics Technology, China). In a typical test, a gas sensor was fabricated by coating a certain amount of In$_2$O$_3$ paste (consisting of In$_2$O$_3$ particles and the ethanol solvent) onto a ceramic tube that was previously mounted with gold electrodes and platinum conducting wires. A resistor wire coil was inserted in the tube as a heater to provide working temperatures from 200 to 500 °C by varying the heating current. The analyses were injected either directly into the chamber or, in the case of liquids like ethanol, onto a metal-plate heater in the test chamber and evaporated completely by heating. The gas-sensing capability of the sensor was defined as the ratio $R_{\text{gas}}/R_{\text{air}}$, where $R_{\text{gas}}$ and $R_{\text{air}}$ are the electrical resistance of the sensor in test gas and in air at the working temperature of about 350 °C, respectively.

2 The experimental results
Fig. S1 the XRD pattern of the as-prepared products.

Fig. S2 the size distribution of the trapezohedraon-shaped In$_2$O$_3$ particles

Fig. S3 The SEM images of In$_2$O$_3$ products prepared by the thermal decomposition of Indium (III) acetate in (a) air at 320 °C, (b) pure TOA at 320 °C, (c) a mixture of OA and TOA at 360 °C.
Fig. S4 (a) The TEM images of the individual octahedron-shaped In$_2$O$_3$ NCs projected from [0̅1̅1̅] direction, top-right inset shows corresponding SAED pattern. (b) Schematic model of an ideal octahedron enclosed {111} facets viewed along the [0̅1̅1̅] direction, (c) TEM image of the same octahedron-shaped In$_2$O$_3$ NCs particle viewed along [1̅1̅1̅] direction, inset: the corresponding SAED pattern, (d) schematic model of an ideal octahedron enclosed within {111} facets viewed along the [1̅1̅1̅] direction.