Supporting Information

Hydrothermal synthesis of a 3D double-sided comb-like ZnO nanostructure and its growth mechanism analysis

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Experimental Section

Hydrothermal synthesis of ZnO nanostructures.

The Si substrates were cleaned with acetone, alcohol and deionized water in an ultrasonic cleaner and blown with N_2 gas. After that, the Al film was deposited on the Si substrates by DC magnetron sputtering. Afterwards, ZnO seeds were deposited on the Al film by RF magnetron sputtering. The thickness of ZnO seeds were controlled by the sputtering time. ZnO nanostructures were grown by hydrothermal method. Details are as follows, Zinc nitrate ($Zn(NO_3)_2 \cdot 6H_2O$) was dissolved in deionized water to make a 0.05 mol/L solution. Then, 1.2 ml ammonia solution (25-28% v/v) was added into the 30 ml zinc nitrate solution and stirring until well mixed. Afterwards, the solution was transferred into a Teflon lined stainless steel autoclave of 40 ml in volume. The Si substrates, which have already deposited Al film and ZnO seeds, were suspended vertically immersed in the solution and heated at a constant temperature of 95 ^oC for 2 h. The obtained sample thoroughly washed with deionized water to remove the residual reactants and dried in the air. ITO substrates are also used under the same conditions.

Characterizations.

The X-ray powder diffraction (XRD) measurements were performed with a Bruker D8 Advance X-Ray Diffractometer, using a Cu-Kα X-ray radiation in the scan range

of 2θ=20-80°. The ZnO products were investigated with a scanning electron microscope (SEM) Hitachi-SU70 equipped with an energy-dispersive X-ray spectrometer (EDS) for the size, morphologies and elements analysis. Transmission electron microscope (TEM), high-resolution TEM (HRTEM), and selected area electron diffraction (SAED) were performed using a FEI Tecnai G^2 F20 transmission electron microscope.

Photocatalytic activity.

The photocatalytic activity of ZnO products was measured by the degradation of Rhodamine B (RhB) in an aqueous solution under the irradiation of Xe lamp (CEL-S500) at room temperature. In a typical experiment, samples (1 cm^2) were vertically immersed in 4 ml aqueous solution of 5 mg/L RhB. Moreover, every 15 minutes, analyzed the solution absorbance of RhB by a UV-Vis spectrophotometer (Phoenix UV1700) at its maximum absorption wavelength of 554 nm.

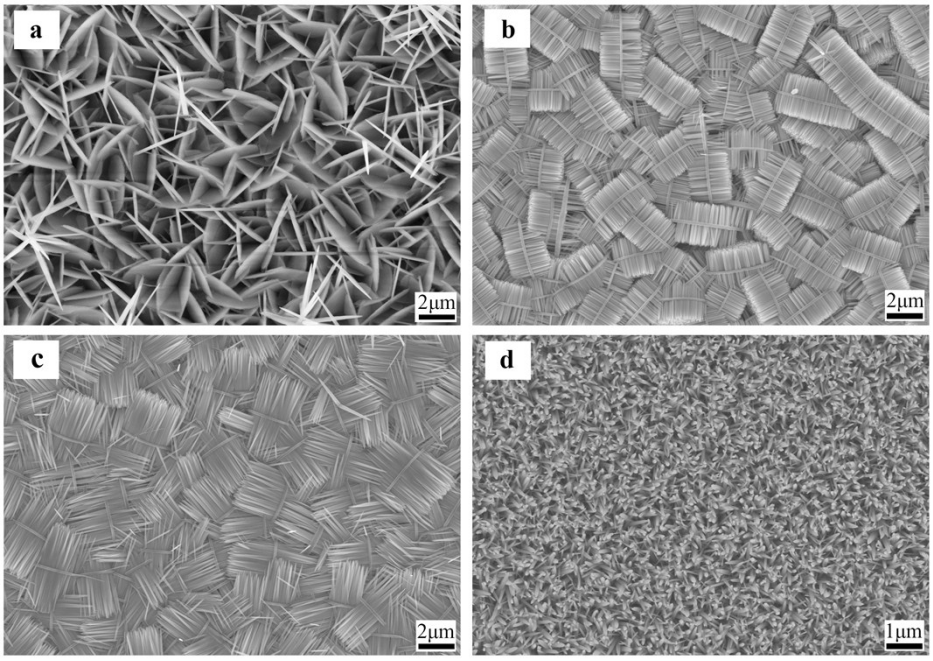

Fig. S1. SEM images of ZnO under different thickness of ZnO seeds on ITO substrates, the thickness of ZnO seeds increase from a-d. (a) 0 nm, (b) 25 nm, (c) 50 nm, (d) 100 nm.

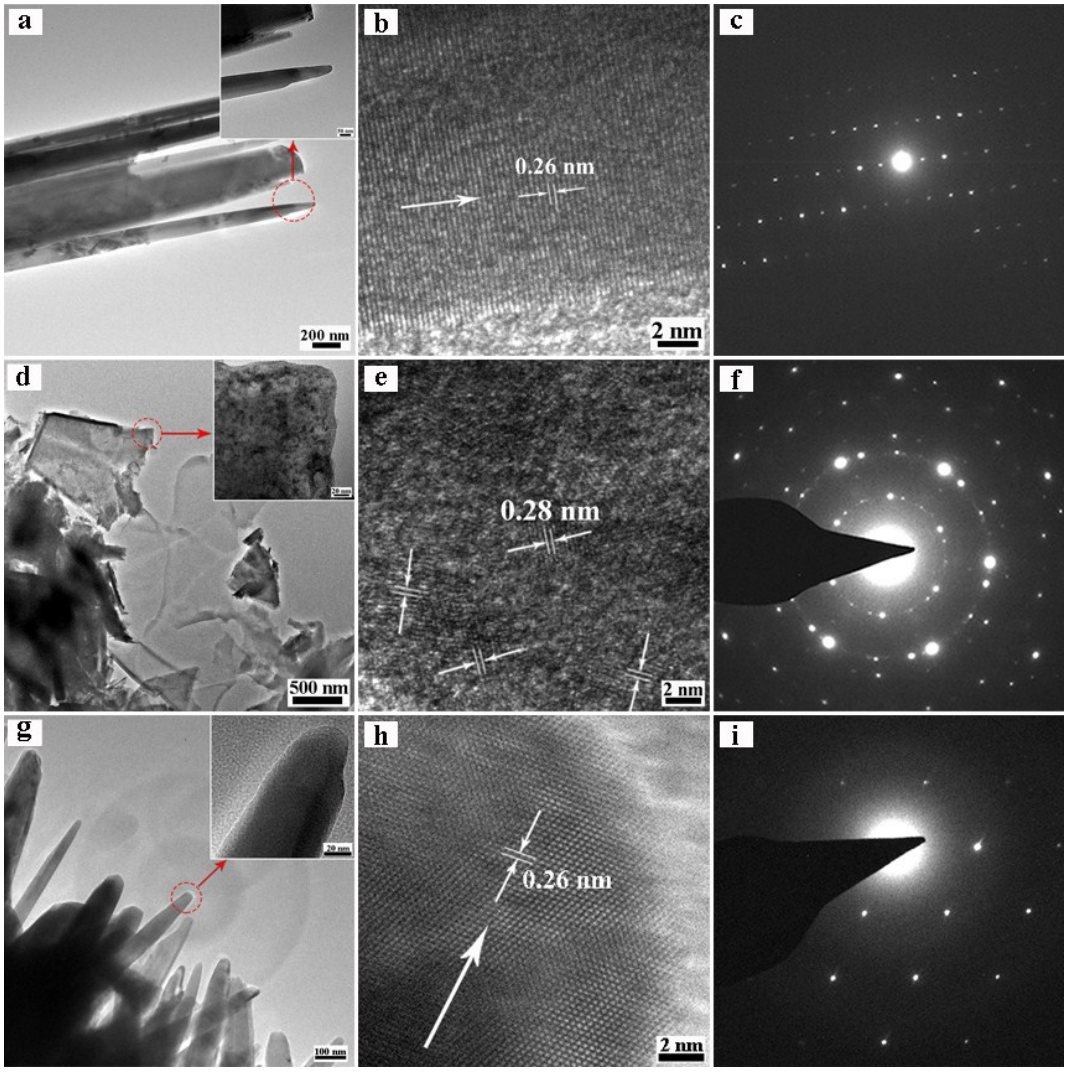

Fig. S2. TEM, HRTEM images and SAED patterns of ZnO nanostructures:

(a, b, c) nanorods of nanocombs, (d, e, f) nanosheets and (g, h, i) nanorod arrays.

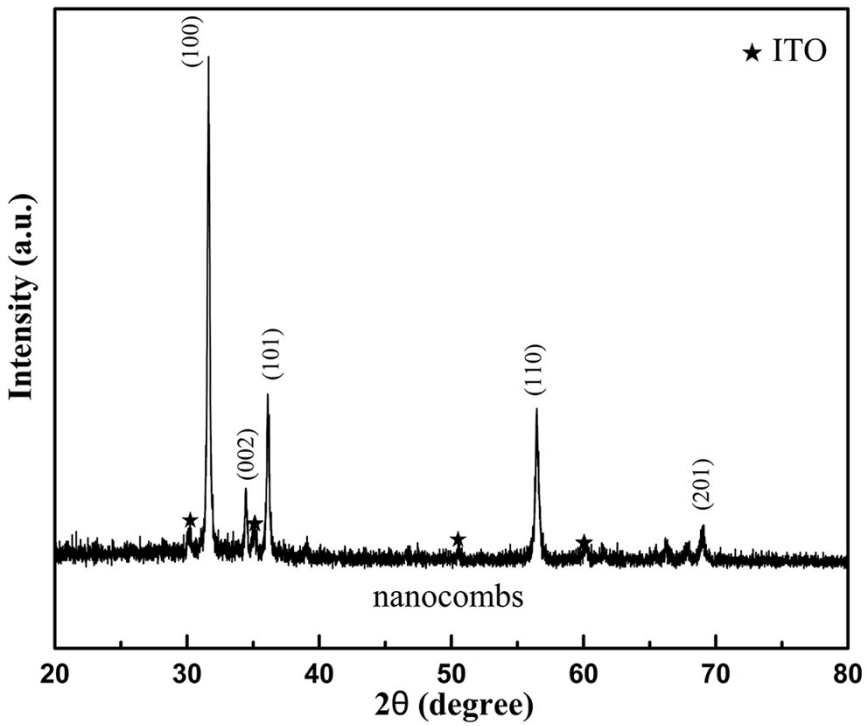

Fig. S3. XRD pattern of 3D double-sided comb-like ZnO nanostructure on ITO substrate.

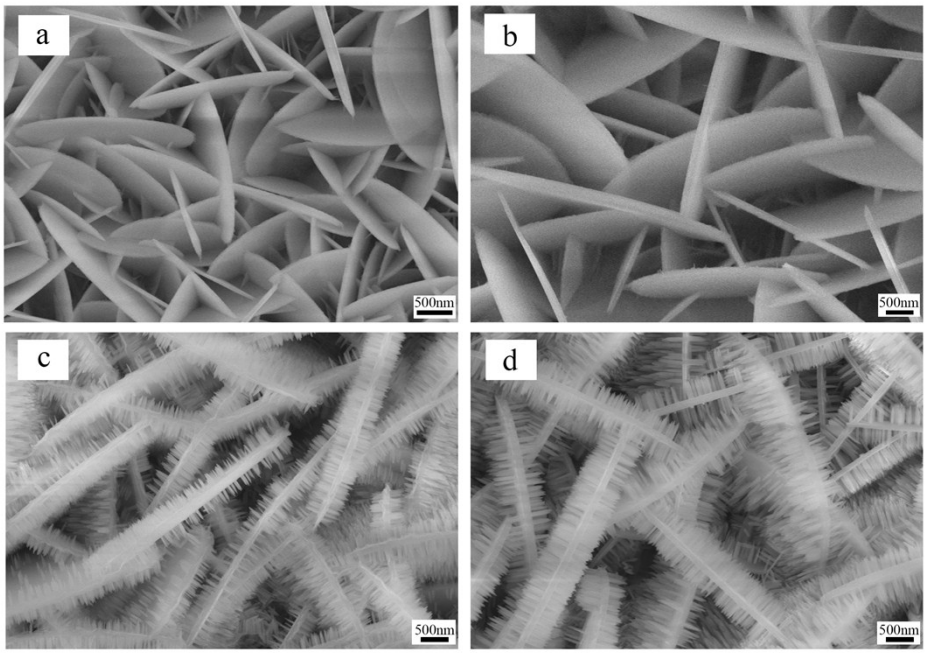

Fig. S4. SEM images of ZnO under different reaction time on ITO substrates (coated with Al film and 30 nm ZnO seeds and prepared at 95 ^{o}C for (a) 5 min, (b) 10 min, (c) 20 min and (d) 30min.

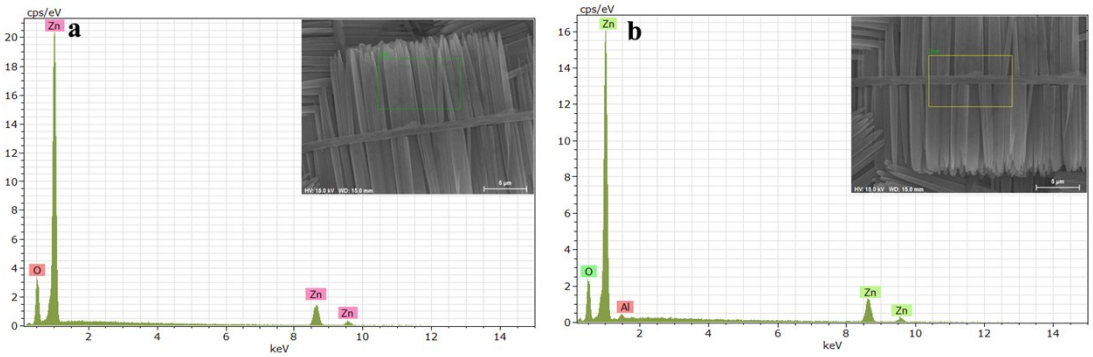

Fig. S5. EDS patterns of different parts of 3D double-side comb-like ZnO,

(a) nanorods and (b) nanosheet.