

# **ZnO nanostructure construction on zinc foil: the concept from an ionic liquid precursor aqueous solution**

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## **Experimental section**

### **Synthesis.**

#### **ZnO nanostructures grown on zinc foil directly.**

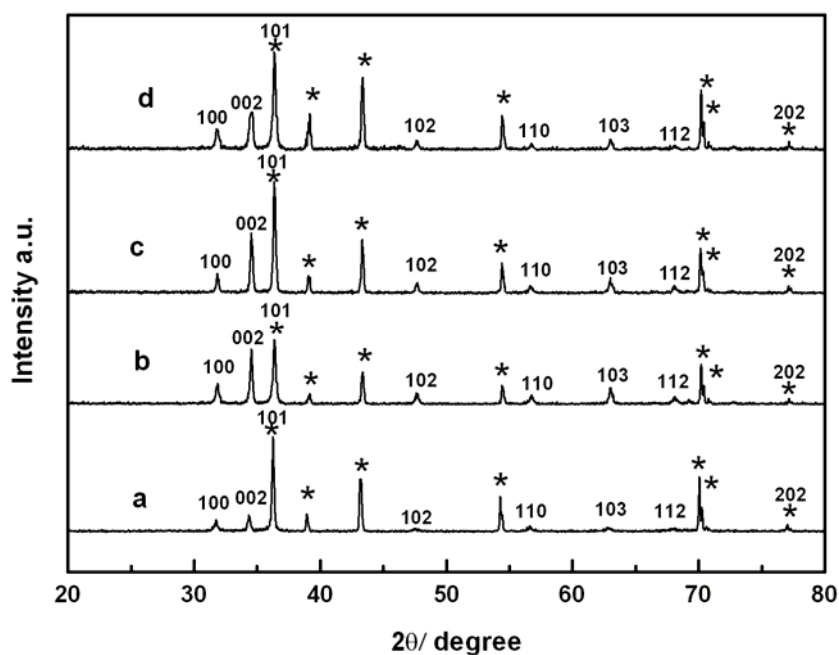
In a typical experiment, a piece of zinc foil (3 cm × 1 cm, pretreated by sonication in ethanol and water successively and dried in air) was perpendicularly put to 0.77 g of tetrabutylammonium hydroxide (TBAH) ionic liquid aqueous solution (32.46% wt) in a glass tube which was then kept at room temperatures for 1 day without stirring. After the reaction, the foil was collected from solution. The reacted part was rinsed with deionized water and ethanol and dried in air for 6 hours. The procedure for constructing ZnO nanostructured on foil at other temperatures is the same as the above.

#### **ZnO nanostructures grown on zinc foil with the assistance of zinc acetate dihydrate salt.**

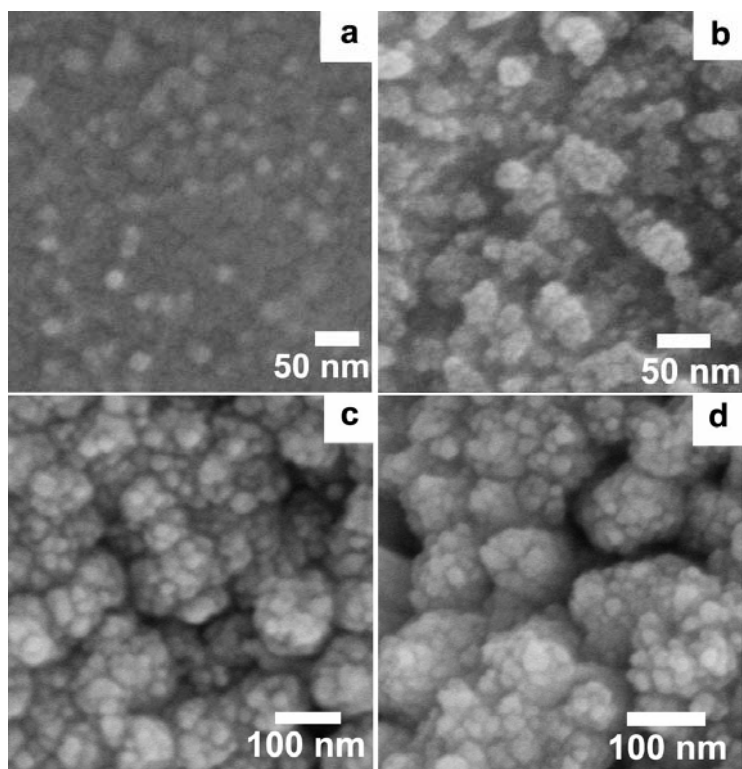
In a typical experiment, a piece of zinc foil (3 cm × 1 cm, pretreated by sonication in ethanol and water successively and dried in air) was perpendicularly put to 0.77 g of tetrabutylammonium hydroxide aqueous solution (32.46% wt) with certain amount of zinc acetate dihydrate in a glass tube which was then kept at room temperature for 1 day without stirring. After the reaction, the foil was collected from solution. The reacted part was rinsed with deionized water and ethanol and dried in air for 6 hours.

The procedure for constructing ZnO nanostructured on foil with the assistance of zinc acetate dihydrate salt at other temperatures is the same as the above, but the reaction time is decreased to 5 hours. Here the zinc acetate dihydrate is used as the zinc salt because of its good solubility in tetrabutylammonium hydroxide ionic liquid.

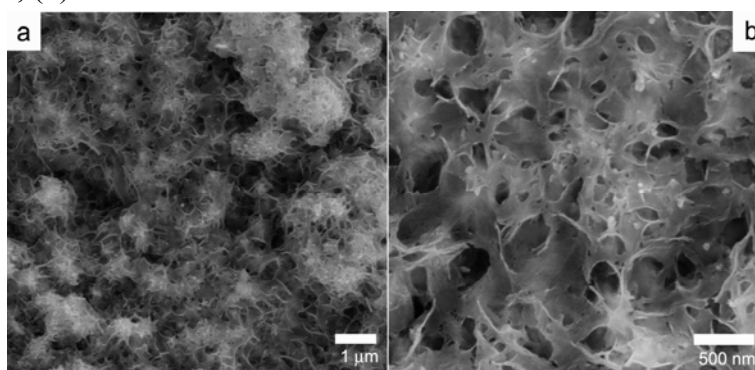
**Characterization.** X-ray diffraction was done on a Rigaku Dmax-rc X-ray diffractometer with Ni filtered Cu K $\alpha$  radiation. SEM was done on a Hitachi SU-70 FESEM operated at 10 kV. The selected area electron diffraction patterns were examined by using a Hitachi H-800 transmission electron microscope. Room temperature photoluminescence spectra were recorded with a Cary Eclipse spectrofluorimeter. Nitrogen adsorption-desorption data were measured using a conventional volumetric technique with a Coulter Omnisorp 100CX sorption analyzer.



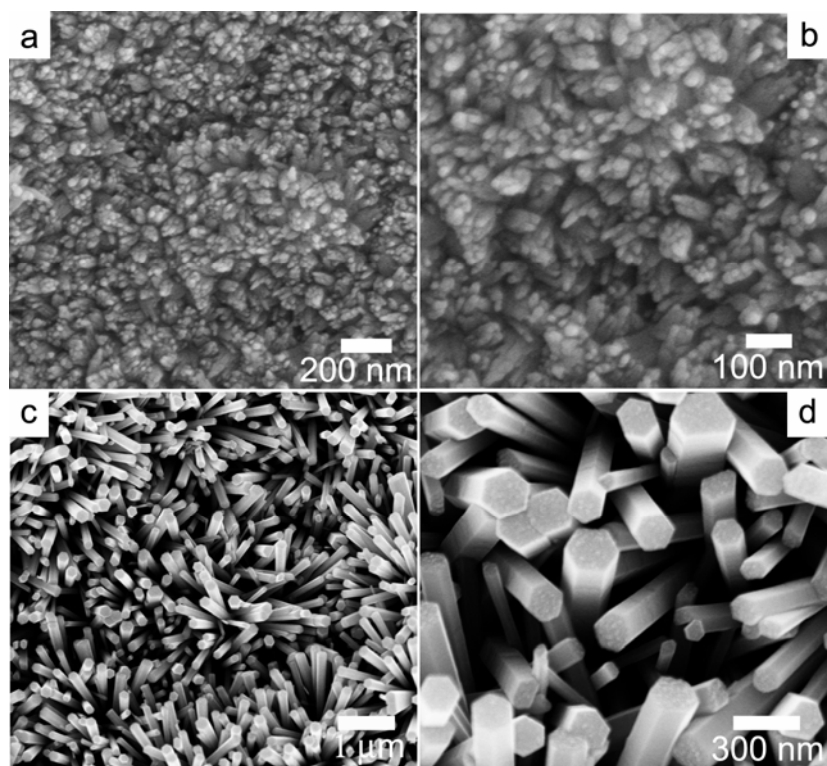
**Figure S1.** XRD patterns of the typical ZnO nanostructures on zinc foil. (a) branched rods, (b) hexagonal rods, (c) hexagonal pyramids (d) porous structure. The peaks marked with stars are attributed to the zinc foil substrate.



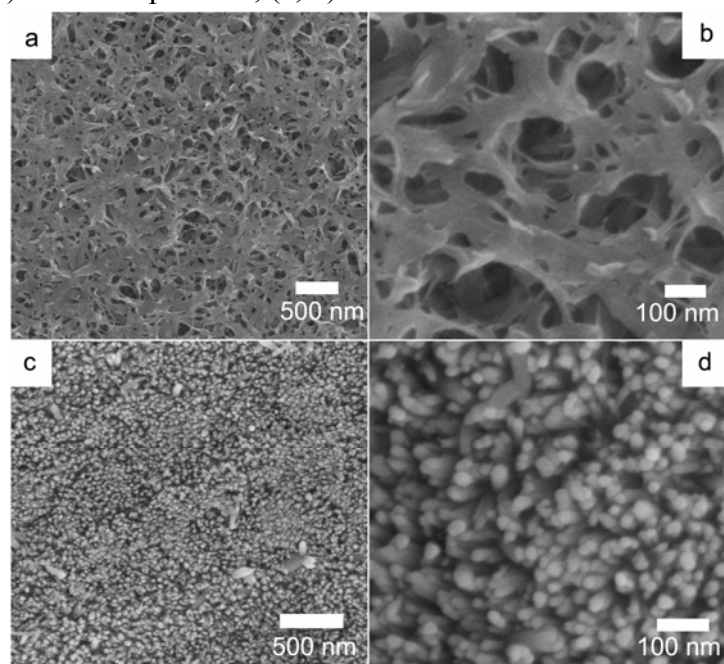
**Figure S2.** SEM images of aligned ZnO branched rods grown on zinc foil at room temperature in TBAH aqueous solution obtained at different reaction time.(a)10 min, (b) 1 h, (c) 5 h, (d) 10 h.



**Figure S3.** SEM images of porous ZnO nanostructures grown on zinc foil at 50 °C in TBAH aqueous solution with the assistance of 10mg zinc acetate dihydrate.



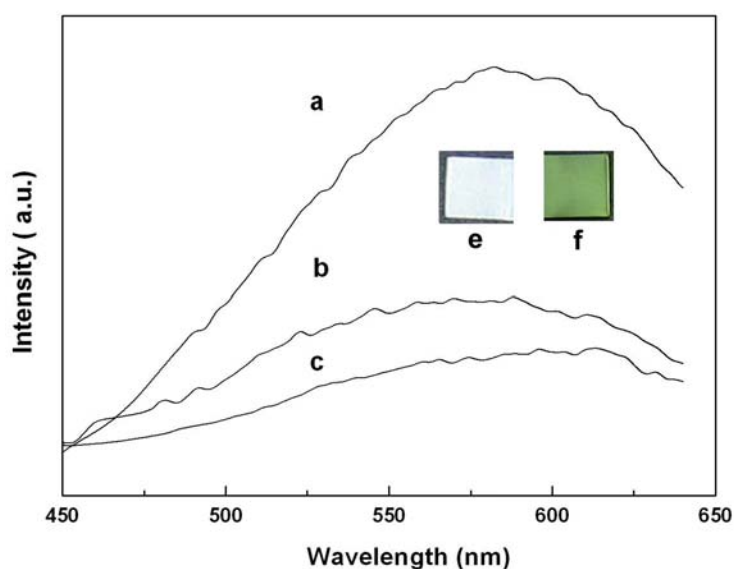
**Figure S4.** SEM images of aligned ZnO nanostructures grown on zinc foil at different temperatures in TBAH aqueous solution with the assistance of 10 mg zinc acetate dihydrate. (a, b) room temperature, (c, d) 80 °C.



**Figure S5.** SEM images of ZnO nanostructures grown on zinc foil in TBAH aqueous solution at 50 °C with the assistance of different concentration of zinc acetate dihydrate. (a, b) 15 mg zinc acetate dihydrate, (c, d) 30 mg zinc acetate dihydrate.

**Table S1.** The experiment results of the ZnO nanostructures constructed on zinc foil in TBAH aqueous solution with the assistance of zinc acetate dihydrate salt

Zinc acetate dihydrate concentration (mg)	10	15	20	30	10	15	20	30	10	15	20	30
Temperature	Room temperature				50 °C				80 °C			
Morphology	Aligned branched rods				Porous nanostructure	Aligned quasi-round nanorods			Aligned hexagonal rods		Aligned quasi-round nanorods	



**Figure S6.** Room-temperature photoluminescence spectra for the typical samples. (a) aligned hexagonal pyramids, (b) aligned quasi-round nanorods, (c) aligned hexagonal rods. (e) photograph of the sample corresponding to (a), (f) photograph of the sample corresponding to (a) under UV lamp irradiation.