Supporting Information

Flower shaped homocentric pencil like ZnO nanorod bundles: Synthesis, characterisation and study of its photocatalytic activity †

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Procedure for the synthesis of flower shaped homocentric pencil like nanorod bundles or ZnO flowers

ZnO flowers were synthesized by slight modification the procedure described by J.Duan et al.[1]. 150 ml double distilled deoxygenated water was taken in a 200 ml round bottom flask. 1g of $Zn(NO_3)_2.6H_2O$ and 0.3 g of PEG-4000 were dissolved in it to form a transparent solution with vigorous stirring. After that, the p^H of the resulting mixture was made 9.7 by adding NH_3 solution drop wise at room temperature. The resulting mixture was refluxed at 80° C for 8 h at N_2 atmosphere and cool down naturally. The precipitates was collected and washed with distilled water for several times. After washed, the resulting suspension was diluted to a total volume of 80 ml with deoxygenated double distilled water and transferred into a Teflon lined autoclave of 100 ml capacity. After being sealed, the autoclave was put into an hot air oven and maintained at 110° C for 16 h. After that, the autoclave was allowed to cool down naturally. Finally, the as synthesized ZnO flowers were washed with double distilled water and dried at 100° C in a hot air oven.

$$NH_3 + H_2O \leftrightarrow NH_3.H_2O \leftrightarrow NH_4^+ + HO^-$$

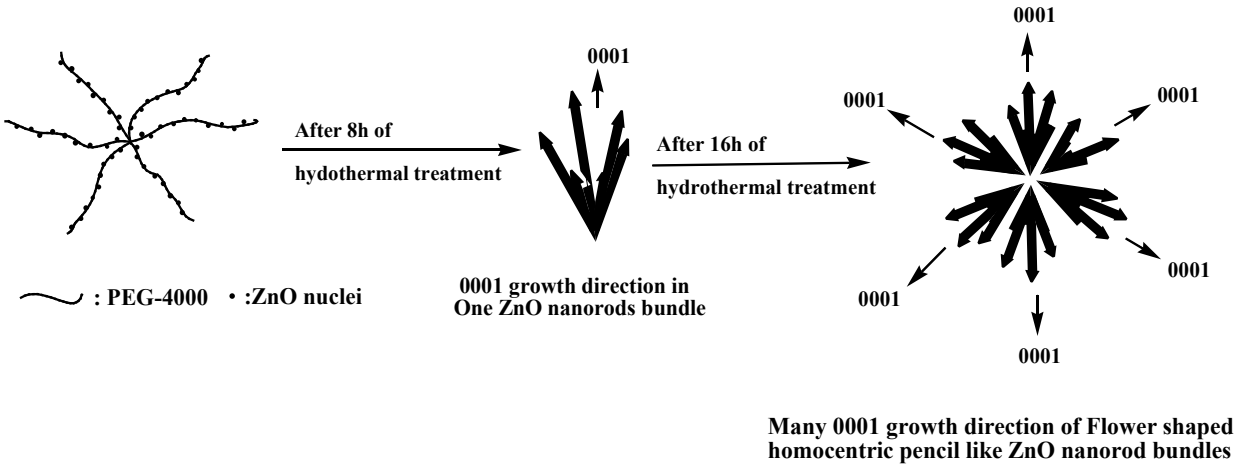
$$Zn^{2+} + 4NH_3 \rightarrow Zn(NH_3)_4^{2+}$$

$$Zn(NH_3)_4^{2+} + 2OH^- \rightarrow ZnO + 4NH_3 + H_2O$$

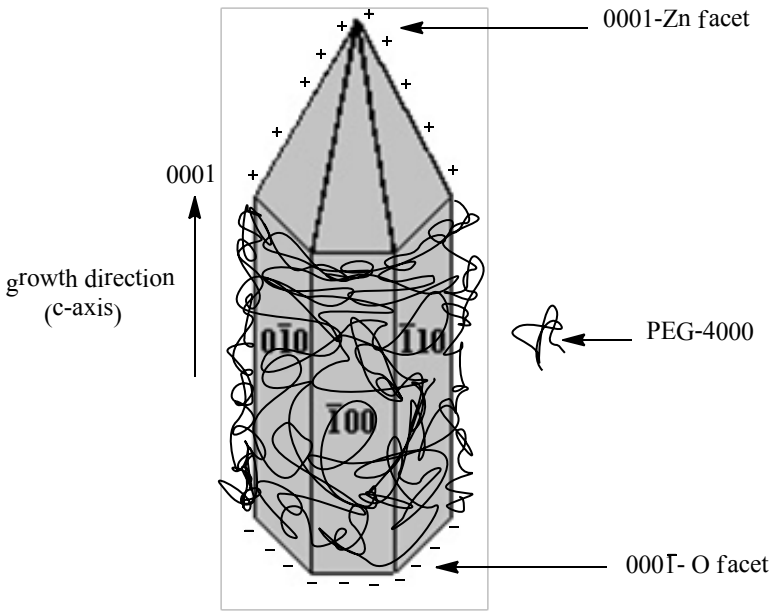
$$Zn^{2+} + 4OH^- \rightarrow Zn(OH)_4^{2-}$$

$$Zn(OH)_4^{2-} \rightarrow ZnO + H_2O + 2OH$$

Scheme S1. Possible reaction scheme of formation of ZnO nanostructure



Scheme S2: Mechanistic steps of synthesis of flower shaped ZnO nanorod bundles



Scheme S3: Growth of one individual ZnO nanorod

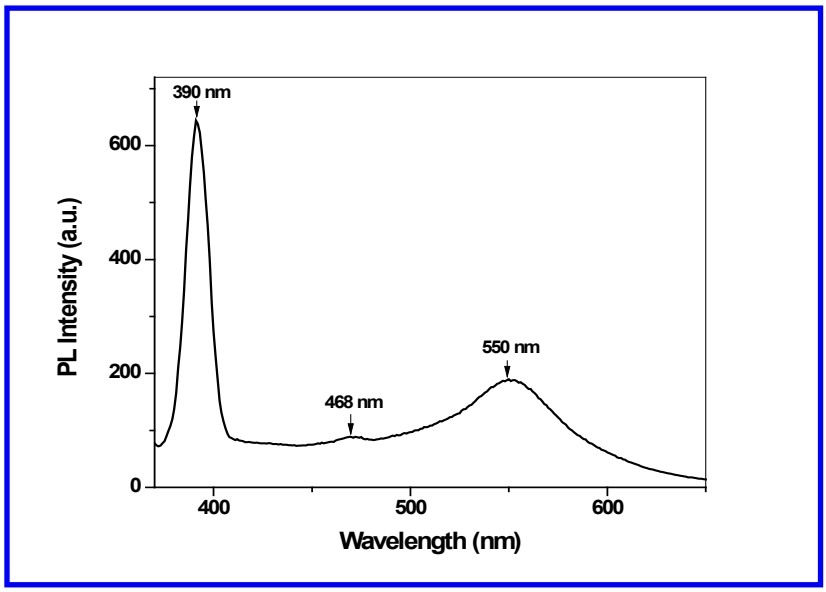


Fig. S1 Room temperature Photoluminescence spectra of ZnO flowers

The room temperature PL was carried out in a Shimadzu, Spectrofluorophotometer, RF-5301 and measured at excitation wavelength of 350 nm.

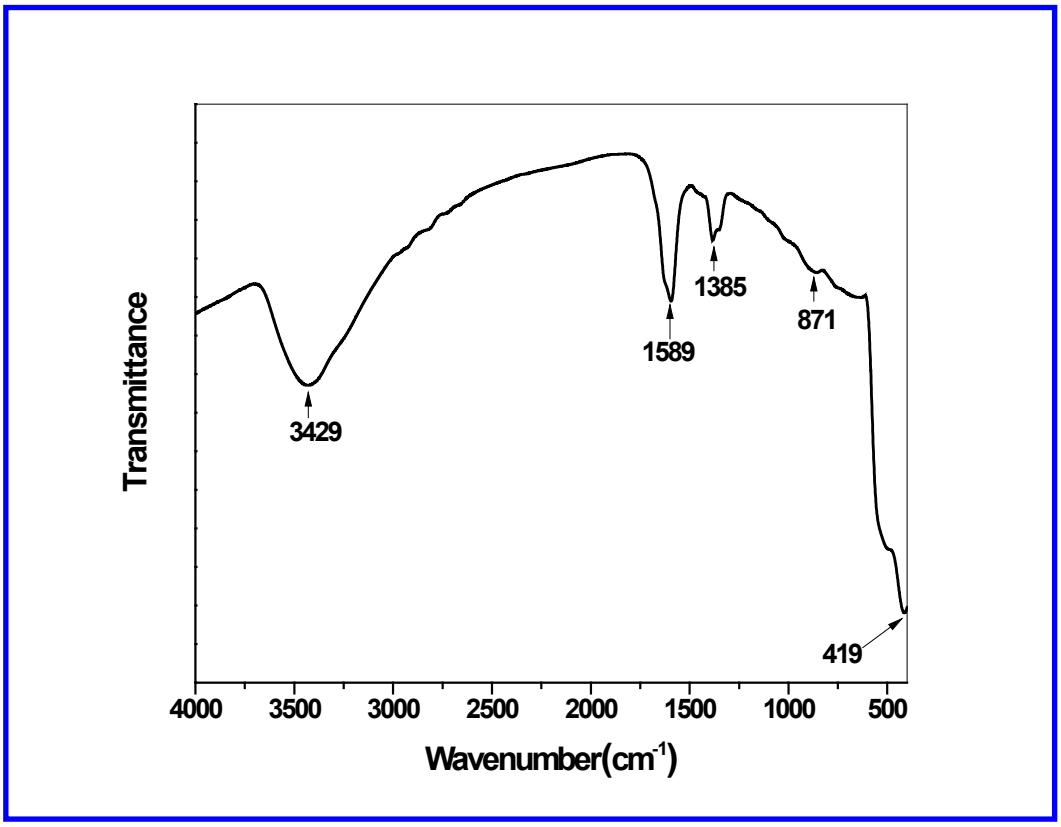


Fig. S2 FT-IR spectra of synthesized ZnO flowers

In the FT-IR the broad bands around 3429 cm^{-1} and 1589 cm^{-1} are due to surface adsorbed O-H stretching and bending mode of vibration respectively. The sharp band at 419 cm^{-1} is characteristic vibration mode of Zn-O bonding [2].

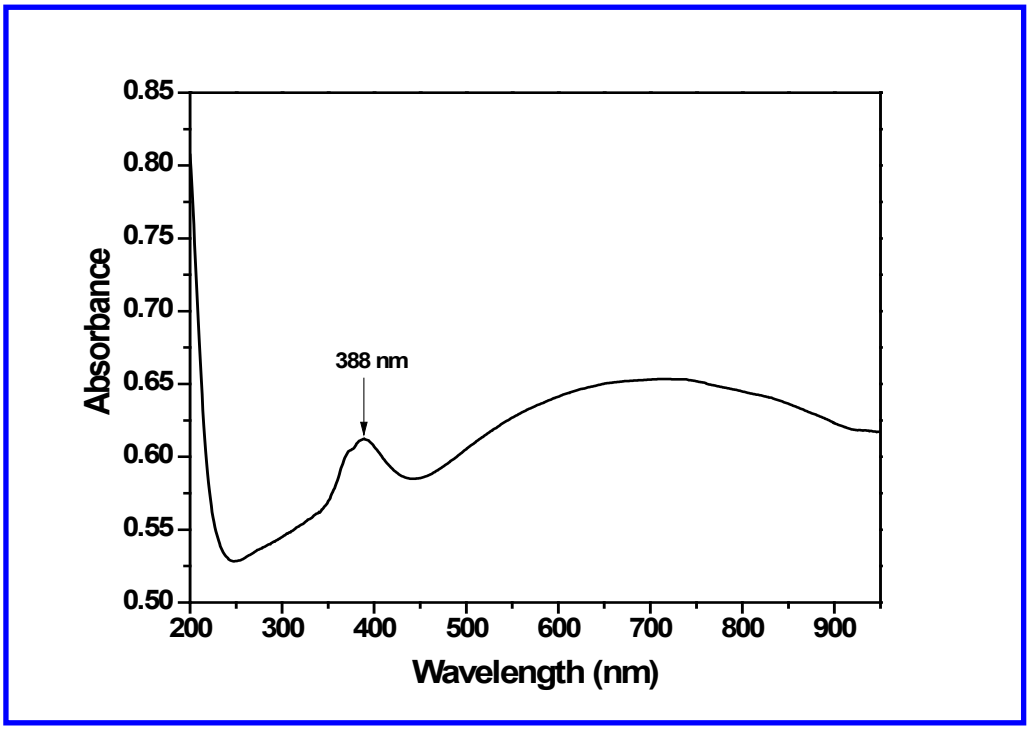


Fig. S3 UV-Vis spectra of synthesized ZnO flowers

The UV-Vis absorption spectra of the ZnO sample dispersed in distilled deionized water is shown in the figure S3. The λ_{max} observed UV for ZnO flowers are at 388 nm and apart from this broad absorption in the visible spectral range suggested that more absorption states or defect energy bands exist in the as-synthesized ZnO sample [3]. In spite of showing excitonic characteristics, an asymmetric tail was observed toward the higher wavelengths because of scattering. ZnO is insoluble in water, so, an appreciable amount of light always scattered by the dispersions because of the inhomogeneous distributions of the nanorod bundles [3].

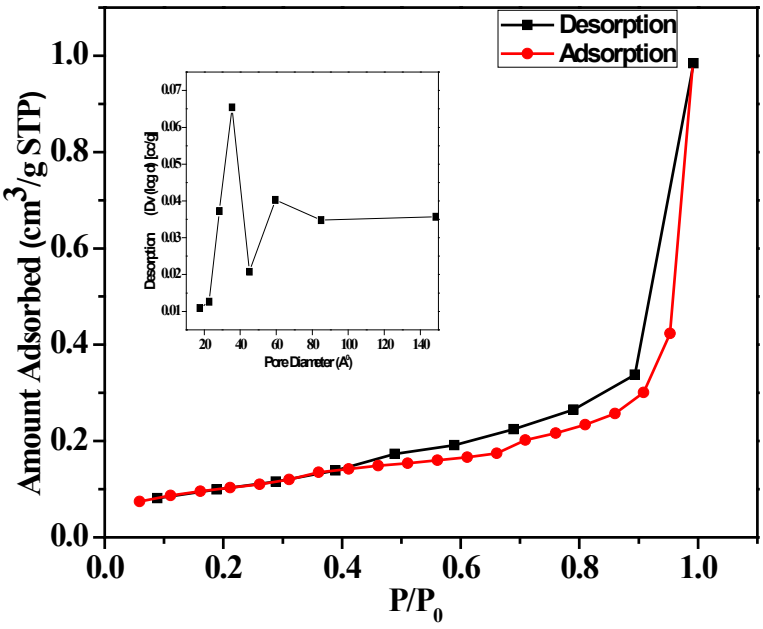


Fig. S4 The BET N_2 adsorption-desorption isotherm of ZnO flowers and BJH pore size distribution (inset).

Description about Warburg apparatus:

The Warburg apparatus is a device used for measuring the pressure of a gas at constant volume and constant temperature so that the pressure is a measure of the gas and changes in pressure reflect the production or absorption of the gas. This manometric apparatus was first introduced by German biochemist and nobel laurate Otto Heinrich Warburg [4]. The apparatus consists of a series of flasks attached to U-shaped manometers. The flasks are submerged in a temperature controlled water bath with the manometers mounted around the outside of the water bath on a shaking mechanism. At thermal mass transfer equilibrium, an initial reading is obtained on the manometer, and the volume of gas produced or absorbed is determined at specific time intervals. This apparatus has been efficiently used in soil metabolism studies, environmental microbiology, for measurement of O_2 consumption or evolved CO_2 by tissue homogenates or tissue slices at constant temperature and pressure.

[1] J. Duan, X. Huang, E. Wang, *Materials Lett.* 2006, **60**, 1918-1921.

[2] Y.J. Kwon, K.H. Kim, C.S. Lim, K.B. Shim, *J. of Ceramics Processing Res.* 2002, **3**, 146-149.

[3] T. Ghoshal, S. Kar, S. Chaudhuri, *J. Cryst. Growth* 2006, **293**, 438-446.

[4]"The Nobel Prize in Physiology or Medicine 1931". www.nobelprize.org/nobel_prizes/medicine/laureates/1931/