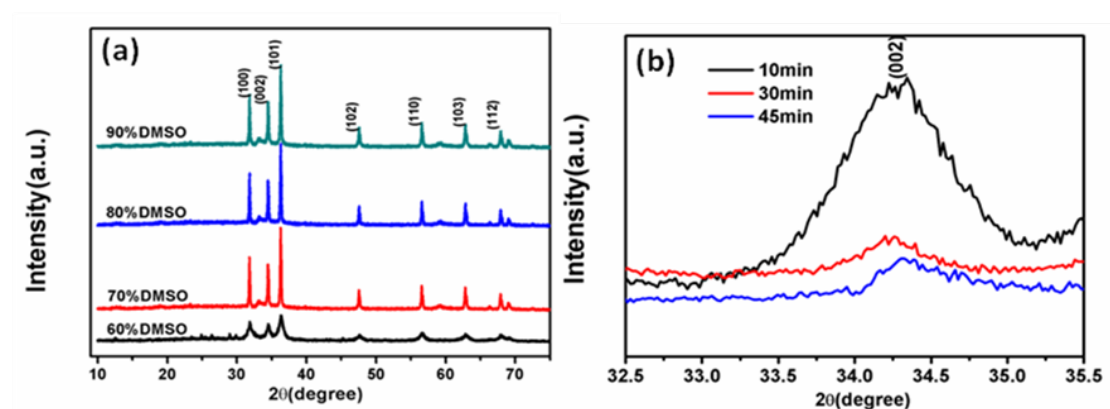# Supporting Information

Controllable Synthesis of Hierarchical ZnO Nanodisks for Highly Photocatalytic Activity

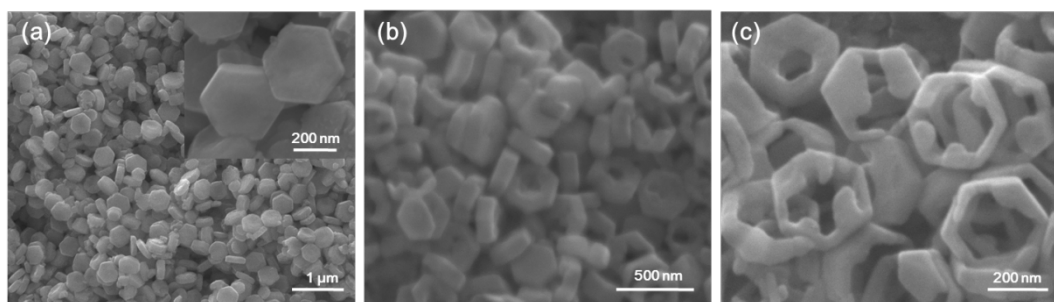**Teng Zhai,[a] Shilei Xie,[a] Yufeng Zhao,[a] Xiaofeng Sun,[a] Xihong Lu,[a,b] Minghao Yu,[a] Ming Xu,[a] Yexiang Tong*[a]**
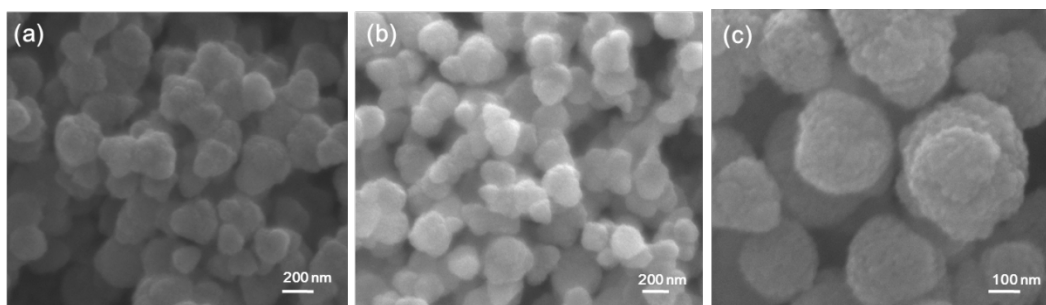
Fig. S1 (a) XRD patterns of the different products obtained with different concentrations of DMSO. (b) Enlarge XRD patterns of the ZnO nanorings obtain with different reaction time in the range $2\theta = 32.5°\sim 35.5°$.
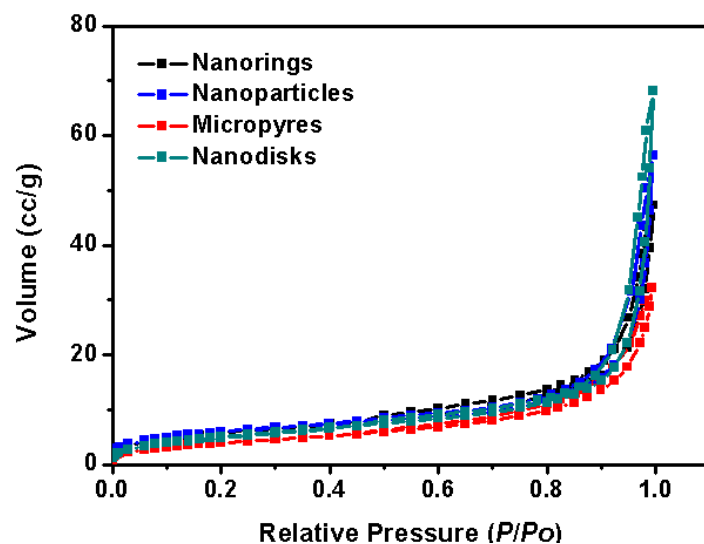

Fig. S2 SEM images of ZnO nanorings obtained at different time intervals: (a) 10 min, (b) 30 min, and (c) 45 min.

Fig. S3 SEM images of ZnO nanoparticles obtained at different time intervals: (a) 10 min, (b) 30 min, and (c) 45 min.
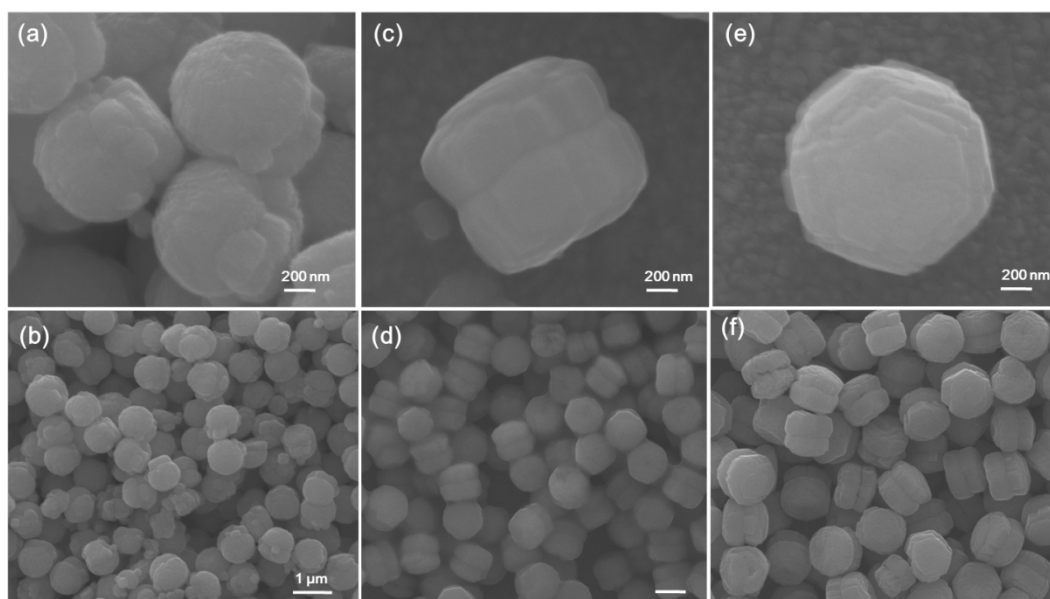
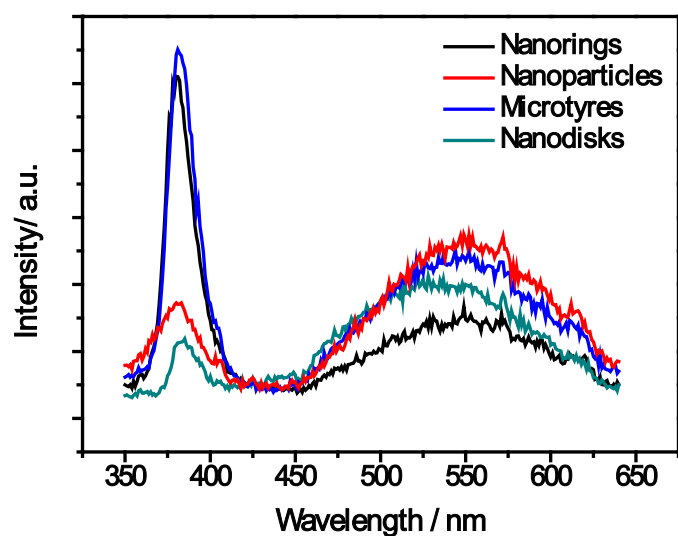

Fig. S4 SEM images of ZnO microtyres obtained at different time intervals: (a, b) 10 min, (c, d) 30 min, and (e, f) 45 min.

Fig. S5 Nitrogen adsorption–desorption isotherms of ZnO nanorings, nanoparticles, mocrotyres and nanodisks.
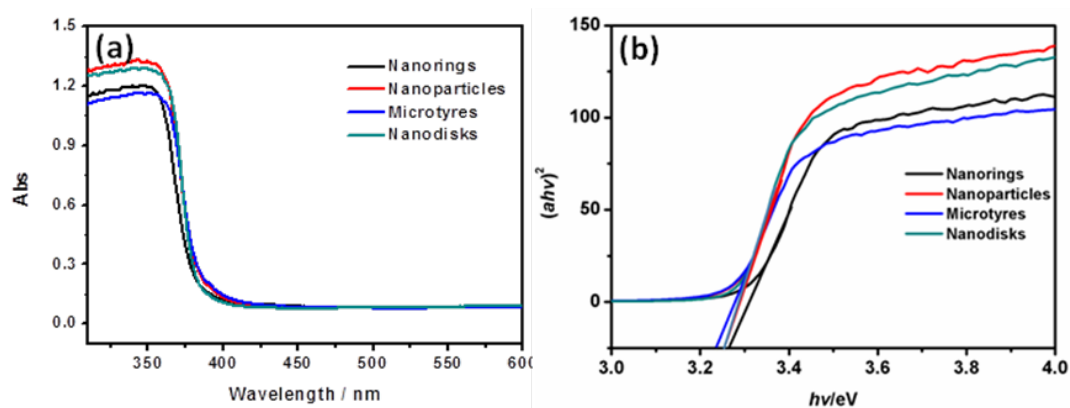
Fig. S6 (a) UV-vis diffuse reflectance spectra and (b) $(\alpha h v)^2$ vs $h v$ curves for ZnO nanorings, nanoparticles, mocrotyres and nanodisks.

Figure S7. Room temperature photoluminescence (PL) spectra of the prepared samples with the excitation wavelength was 325 nm.

The optical band gap (E_g) of a semiconductor material can be calculated from the equation of $(\alpha h v)^n = A (h v - E_g)$, where hv is the photon energy, α is the absorption coefficient, A is a constant for the material, and n is 2 for a direct transition or 1/2 for an indirect transition.[1] As shown in Fig. S6b, the calculated direct bang gap for the nanorings (60% DMSO), nanoparticles (70% DMSO), microtyres (80% DMSO) and nanodisks (90% DMSO) is about 3.26, 3.25, 3.24 and 3.26 eV, respectively. These values are slightly smaller than the theoretical value of bulk ZnO (3.37 eV).

It is well known that the impurities in ZnO nanostructures can adjust the crystal structures and cause the change of properties. ZnO doping with different transition metal ions is an effective approach to tune up the optical band gap of ZnO.[3-5] However, in our present case, any impurities such as hydroxide couldn't be observed in our samples by analyzing the XRD, EDS, FTIR and TEM. Hence, the influence of impurities on the optical band gap can be negative. Recently, a red-shift phenomenon of the CeO_2 nanoneedles arising from shape effect was observed by Chang's group,[2] and the oxygen vacancies have been widely accepted for the explanation with the red-shift of ZnO nanostructures.[6-8] From the PL spectra in Figure 3, the broad

emission band between 450 and 630 nm indicates our samples possess oxygen vacancies.[9-10] Thus, based on the discussion above, we believed that the red-shift for the absorption edge is ascribed to the shape effect and oxygen vacancies and this content has been added in the supporting information.

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