Electronic Supplementary Material (ESI) for RSC Advances.

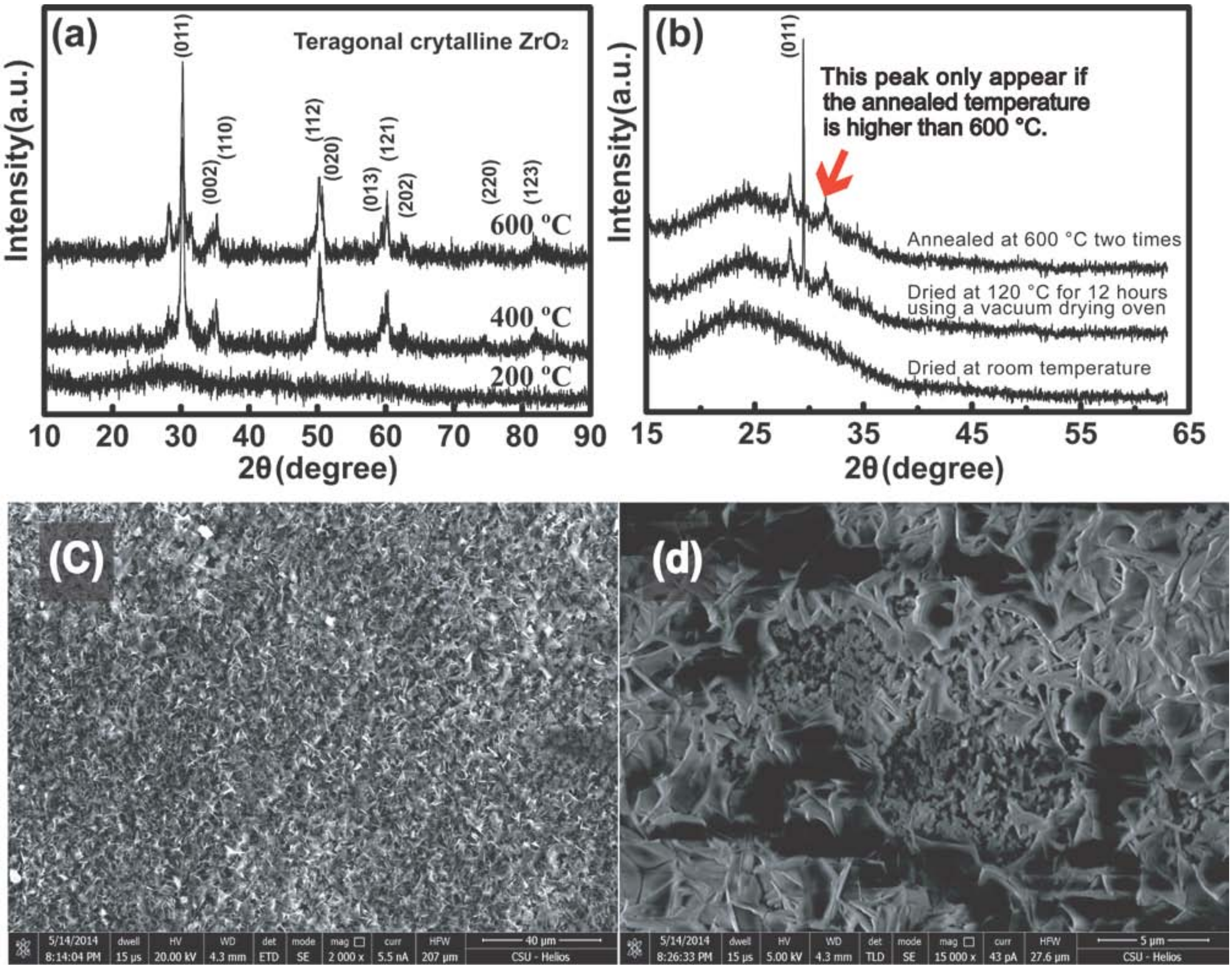

Fig. S1 XRD results of the porous ZrO_2 particles. (a) XRD data of ZrO_2 raw material before the purification. (b) XRD data for ZrO_2 thin film before and after the second time of annealing. (c)-(d) SEM images of the fabricated ZrO_2 thin film dried at room temperature.

Compared Fig. S1 (a) and (b), there are **three key points** need to be explained. **One,** the red-arrow marked diffraction peak in Fig. S1 (a) only appeared if the film has been annealed at the temperature higher than 600 ºC. **Two,** Fig. S1 (c) and (d) is the SEM images of the fabricated porous ZrO_2 thin films if it has not been annealed again at high temperature or has been only dried at room temperature. The surface covered a layer of organic residues. Thus the XRD data for this sample only has signal of the substrate. Further SEM investigations of Fig. S1 (c) and (d) support this conclusion. **Three,** the narrow Half-peak width illustrates a smaller average particle size and a narrower size distribution of ZrO_2 for Fig. S1 (a) compared to Fig. S1 (b). ZrO_2 for the dip-coating were purified from the raw materials that tested in the Fig. 2. Thus it will inevitably own a smaller size and a narrower size distribution. Also, the results suggested that the purification process in our article is effective and efficient. Also, it is interested to found that the film shows a high [011] orientation. This phenomenon will be discussed elsewhere in our other related works.

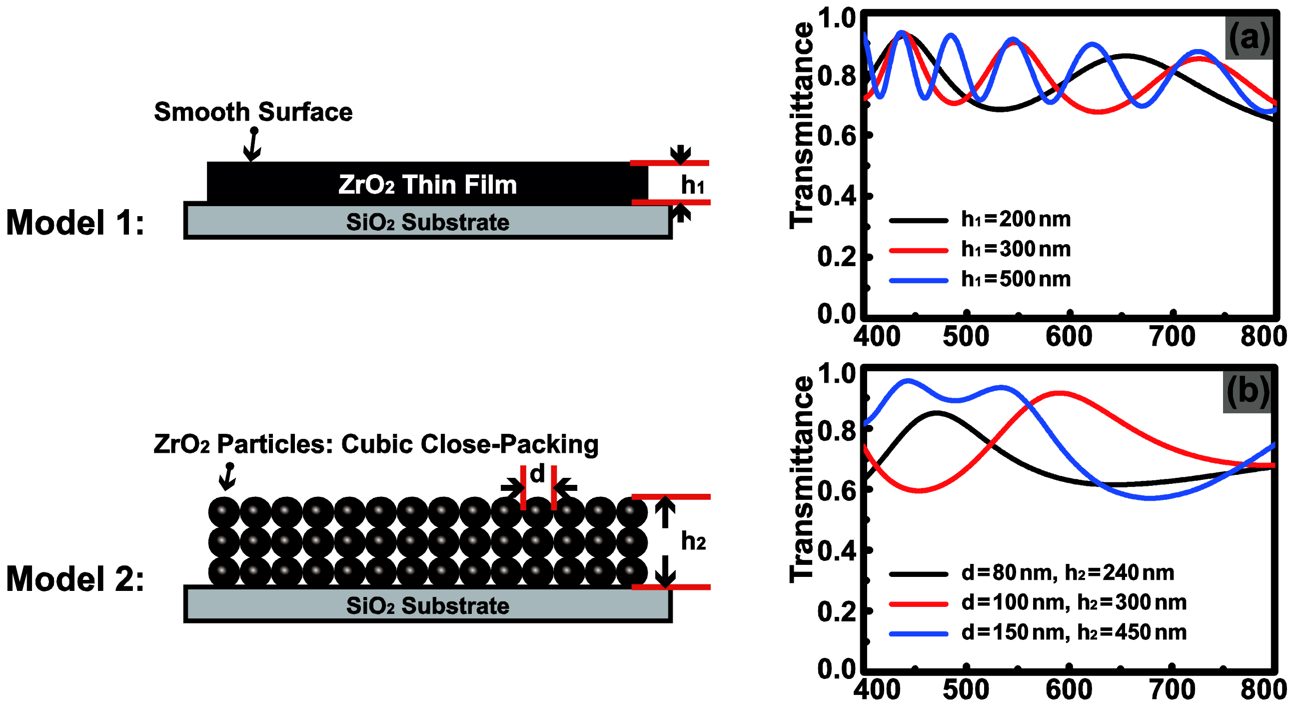

Fig. S2 Two structure models and the FDTD simulated optical properties. (a) Model 1, which composes a smooth surface. h1 is the film' thickness. (b) Model 2, a cubic close-packing structure. The number of layers is fixed, while the particle diameter of d varied from 80 nm to 150 nm.

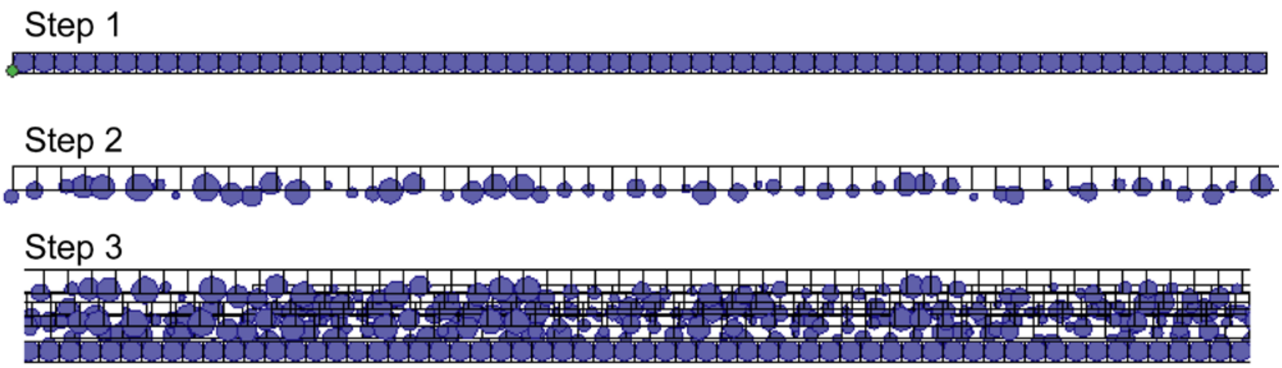

Fig. S3 Steps for building the structural model.

The disordered structure was built via a simple method. First, we supposed that the particle were spherical and close packed as shown in Fig. S3. Every square cell thus contains one single spherical ZrO_2 nanoparticle in its center. Then the coordinate of the center point of every ZrO_2 was changed. Its value was randomly produced by the computer, but it should be confined within the square cell. Also, the diameter of ZrO_2 was varied from 30 to 80 nm accordingly. After these transformations, a series of belts which composed by randomly distributed ZrO_2 particles are achieved (Fig. S3 step 2 shows one of these belts). Finally, we randomly stacked these ZrO_2 belts layer by layer to form a disordered film structure (see Fig. S3 step 3).