Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A

Supporting Information

Cu_2ZnSnS_4 nanoplate arrays synthesized by pulsed laser deposition with high catalytic activity as counter electrodes for dye-sensitized solar cell applications

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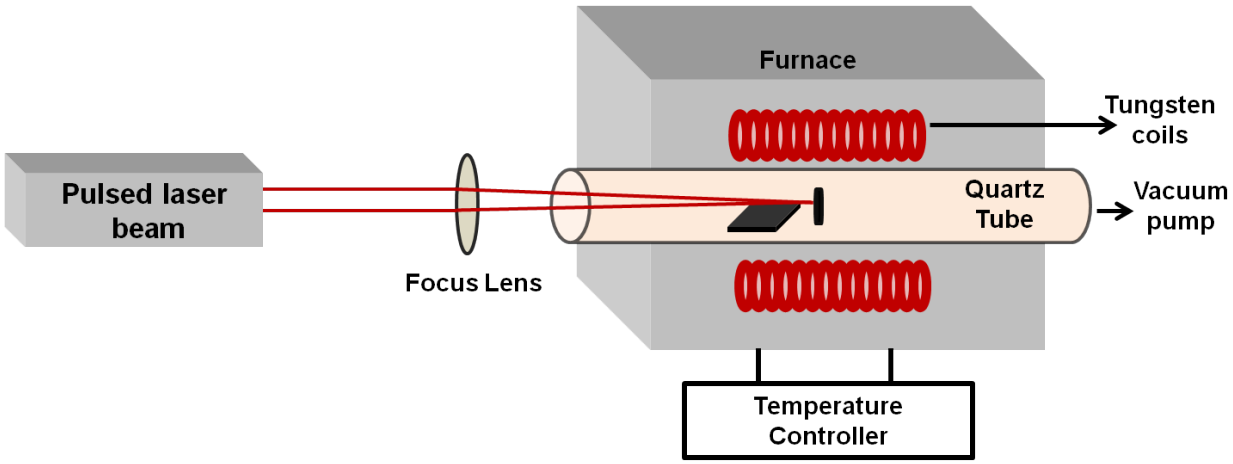

Figure S1: Schematic of the custom made pulsed laser deposition system

A Nd:YAG laser was focused through a focus lens on a CZTS target, located inside a one inch diameter quartz tube. The substrate was placed in front of the target inside the quartz tube, which was connected to a vacuum pump in order to control the atmosphere during the ablation process.

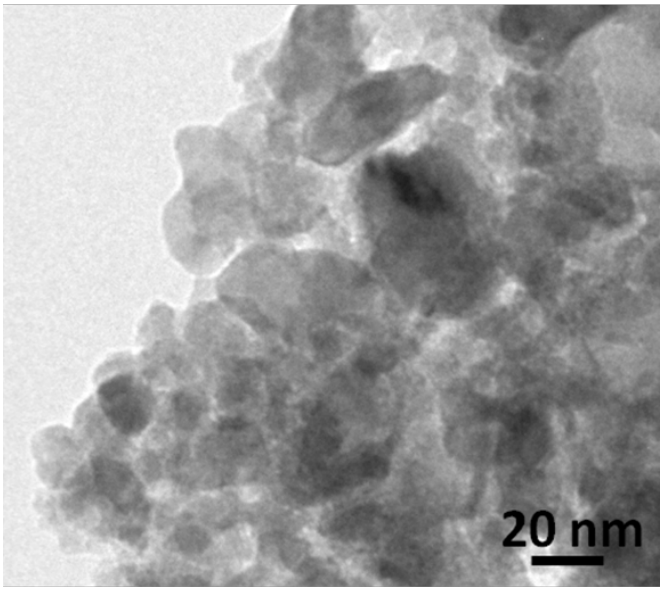

Figure S2 TEM image of a cluster of CZTS nanocrystals with a size of about 20-50 nm, which act as the seed layer for the growth of the CZTS nanoplate array.

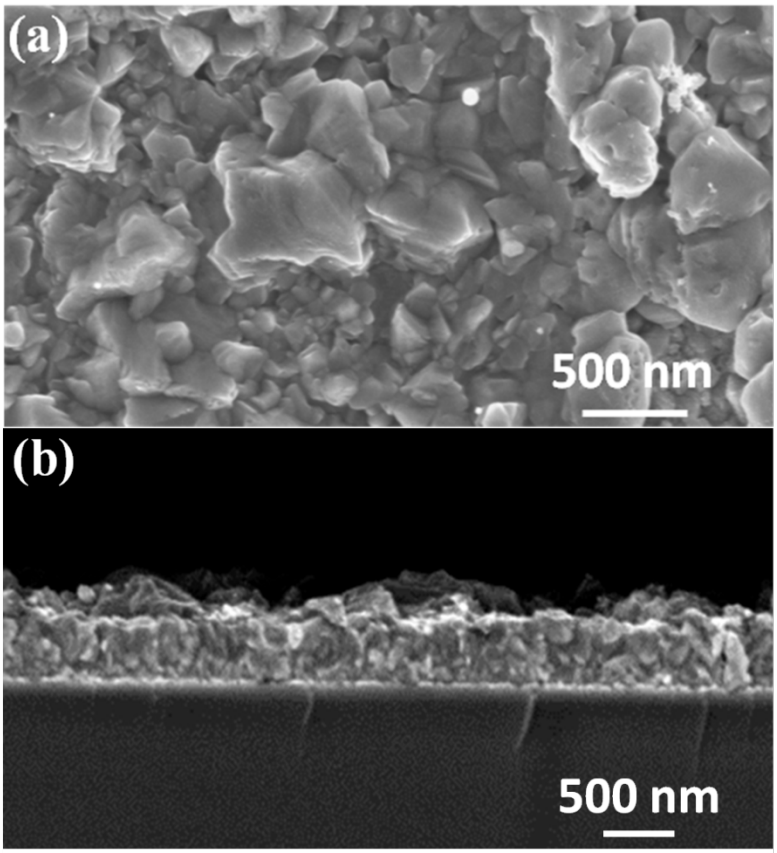

Figure S3: (a) Top view FESEM image, and (b) Cross sectional FESEM image of the CZTS thin film synthesized by pulsed laser deposition (34mJ/cm^{-2}, 450°C) with a similar height as the nanoplates (about ~0.5 μm). The grains with different sizes can be observed from the top view, and no cracks or voids are visible on the top view and cross sectional images of the film.

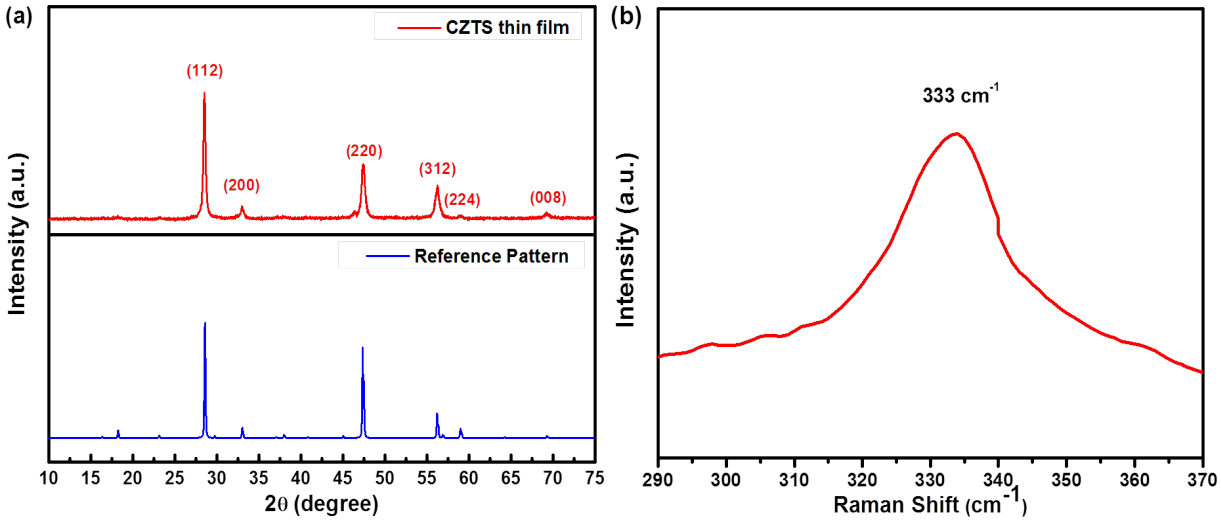

Figure S4: (a) Powder XRD data of the CZTS thin film (500 nm , upper spectrum) used as a CZTS counter electrode in DSSC, which clearly shows (112), (220), (312), and (008) characteristic peaks of CZTS kesterite phase, compared to CZTS reference spectrum JCPDS No. 26-0575 (lower spectrum). The CZTS thin film do not show the presence of the FTO peaks on the XRD data due to the overall thickness of the film which is higher than the penetration depth of the x-rays, and (b) Raman spectrum of the same CZTS thin film with a single peak at 333cm^{-1}, consistent with a pure kesterite phase.