Supporting Information for

In-situ fabrication of Cu_2ZnSnS_4 (Se_4) nanoflake thin films on both rigid and flexible substrates

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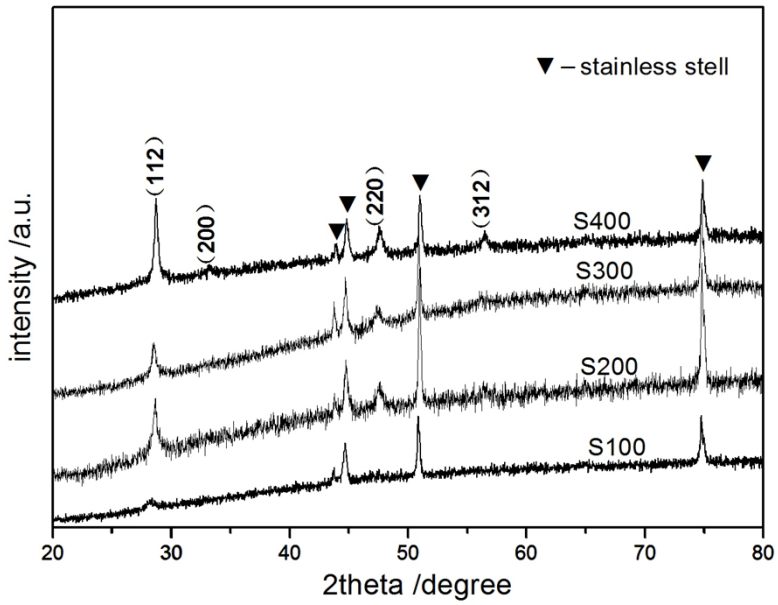

Figure. S1 XRD patterns of the CZTS nanocrystalline thin films samples prepared for18 h at 250 °C on stainless steel substrates. The thicknesses of CuSnZn alloy layers were 100 nm~400 nm.

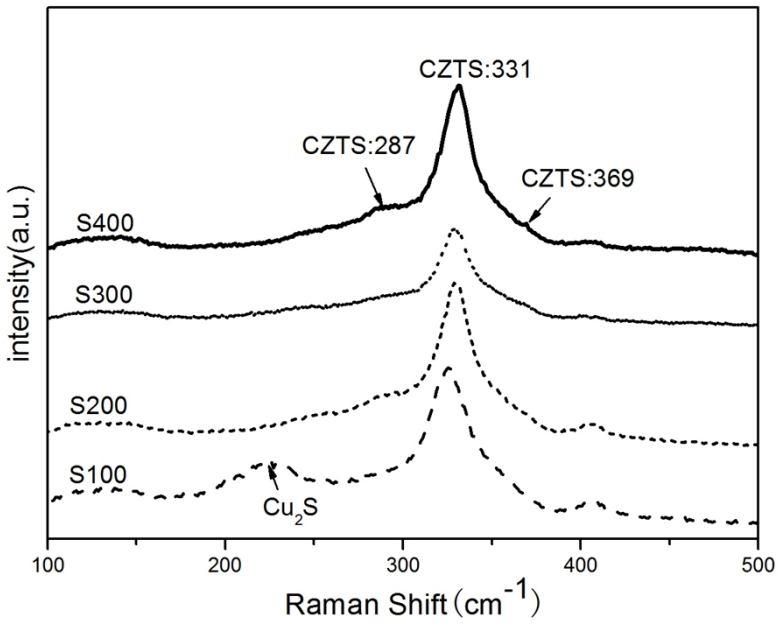

Figure. S2 Raman spectra of the CZTS nanocrystalline thin films samples prepared for18 h at 250 °C on stainless steel substrates. The thicknesses of CuSnZn alloy layers are100 nm~400 nm.

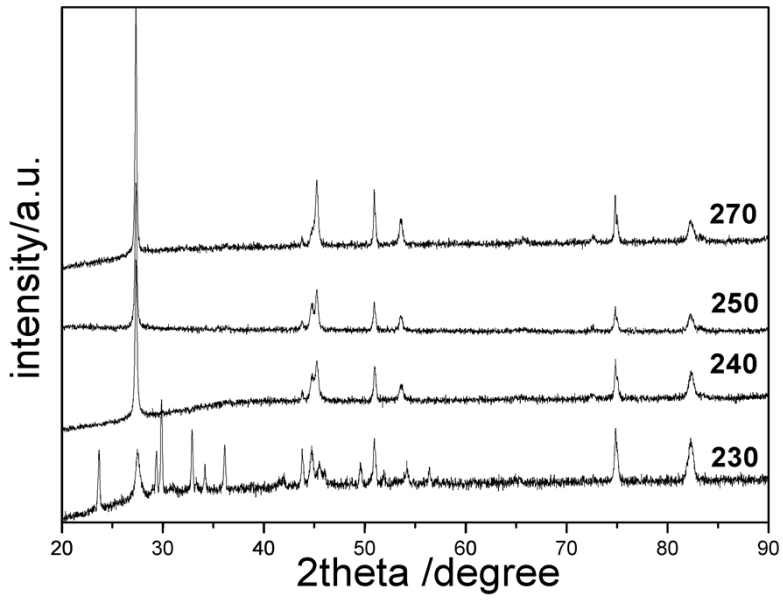

Figure. S3 XRD patterns of the CZTSe nanocrystalline thin films samples prepared at 230~270°C for 18 h on stainless stell substrates. The thickness of CuSnZn alloy layer is 400nm.

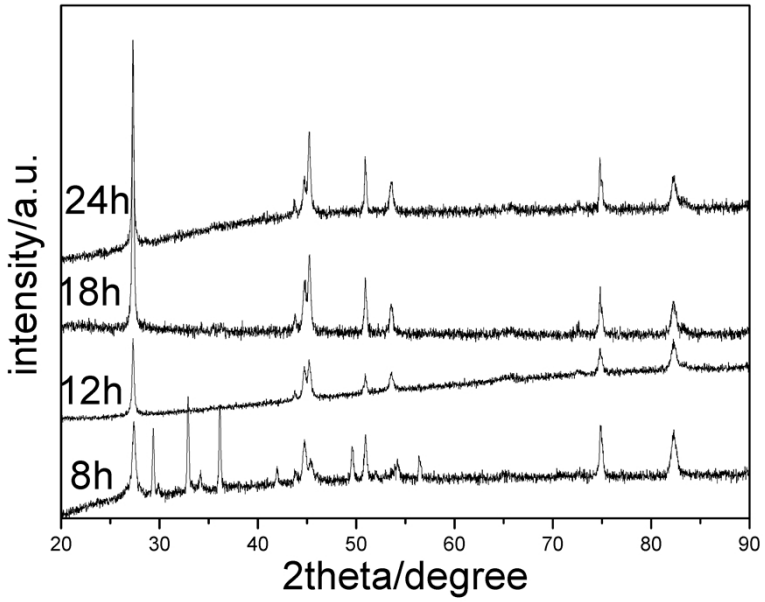

Figure. S4 XRD patterns of the CZTSe nanocrystalline thin films samples prepared for 18h~24h at 250 °C on stainless stell substrates. The thickness of CuSnZn alloy layer is 400nm.

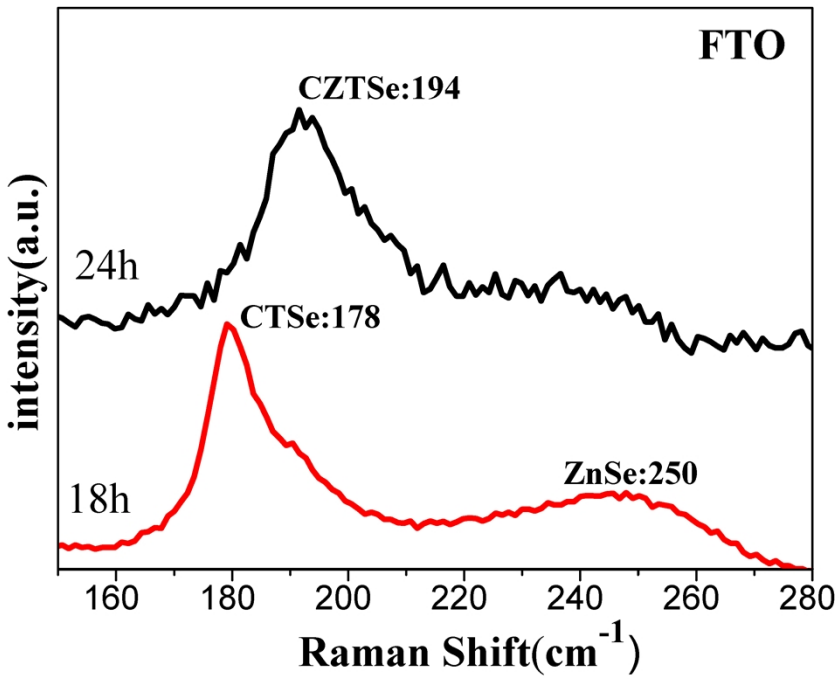

Figure. S5 Raman spectra of the CZTSe nanocrystalline thin films samples prepared for 18 h and 24 h at 250 °C on FTO substrates.

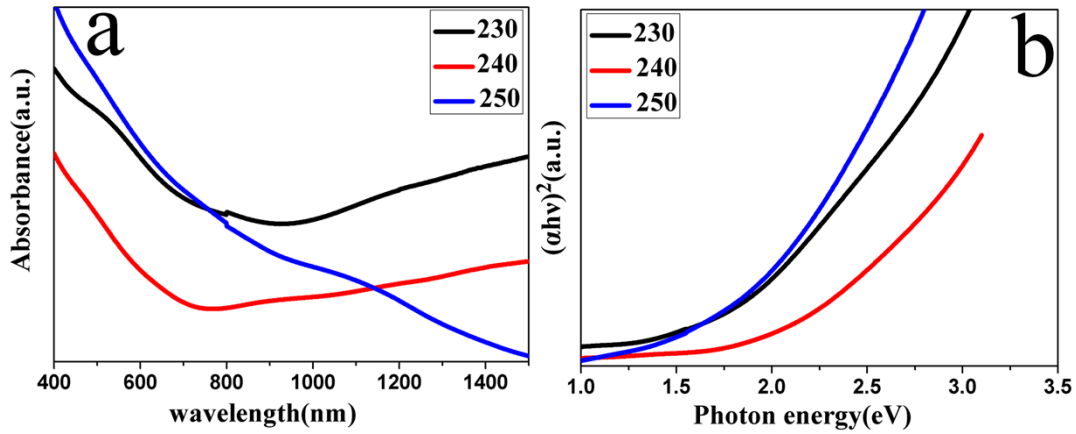

Figure S6 UV-vis-NIR absorption spectra of the CZTS thin film prepared at 230°C, 240°C and 250°C for 18 h (a) and the corresponding $(\alpha h\nu)^2$ *vs*. hν curve (b).

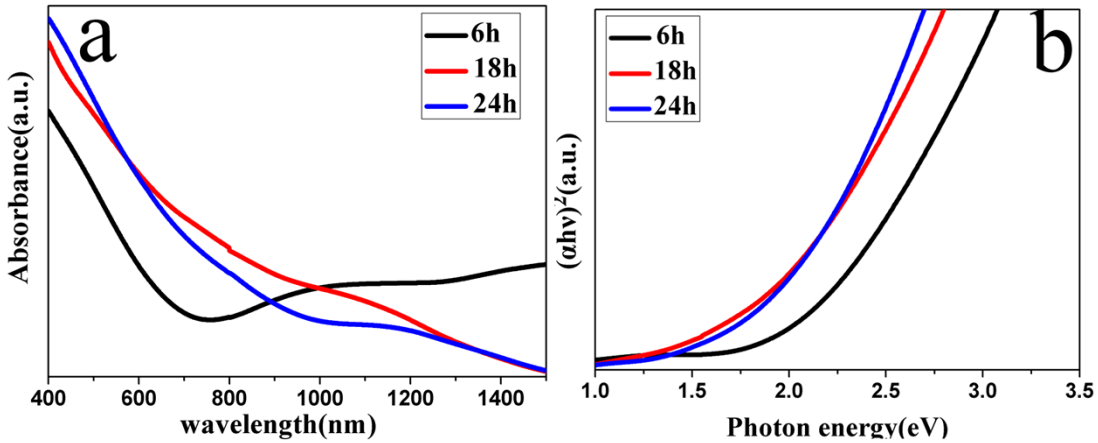

Figure S7 UV-vis-NIR absorption spectra of the CZTS thin film prepared at 250°C for 6 h, 18 h and 24 h (a) and the corresponding $(\alpha h\nu)^2$ *vs*. hν curves (b).

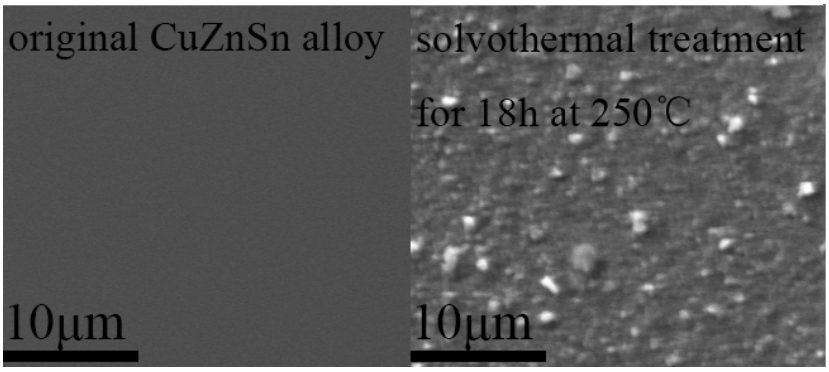

Figure S8 SEM images of the original and solvothermal treated alloy surface.