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Supporting Information

# Kesterite $Cu_2ZnSnS_4$ thin film solar cells by a facile DMF-based solution process

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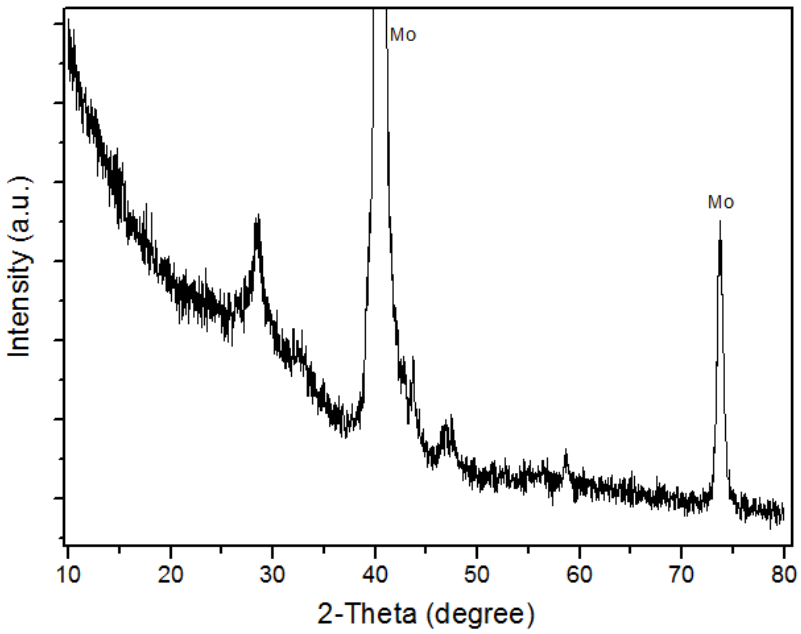


Figure 1S XRD pattern of as-prepared CZTS precursor

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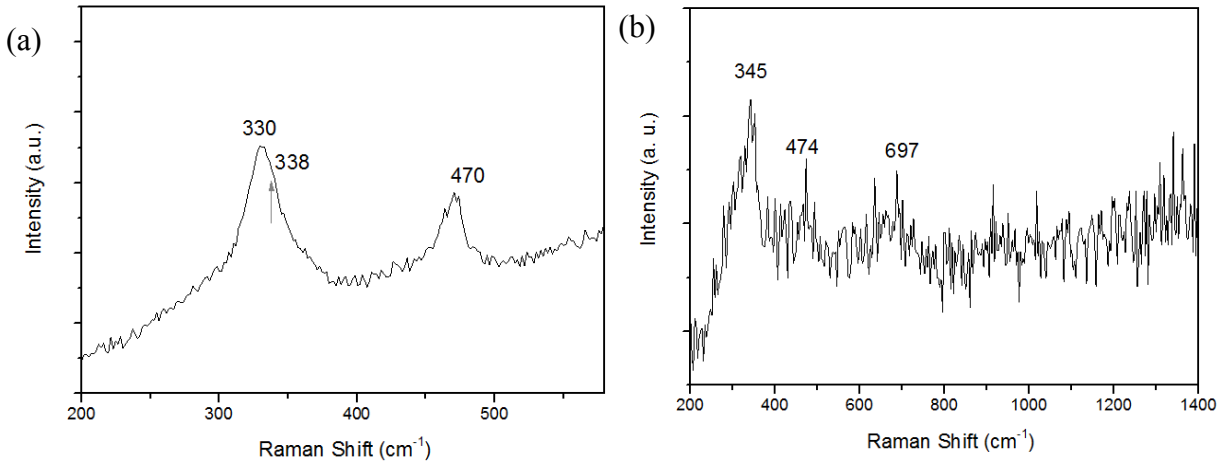


Figure 2S Raman spectra measured with laser excitation wavelength of 514 nm (a) and 325 nm (b) for as-prepared CZTS precursor.

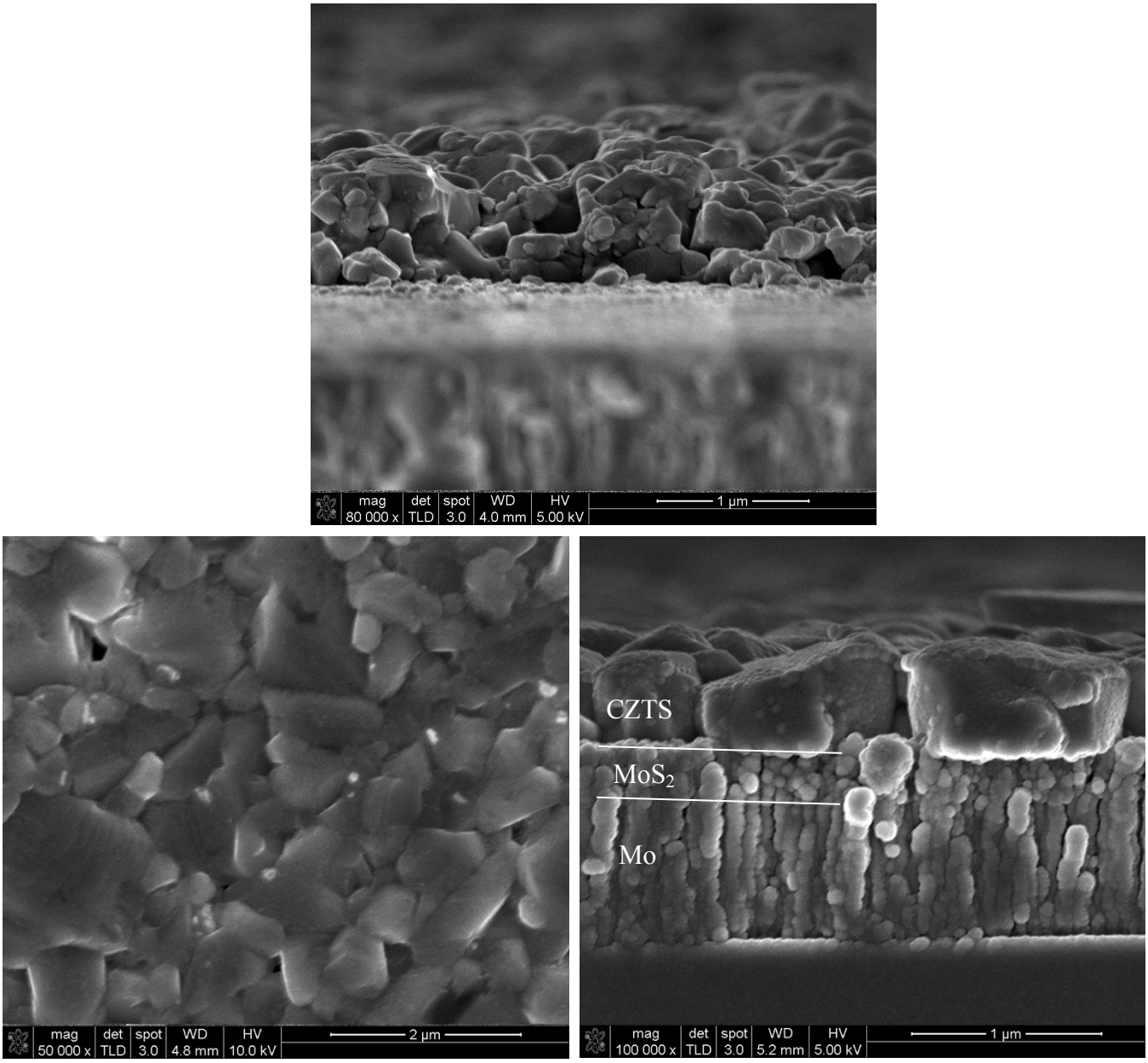


Figure 3S (a) Cross-sectional SEM image of the CZTS absorber from 550 ºC sulfurization; (b) Top-view and (c) cross-sectional SEM images of the CZTS absorber from 580 ºC sulfurization.

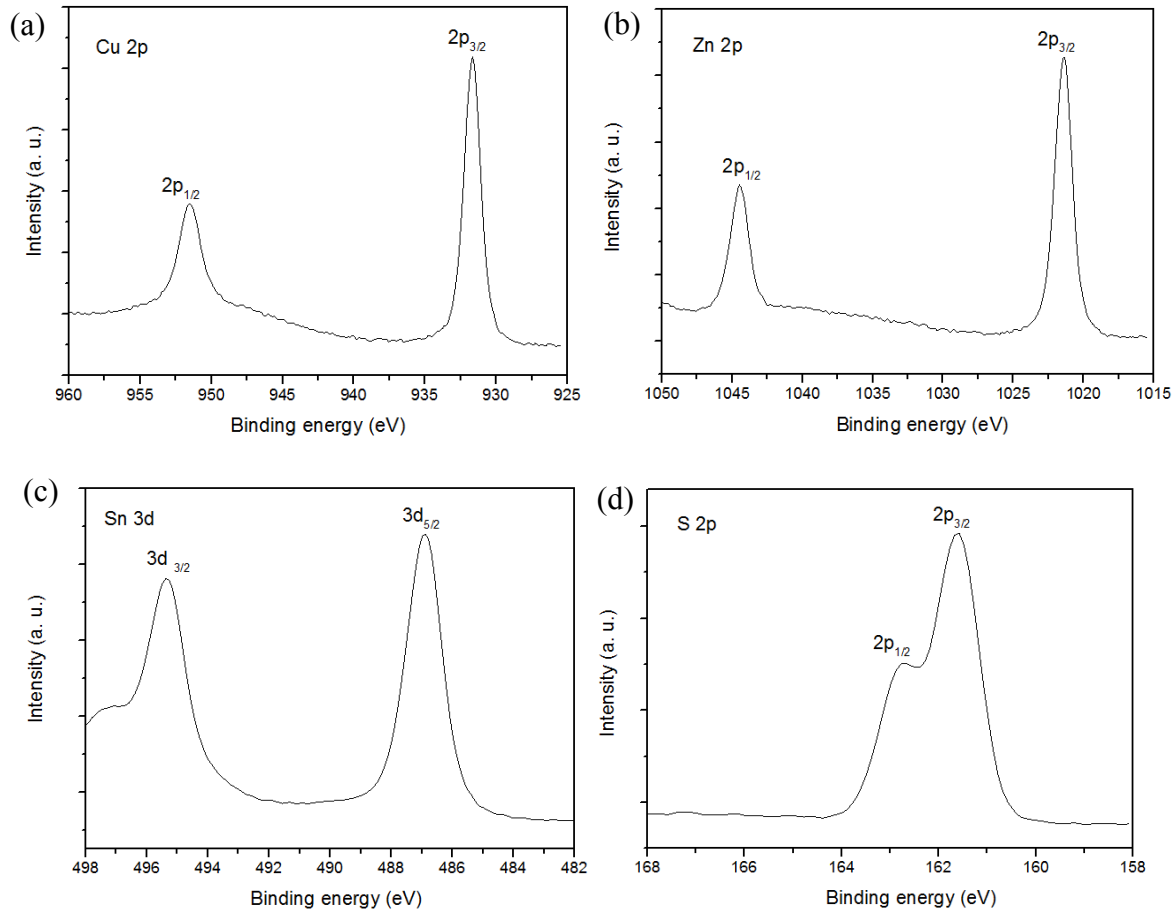


Figure 4S High-resolution XPS spectra of (a) Cu 2p, (b) Zn 2p, (c) Sn 3d, and (d) S 2p for $Cu_2ZnSnS_4$ absorber recorded at room temperature.

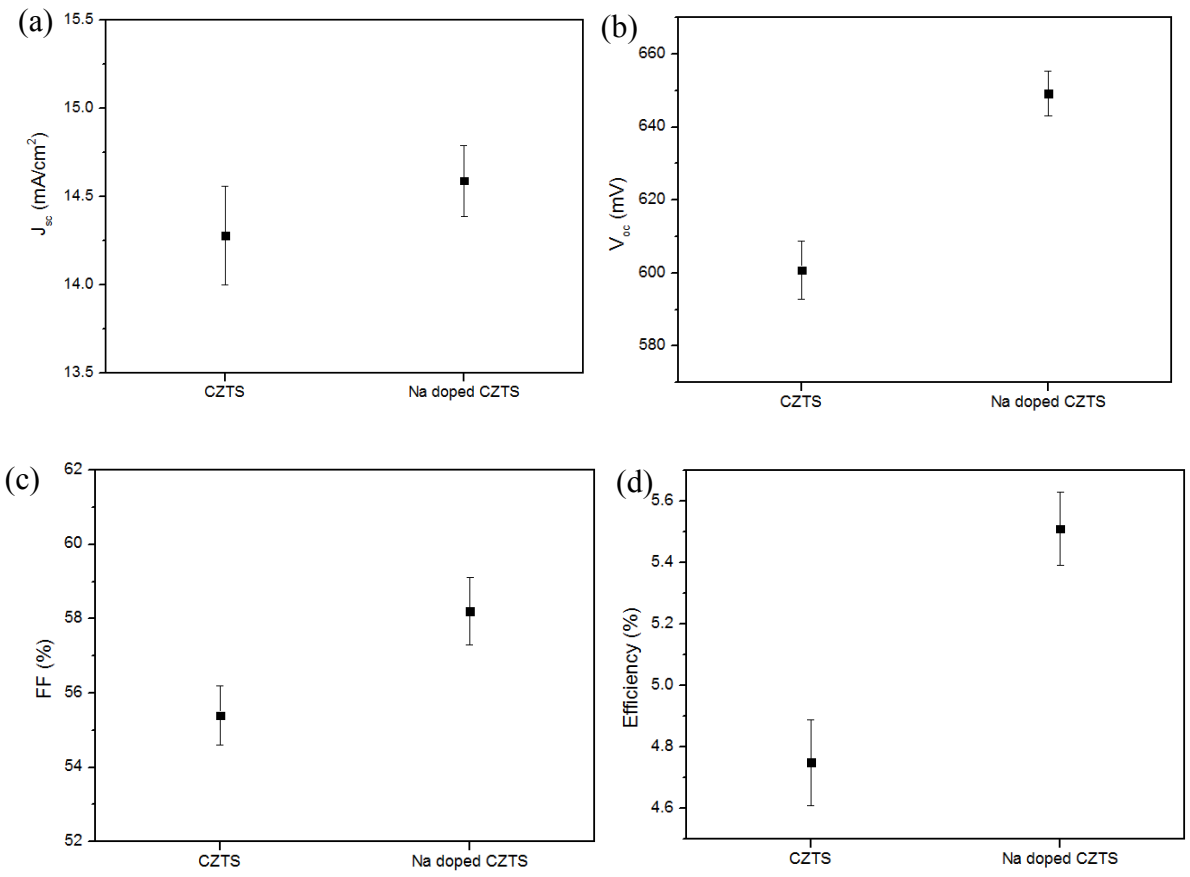


Figure 5S Plots of the electric property comparison between CZTS and Na dope CZTS based devices, (a) $V_{OC}$; (b) $J_{SC}$; (c) FF; (d) Efficiency.