Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information

Ge-Alloyed CZTSe Thin Film Solar Cell Using Molecular Precursor Adopting Spray Pyrolysis Approach

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Tables and Figures: Supporting Information

Table S1. Lattice parameters of postselenized CZTSe and CZGTSe thin films calculated from XRD results. Here, the lattice parameters include errors a (Å) $\pm$ 0.005 Å, c (Å) $\pm$ 0.008 Å, V $\pm$ 1 Å^3, $\eta \pm 0.0004$.

Table S2. Carrier concentration, mobility, resistivity of postselenized CZTSe and CZGTSe thin films obtained from Hall effect measurements.

Fig. S1. Precursor solution prepared in DIW and DMSO for deposition of CZTS and CZGTS thin films.

Fig. S2. X-ray diffraction patterns (a) and Raman spectra (b) of as-sprayed CZTS and CZGTS films.

Fig. S3. The plot of $(E \times EQE)^2$ vs photon energy to estimate the band gap of respective absorber layer.

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Fabricated Films	a (Å)	c(Å)	V(Å^3)	η(c/2a)
CZTSe	5.681	11.355	365.8027	0.9976
CZGTSe	5.656	11.276	360.7062	0.9968

Table S2. Carrier concentration, mobility, resistivity of postselenized CZTSe and CZGTSe thin films obtained from Hall effect measurements.

Fabricated Films	Carrier Concentration (cm^{-3})	Mobility (cm^2/V·s)	Resistivity (Ω·cm)
CZTSe	5.946 x 10^{17}	9.656 x 10^{-1}	1.087 x 10^{1}
CZGTSe	5.242 x 10^{18}	1.982	1.664

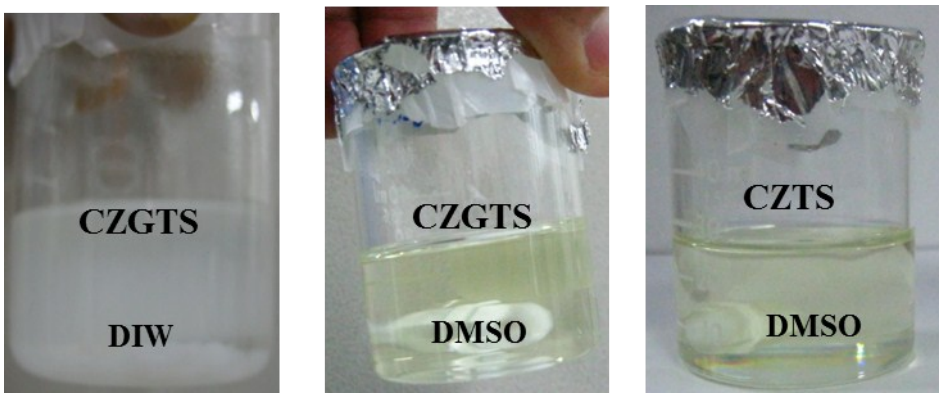

Fig. S1. Precursor solution prepared in DIW and DMSO for deposition of CZTS and CZGTS thin films. The precursor solution of CZTSe and CZGTSe prepared with DMSO is stable and well dissolved.

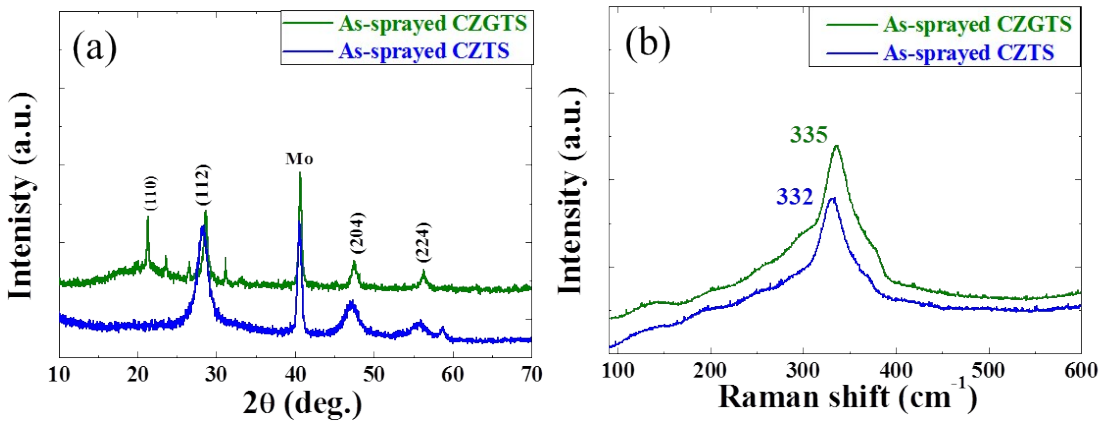

Fig.S2. X-ray diffraction patterns (a) and Raman spectra (b) of as-sprayed CZTS and CZGTS films.

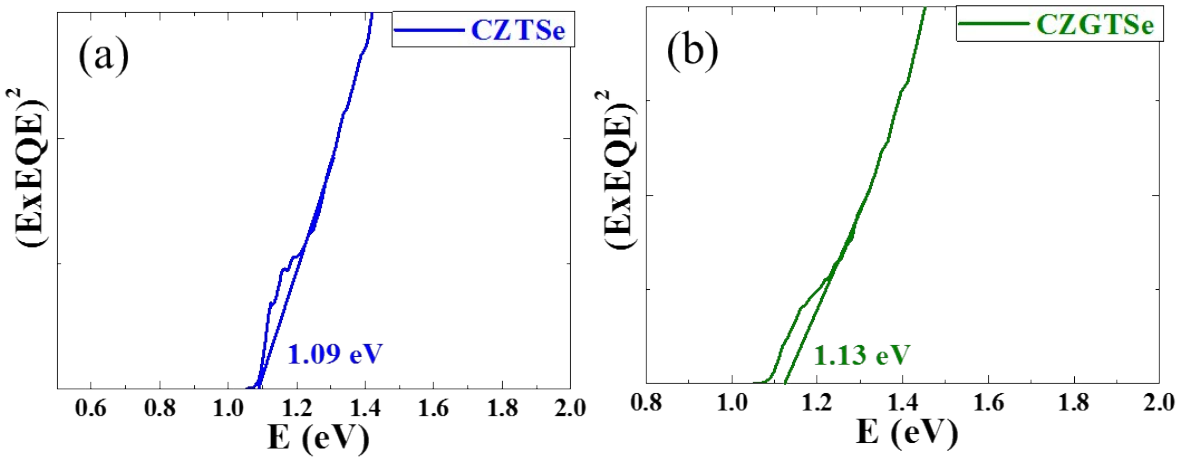

Fig. S3. The plot of (E × EQE)^2 vs photon energy to estimate the band gap of respective absorber layer.