

## Supplementary Information

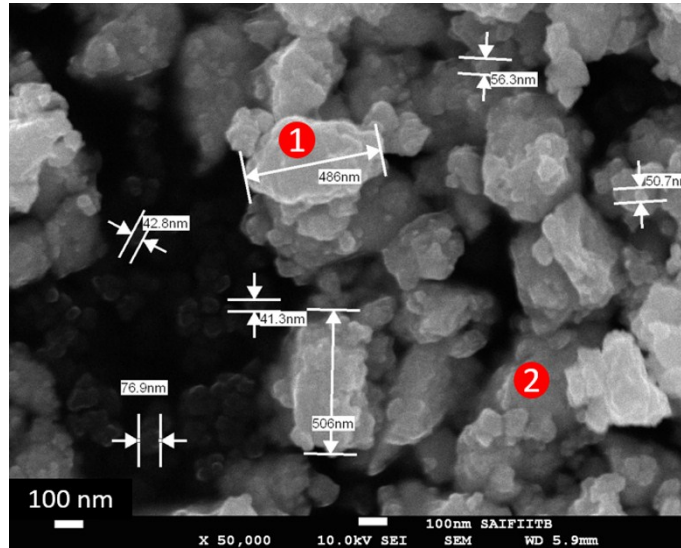
### Synthesis and characterization of kesterite $\text{Cu}_2\text{ZnSnTe}_4$ *via* ball-milling of elemental powder precursors

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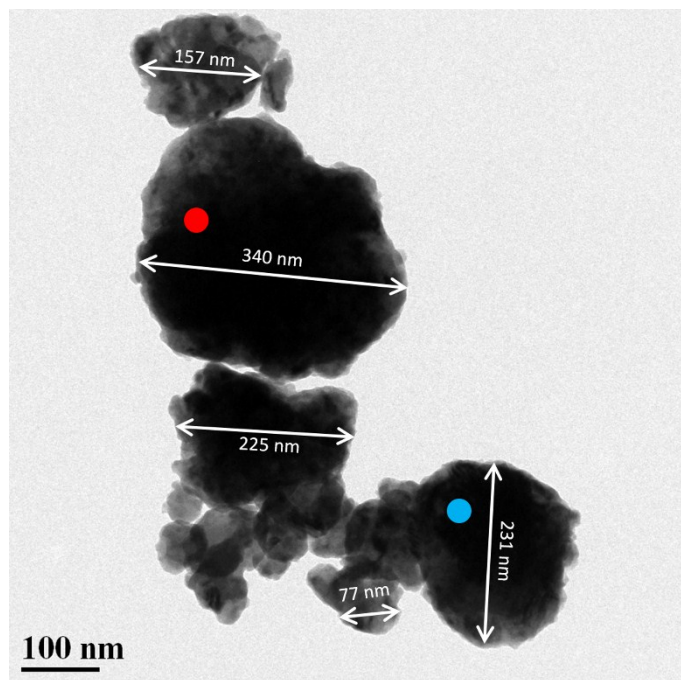
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**Fig. S1** and **S2** shows the SEM and TEM image of the as synthesized CZTTe sample. The agglomeration in particles can be observed in both the images and various sizes in the analyzed samples are represented in the figures.



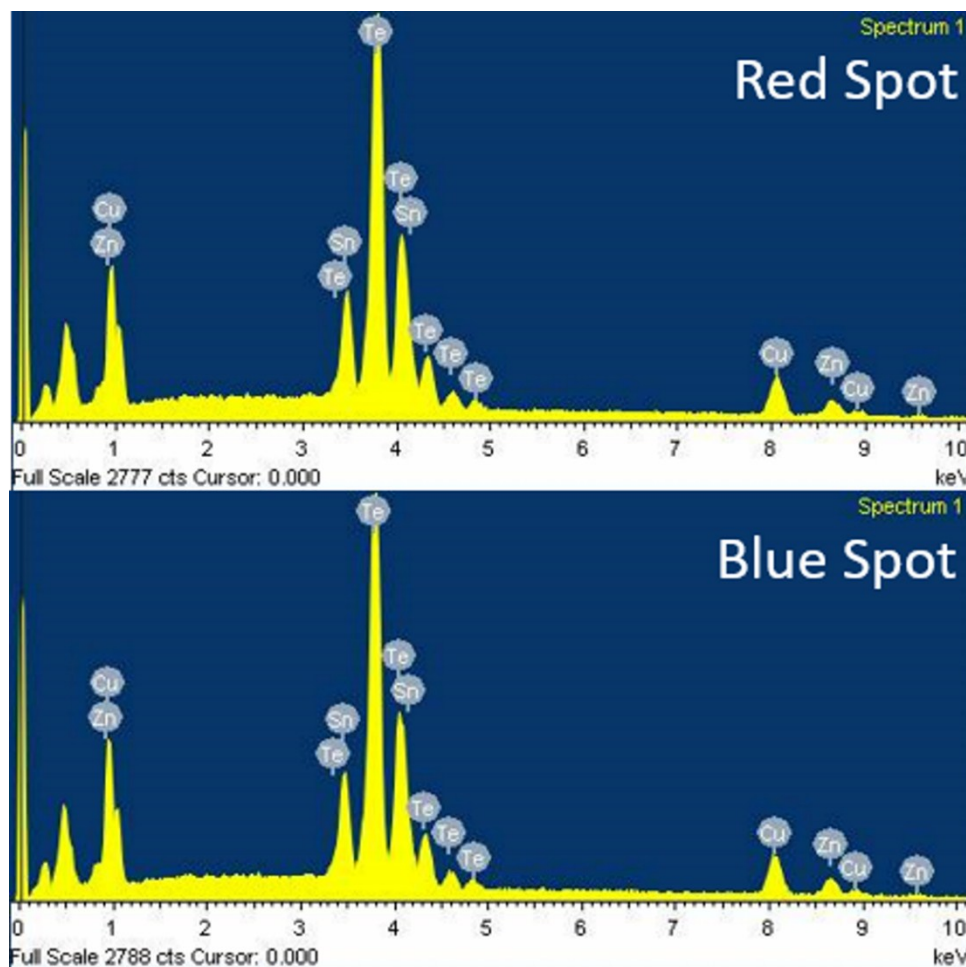
*Fig. S1: SEM image of the CZTTe sample*



*Fig. S2: TEM Bright Field image of the CZTTe sample*

The SEM - EDS data shown in **Table 2** are corresponding to two positions in the samples, which are marked as 1 and 2 as shown in the **Fig. S1**.

The TEM - EDS data presented in **Table S1** are corresponding to the two positions in the sample, which are represented as red and blue spot as shown in the **Fig. S2**. TEM-EDS spectra of the samples are shown in **Fig. S3** for red spot (top panel) and blue spot (bottom panel).

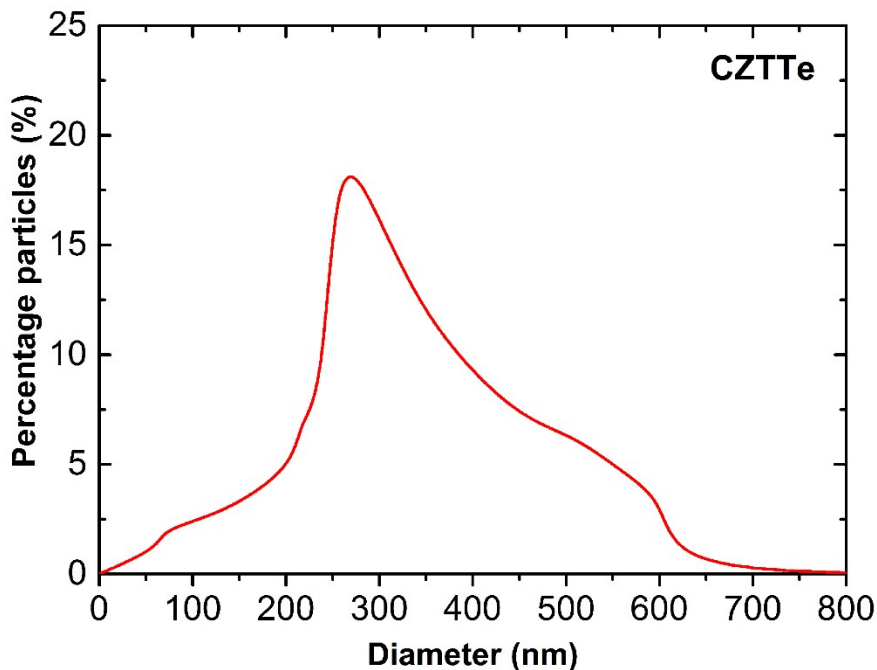


**Fig. S3:** TEM-EDS spectra of the CZTTe sample taken at two spots as shown in Fig. S2

**Table S1:** EDS analysis of as-synthesized CZTTe sample.

Atomic percentage (%)				
	Cu	Zn	Sn	Te
<b>Stoichiometric</b>	25	12.50	12.50	50
<b>Red Spot</b>	25.13	12.20	12.34	50.33
<b>Blue Spot</b>	25.22	12.37	12.46	49.95

It is evident from **Fig. S1** and **S2** that most of the particles were irregularly shaped and highly agglomerated. Therefore, to determine the particle size distribution, instead of image analysis, bulk powder sample was analyzed using Dynamic Light Scattering (DLS) technique. For the present case of CZTTe, the particle size distribution obtained using Dynamic light scattering technique (*Instrument: Brookhaven BI-200SM Goniometer with BI-9000AT digital auto correlator*) is given in **Fig. S4**.



**Fig. S4:** Particle size distribution of CZTTe nano-particles

It can be seen from **Fig. S4** that mostly the particle size lies in the range of 250-400 nm. The wide particle size distribution can be attributed to the fact that we are using ball milling technique.