Supplementary Material

## Hierarchical architecture of CuInS<sub>2</sub> microspheres thin films: Altering laterally aligned crystallographic plane growth by Cd and V doping

Logu Thirumalaisamy<sup>1, 2</sup>, Ramesh Raliya<sup>1</sup>, Shalinee Kavadiya<sup>1</sup>, Soundarrajan Palanivel<sup>2</sup>,

Kunjithapatham Sethuraman<sup>2,\*</sup> and Pratim Biswas<sup>1,\*</sup>

<sup>1</sup> Aerosol and Air Quality Research Laboratory, Department of Energy, Environmental and

Chemical Engineering, Washington University in St. Louis, St. Louis, Missouri, 63130, USA.

<sup>2</sup> School of Physics, Madurai Kamaraj University, Madurai - 625 021, Tamil Nadu, India.



Figure S1. Cross sectional SEM image of (a) pristine, (b) 15 wt% Cd doped CIS, (c) 15 wt% V doped CIS film.



Fig. S2 (a & b) Magnified shift in the (112) XRD peak with respect to Cd and V doping, (c) Variation of d-spacing as a function of dopant concentration.



Fig. S3 SEM image Peeled off  $CuInS_2$  thin film grown without seed layer



Fig. S4 SEM images of the CuInS<sub>2</sub> samples prepared using different reaction times (140°C): (a) 2, (b) 4, (c) 6, and (d) 8 h.



Fig. S5 (a) Photoluminescence (PL) spectra of pristine and Cd-doped CIS film, (b) Photoluminescence spectra of pristine and V-doped CIS thin films.



Fig. S6 I–*V* characteristic curve in dark and under presence of light for CIS thin film samples with different amount of dopant. (a)V 5wt%, (b) V 10 wt%, (c) Cd 5 wt%, (d) Cd 10 wt%.

S.No	Sample	Thickness
1	Pristine CIS	$6.07 \pm 0.15 \ \mu m$
2	CIS: Cd (5 wt%)	$6.02\pm0.15~\mu m$
3	CIS: Cd (10 wt%)	$6.06\pm0.15~\mu m$
4	CIS: Cd (15 wt%)	$6.01 \pm 0.15 \ \mu m$
5	CIS: V (5 wt%)	$6.17 \pm 0.15 \ \mu m$
6	CIS: V (10 wt%)	$6.13 \pm 0.15 \ \mu m$
7	CIS: V (15 wt%)	$6.18 \pm 0.15 \ \mu m$

Table. S1. Show the thickness chart of the prepared microsphere films.