

## Exploring the optoelectronic properties of SnSe: A new insight

Manoj Kumar<sup>1,2,3</sup>, Sanju Rani<sup>1,2</sup>, Pargam Vashistha<sup>1,4</sup>, Govind Gupta<sup>1,4</sup>, Xu Wang<sup>3\*</sup> and V.N. Singh<sup>1,2\*</sup>

<sup>1</sup>Academy of Scientific and Innovative Research (AcSIR), Ghaziabad, Uttar Pradesh- 201002, India

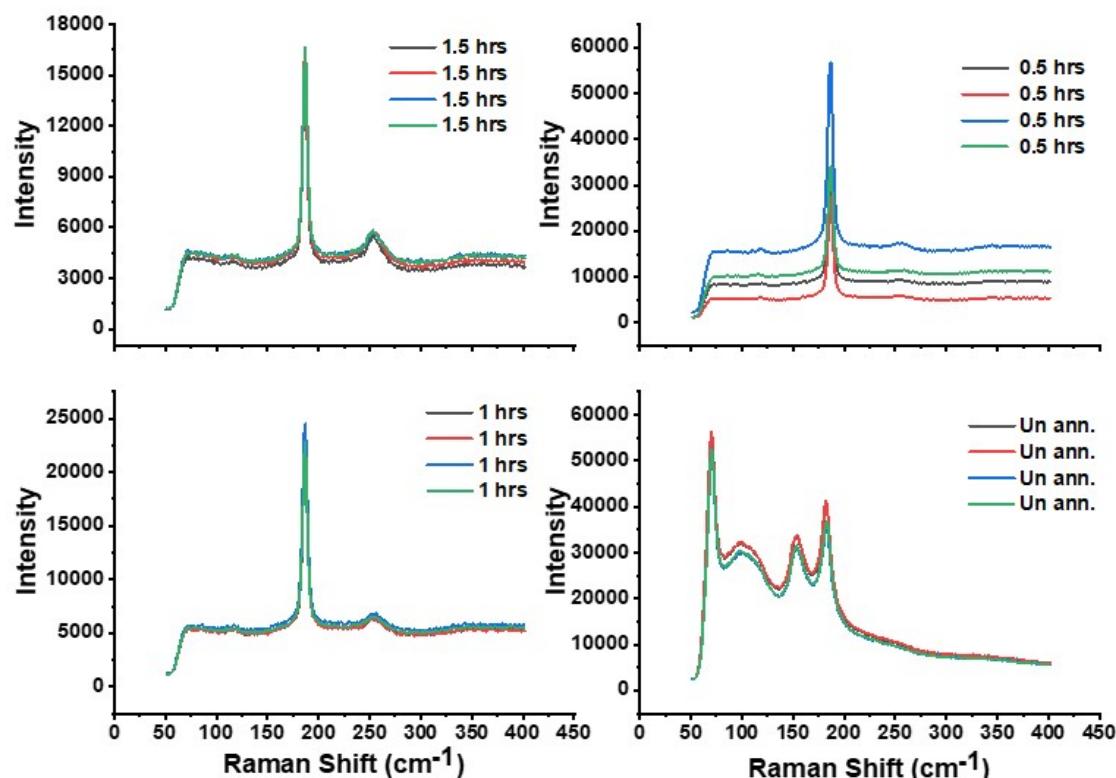
<sup>2</sup>Indian Reference Materials (BND) Division, CSIR-National Physical Laboratory, Dr. K. S. Krishnan Marg, New Delhi-110012, India

<sup>3</sup>School of Engineering, RMIT University, VIC 3000 Australia

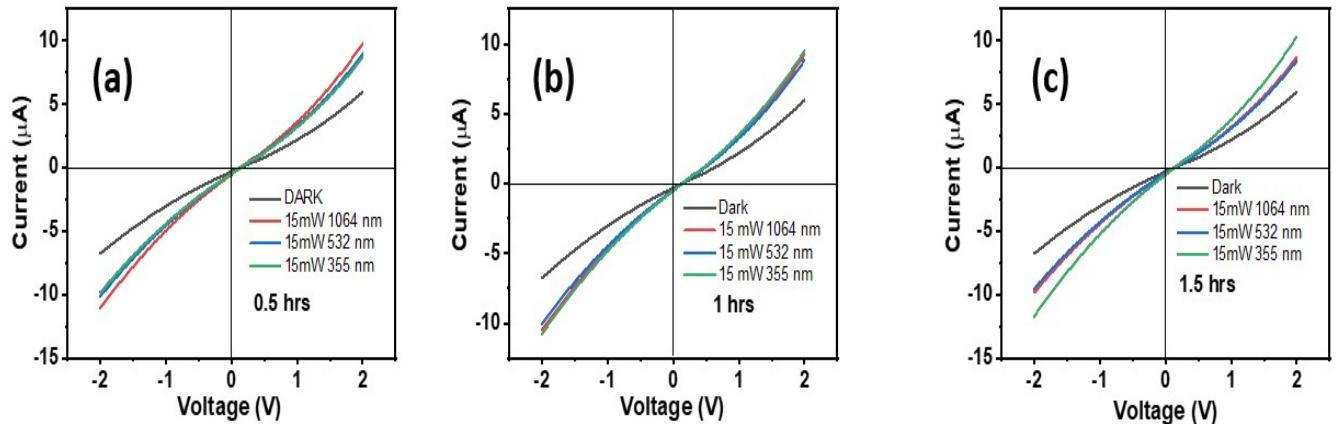
<sup>4</sup>Sensor Device Metrology Division, CSIR-National Physical Laboratory, Dr. K. S. Krishnan Marg, New Delhi 110012, India

**Corresponding author:** [singhvn@nplindia.org](mailto:singhvn@nplindia.org) (VNS) and [xu.wang@rmit.edu.au](mailto:xu.wang@rmit.edu.au) (Xu Wang)

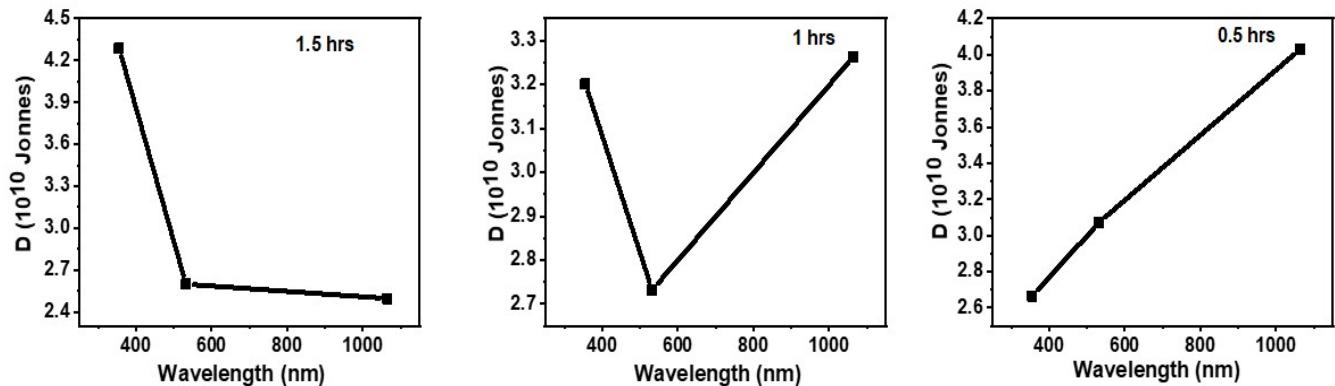
### Supplementary Information-



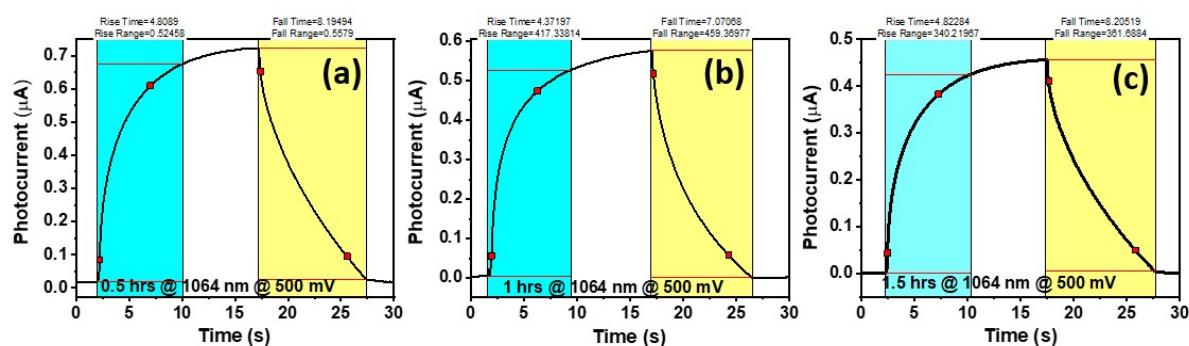
**Figure S1 Raman spectra at randomly selected points on the film of the samples annealed at different times.**



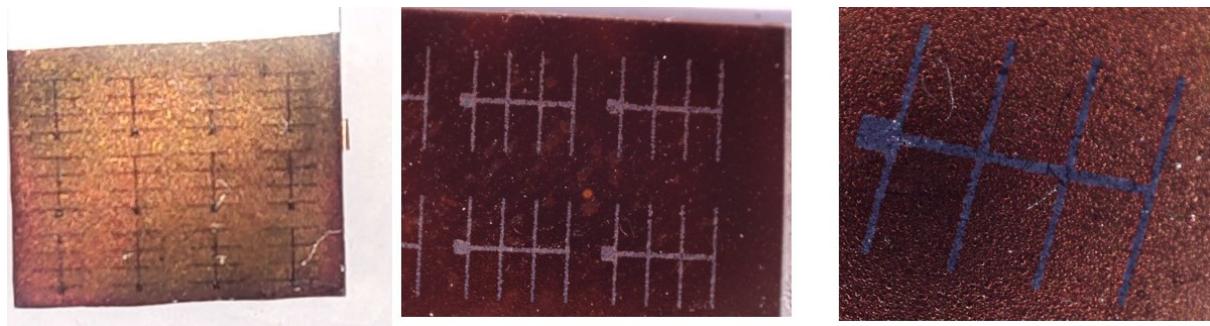
**Figure S2. I-V of the devices under different conditions.**



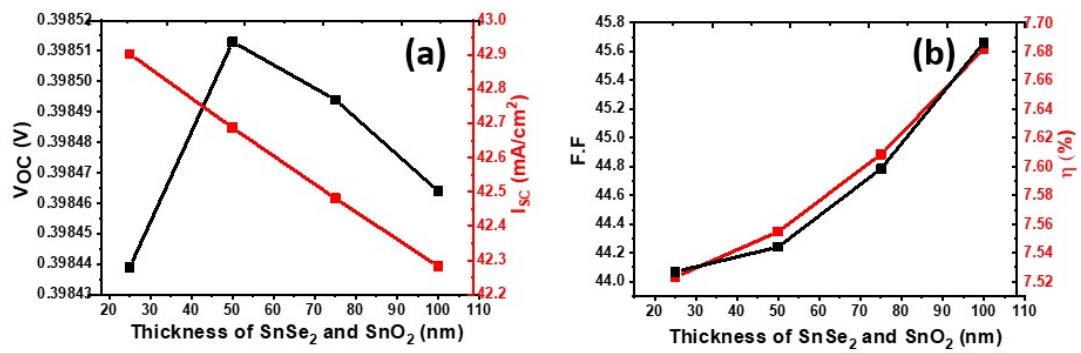
**Figure S3. Detectivity of the devices**



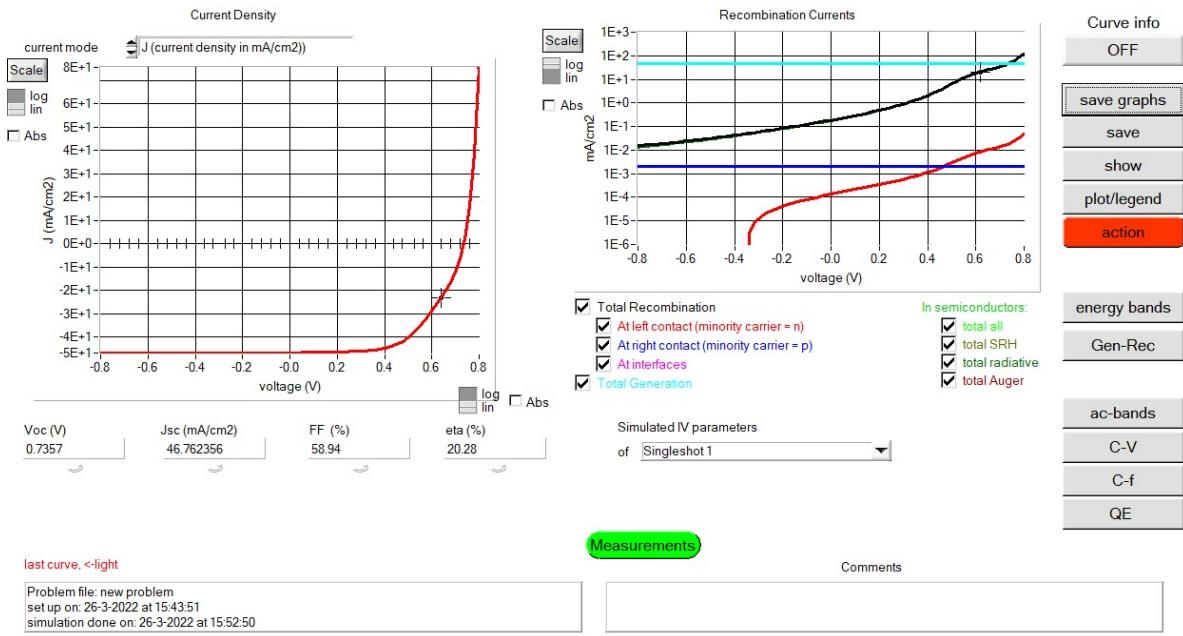
**Figure S4. Rise and decay time fitting at 1064 nm of (a) 0.5, (b) 1, and (c) 1.5 hrs annealed devices.**



**Figure S5.** Images of an actual solar cell device of SnSe annealed at 300 °C for one hour (having Ag silver contacts on the front face made using masking).



**Figure S6.** Effect of thickness of  $\text{SnSe}_2$  and  $\text{SnO}_2$  on the parameters,  $\text{Voc}$ ,  $\text{Jsc}$  (a),  $\text{FF}$ , and efficiency ( $\eta$ ) (b) of SnSe-based solar device.



**Figure S7. IV panel of the SCAPS-1D software shows efficiency of 20.28 %, with a back contact of 5.3 eV.**