Supplementary Information

Fabrication of Cu_2MSnS_4 ($M = Co^{2+}$, Ni^{2+}) Nanocrystals Thin Films and Its Application in Photodetector by a Simple Solution Process

Kaisi Liu,[a,b] Bin Yao,[a,b*] Yongfeng Li,[a,b*] Zhanhui Ding,[a,b] Zhenyu Xiao,[a,b] Yuhong Jiang,[a,b] Gang Wang[c] and Daocheng Pan [c*]

[a]Key Laboratory of Physics and Technology for Advanced Batteries (Ministry of Education), College of Physics, Jilin University, Changchun, 130012, China. E-mail: binyao@jlu.edu.cn and liyongfeng@jlu.edu.cn

[b]State Key Lab of Superhard Materials, College of Physics, Jilin University, Changchun, 130012, China

[c]State Key Laboratory of Rare Earth Resource Utilization, Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, 5625 Renmin Street, Changchun,130022, China. E-mail: pan@ciac.ac.cn

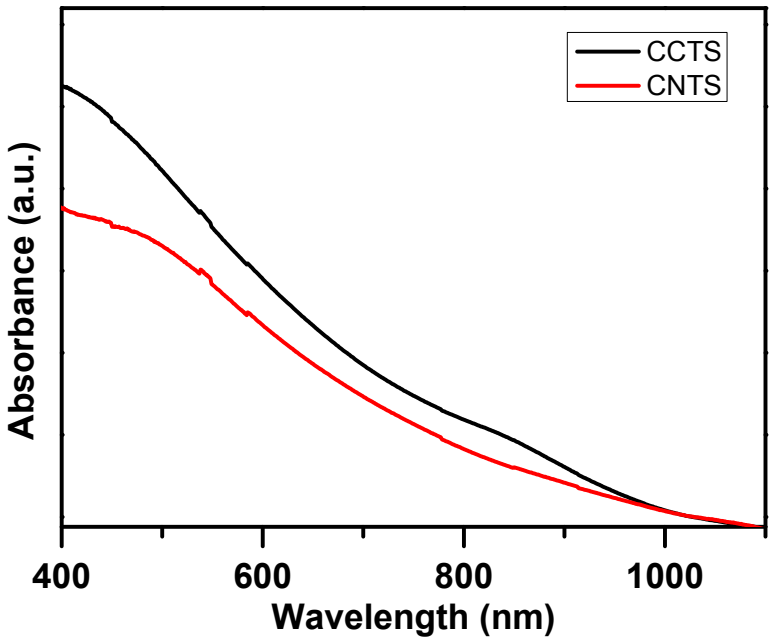

Fig. S1 UV-vis-NIR absorption spectra of as-prepared CCTS and CNTS thin films.

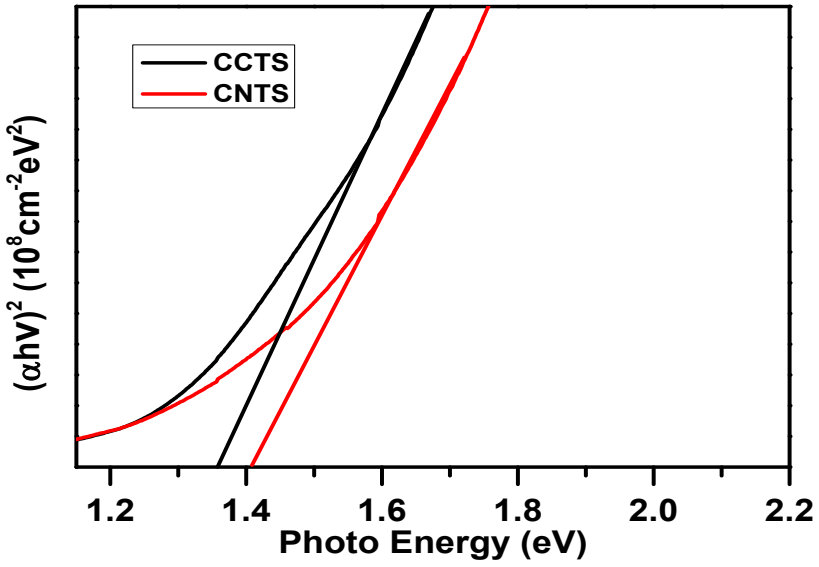

Fig. S2 The band gaps of CCTS and CNTS thin films determined by the plots of absorption squared vs photo Energy.

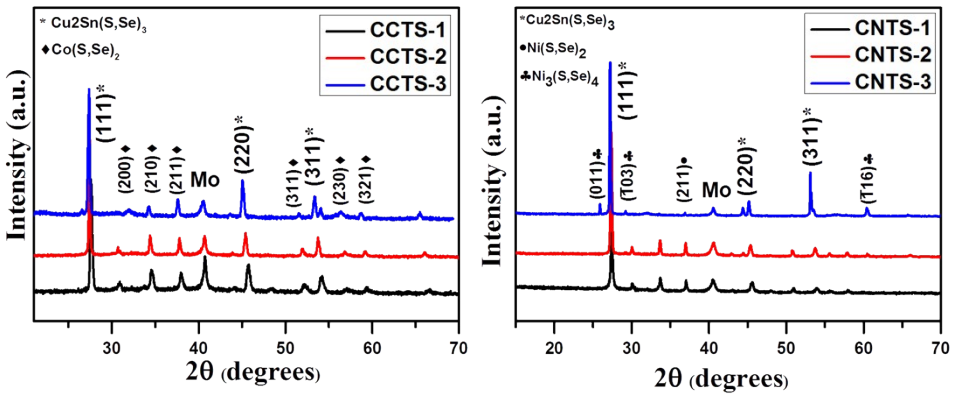

Fig. S3 The powder XRD patterns of selenized CNTS and CCTS nanocrystal thin films after selenization at 460°C, 500°C, 580°C for 10 min in a graphite box.

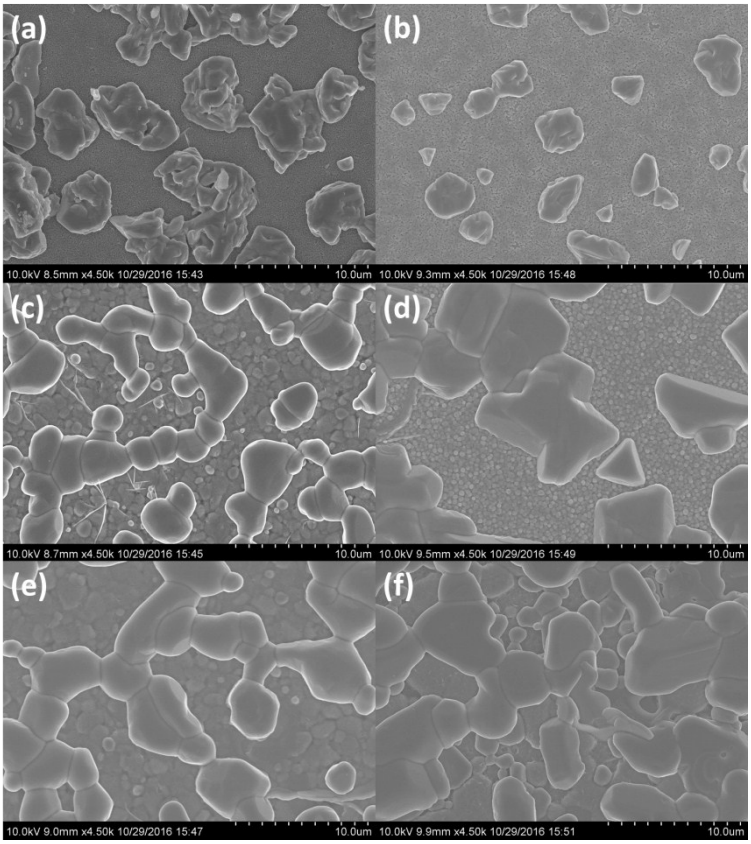

Fig. S4 The top-view SEM surfaces of the selenized CCTS thin films annealing at 460°C (a), 500°C (c), 580°C (e) for 10 min and the surfaces of selenized CNTS thin films annealing at 460°C (b), 500°C (d), 580°C (f) for 10 min.

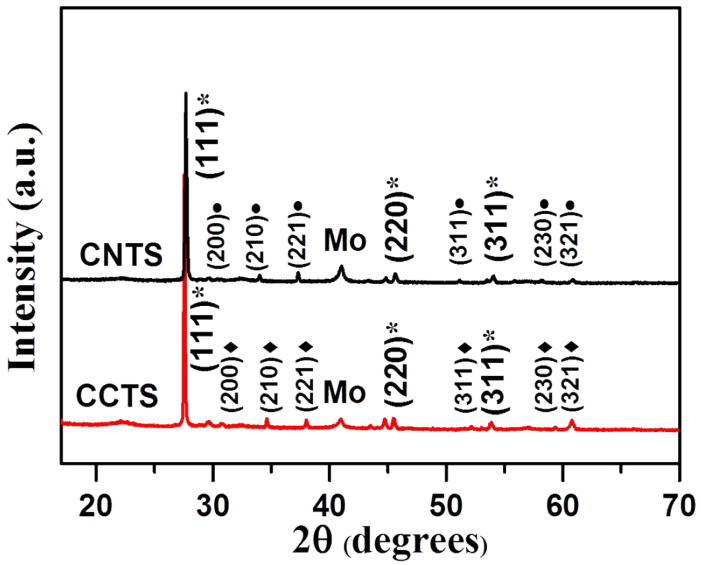

Fig. S5 The powder XRD patterns of selenized CNTS (black) and CCTS (red) nanocrystal thin films using thiourea-based precursor solution after selenization at 540 ^{o}C for 10 min in a graphite box.

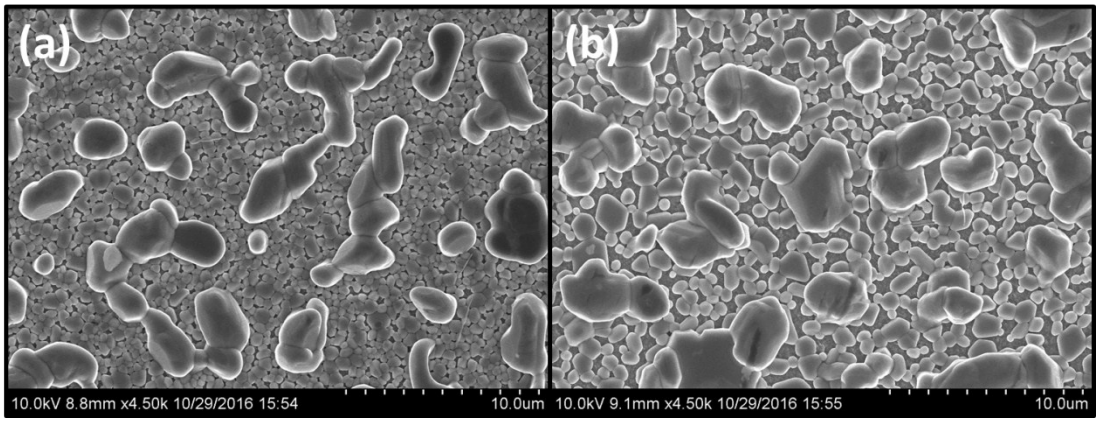

Fig. S6 The top-view SEM images of the selenized CCTS(a) and CNTS (b) thin films annealing at 540^{o}C for 10 min using metal/thiourea precursor solutions.

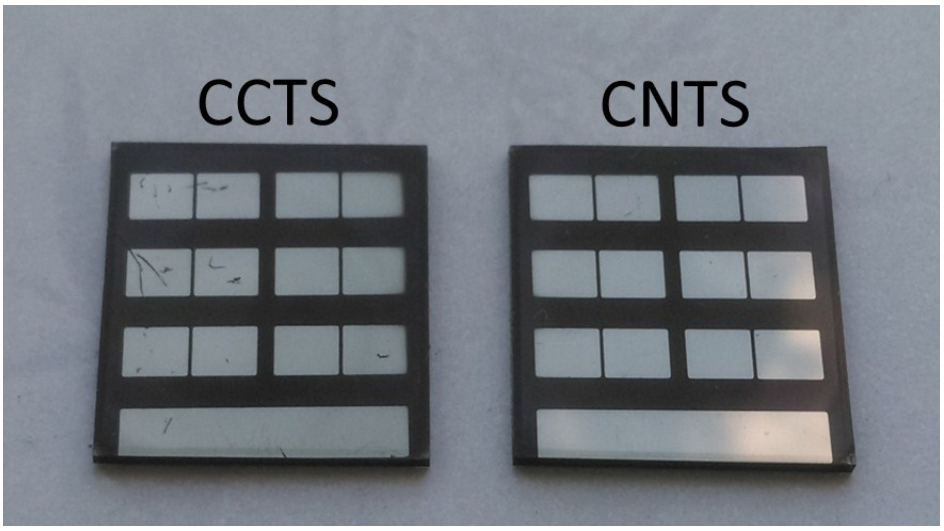

Fig. S7 Digital photograph of CCTS and CNTS nanocrystal-based photodetector devices.

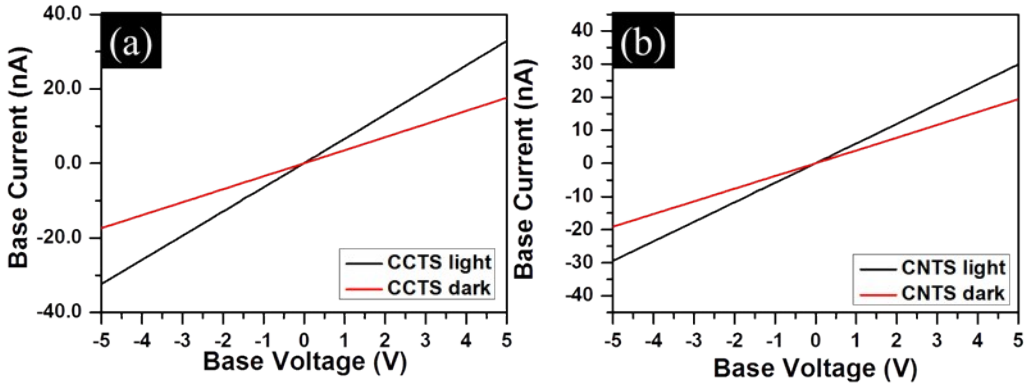

Fig. S8 The *I-V* characteristics of CCTS (a) and CNTS (b) photodetector devices.