Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information

Environmentally friendly solution route to kesterite $Cu_2ZnSn(S,Se)_4$ thin films for solar cell applications

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The GIXRD patterns for the as-synthesized CuS, ZnS and SnS_2 nanoparticles are shown in Fig. S1. It was found that CuS covellite (JCPDS no. 006-0464) and ZnS sphalerite (JCPDS no. 005-0566) was successfully synthesized. The synthesis of SnS_2 nanoparticles was carried out using Sn^{4+} and S^{2-} and this has been reported previously.[1] For SnS_2 nanoparticles, three major humps at 2θ values of around 18º, 30º and 50º were observed in the GIXRD pattern. The lack of distinct peaks in the GIXRD pattern may be attributed to the high amorphous content of this sample. EDS analysis also showed that the Sn to S ratio is 1:1.80, which is close to stoichiometric value of 1:2 for SnS_2.

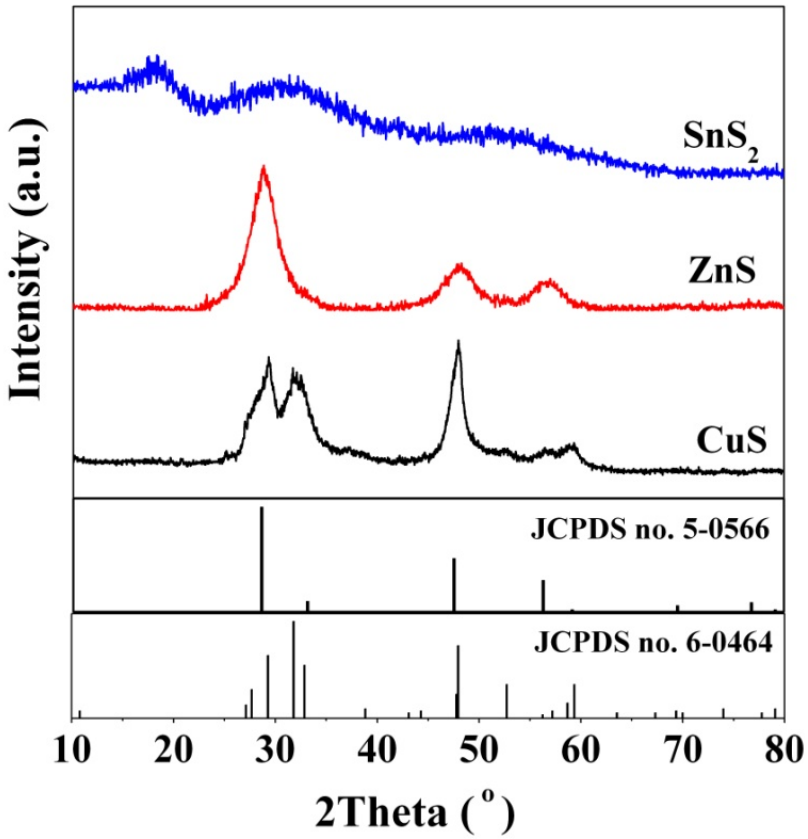

Fig. S1. XRD patterns from as-synthesized CuS and ZnS nanoparticles matched with CuS (JCPDS no. 6-0464) and ZnS (JCPDS no. 5-0566). The as-synthesized SnS_2 nanoparticles show a high amorphous content. The XRD samples were prepared by spraying the respective nanoparticle suspension onto SLG.

1. Tsukigase, H.; Suzuki, Y.; Berger, M. H.; Sagawa, T.; Yoshikawa, S.; J. Nanosci. Nanotechno. **2011**, 4, 3215.