Electronic Supplementary Material (ESI) for Energy & Environmental Science

Reaction Pathways for the Formation of $Cu_2ZnSn(Se,S)_4$ Absorber Materials from Liquid-Phase Hydrazine-based Precursor Inks

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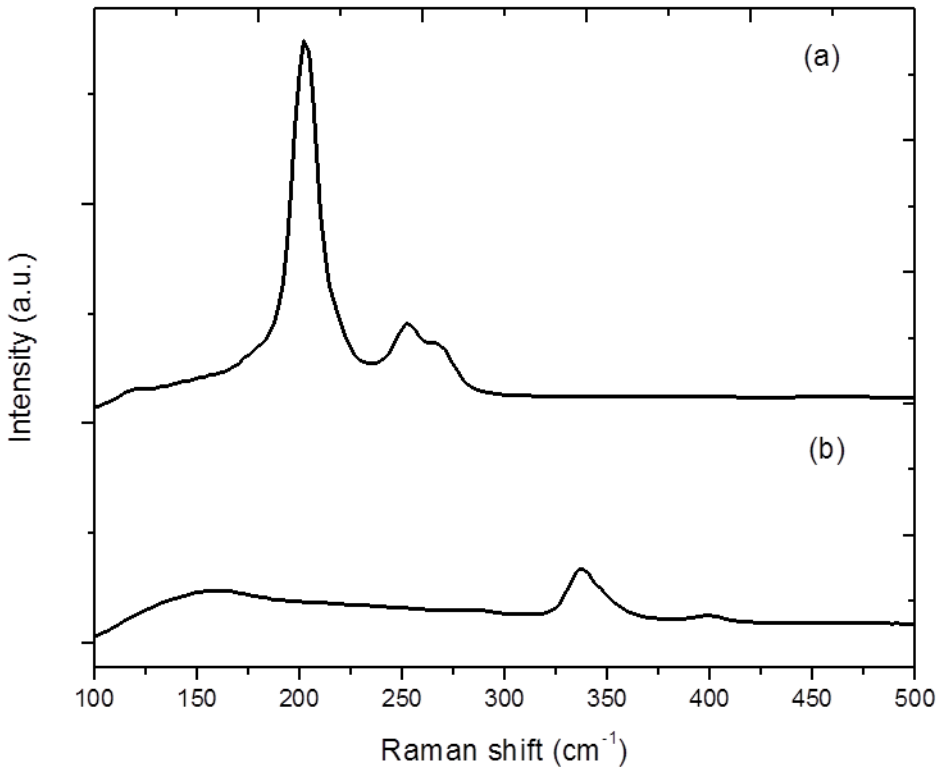
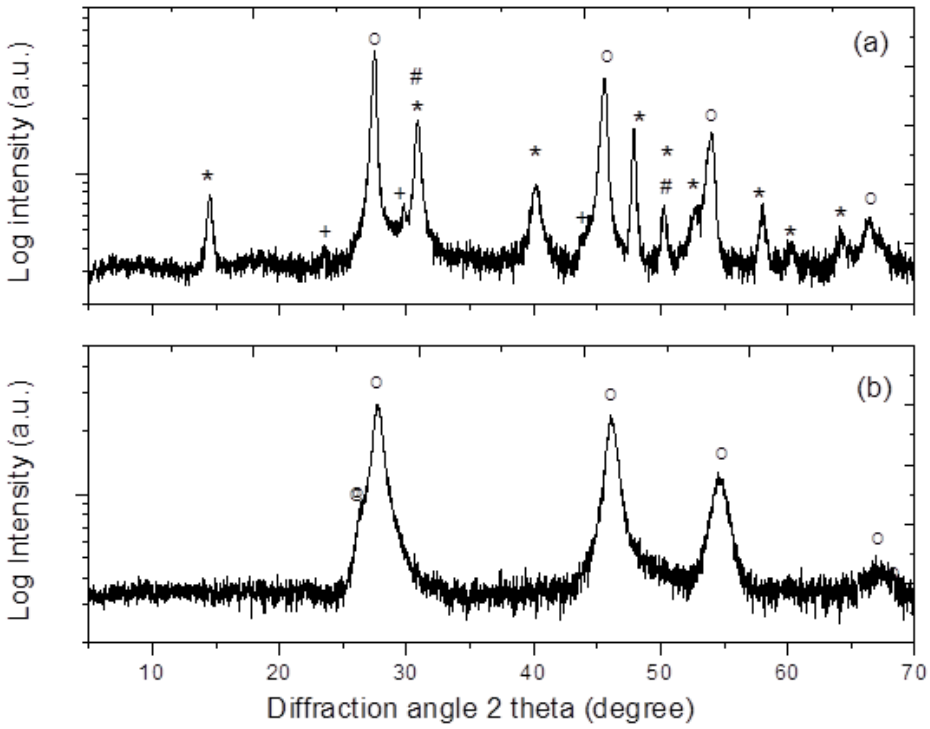
Electronic Supplementary Information



S. 1.

Raman spectra of (a) $SnSe_2$-Se solution with $SnSe_2$: Se = 1: 1 and (b) Cu_2S-S solution with Cu_2S : S = 1: 2.



S. 2.

Powder XRD pattern of the powder prepared by (a) drying Cu_2S-S and $SnSe_2$-Se mixed solution annealing at 200°C, and (b) filtering and drying CZTSe precursor solution. $Cu_2Sn(Se,S)_3$ or kesterite is marked by "o" (reference code 01-089-2879); $SnSe_2$ is marked by "*" (reference code 00-023-0602); CuSe is marked by "#" (reference code 00-049-1457); Se is marked by "+" (reference code 00-042-1425); hexagonal ZnX is marked by "@"