Supplementary Information

Structural investigations of $SnS_{1-x}Se_x$ solid solution synthesized from chalcogeno-carboxylate complexes of organo-tin by colloidal and solvent-less route

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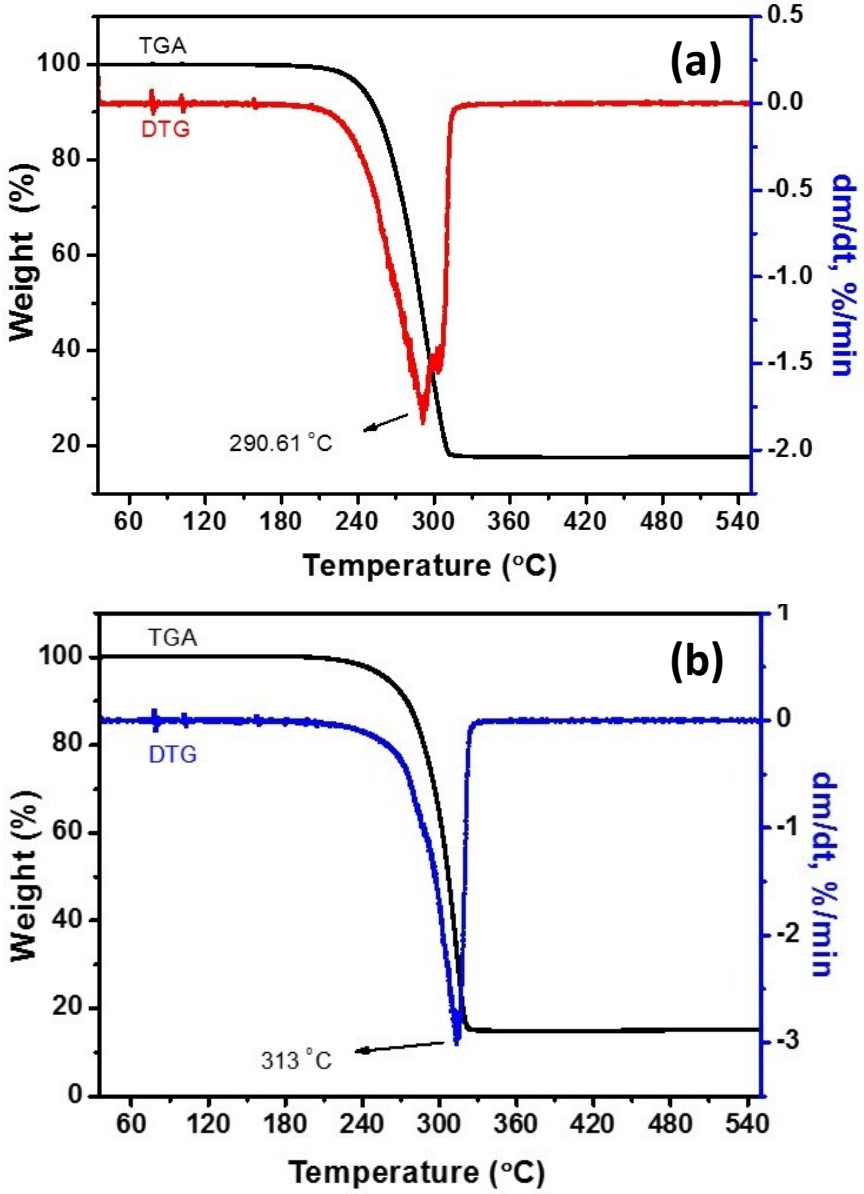
Table S1. Summary of the required composition of the elements in solid solution and composition observed by the EDX analysis.

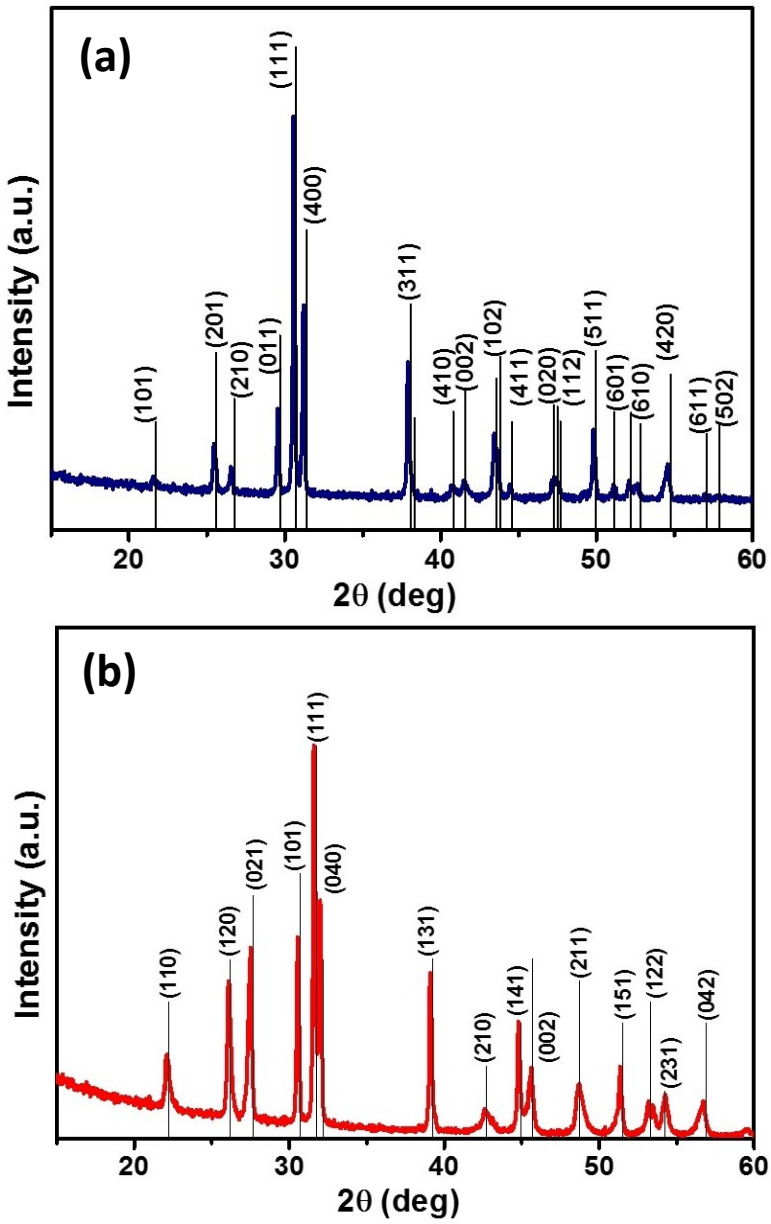
Composition [Se]/[Se]+[S]	**Target composition**	**Required Stoichiometry**	**EDX Sn:S:Se**	**Alloy stoichiometry**
0 (SnS)	SnS	50:50	50.9:49.1	$Sn_{1.02}S_{0.98}$
0.2	$SnS_{0.80}Se_{0.20}$	50:40:10	51.3:38.3:10.4	$Sn_{1.03}S_{0.76}Se_{0.21}$
0.4	$SnS_{0.60}Se_{0.40}$	50:30:20	51.1:30.4:18.5	$Sn_{1.02}S_{0.61}Se_{0.37}$
0.6	$SnS_{0.40}Se_{0.60}$	50:20:30	51.4:19.6:29	$Sn_{1.03}S_{0.39}Se_{0.58}$
0.8	$SnS_{0.20}Se_{0.80}$	50:10:40	50.8:9.9:39.3	$Sn_{1.02}S_{0.19}Se_{0.79}$
1 (SnSe)	SnSe	50:50	51.7:48.3	$Sn_{1.03}Se_{0.97}$

Table 2. Summary of the required composition of the elements and composition observed by EDX analysis for samples synthesized by melt method.

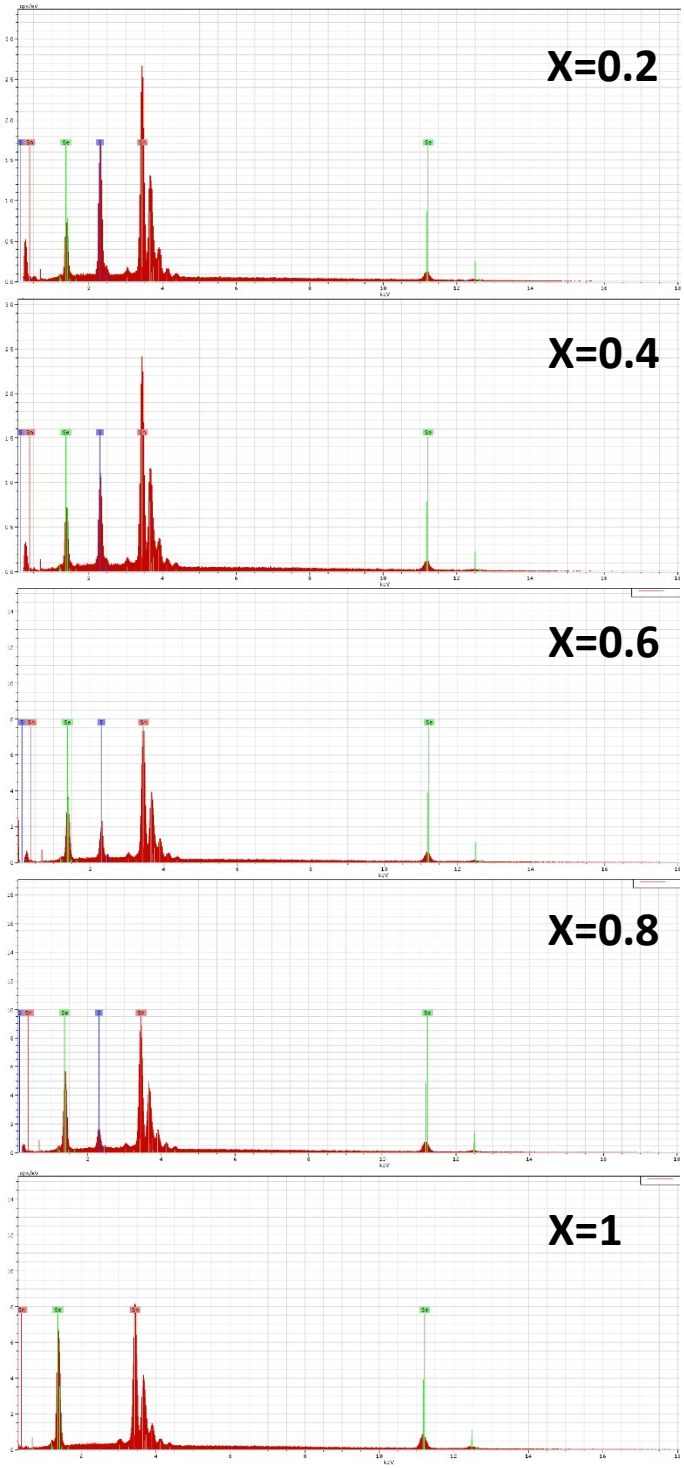
Composition [Se]/[Se]+[S]	**Target composition**	**Required Stoichiometry**	**EDX Sn:S:Se**	**Alloy stoichiometry**
0 (SnS)	SnS	50:50	53.5:46.5	$Sn_{1.07}S_{0.93}$
0.2	$SnS_{0.80}Se_{0.20}$	50:40:10	52.9:38.5:8.6	$Sn_{1.06}S_{0.77}Se_{0.17}$
0.4	$SnS_{0.60}Se_{0.40}$	50:30:20	52.7:29.1:18.2	$Sn_{1.05}S_{0.58}Se_{0.37}$
0.6	$SnS_{0.40}Se_{0.60}$	50:20:30	55.5:18.8:25.7	$Sn_{1.11}S_{0.37}Se_{0.52}$
0.8	$SnS_{0.20}Se_{0.80}$	50:10:40	54.3:9:36.7	$Sn_{1.08}S_{0.18}Se_{0.74}$
1 (SnSe)	SnSe	50:50	55.5:44.5	$Sn_{1.11}Se_{0.89}$



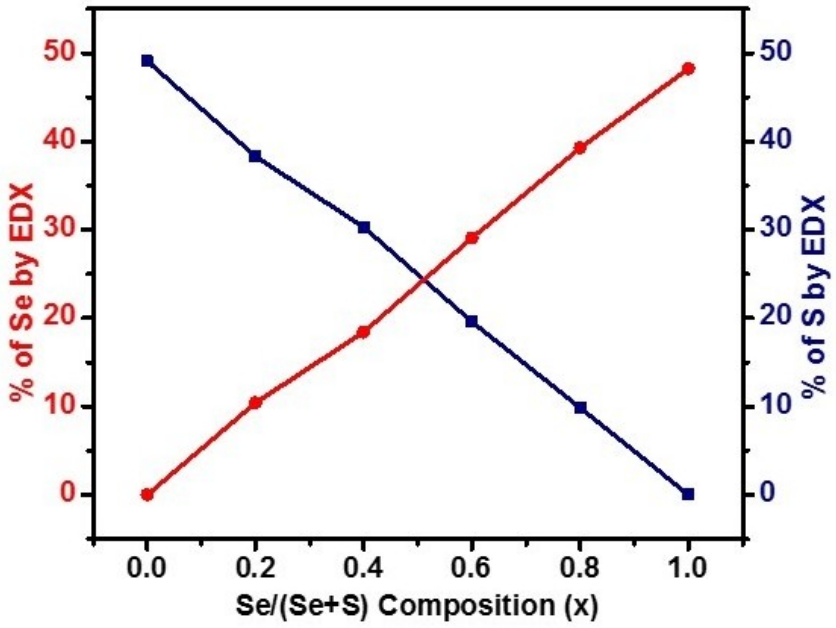
Supplementary Figure S1. Overlapped thermogravimetric and differential thermogravimetric curves for (a) complex **(1)** and (b) complex **(2)**.



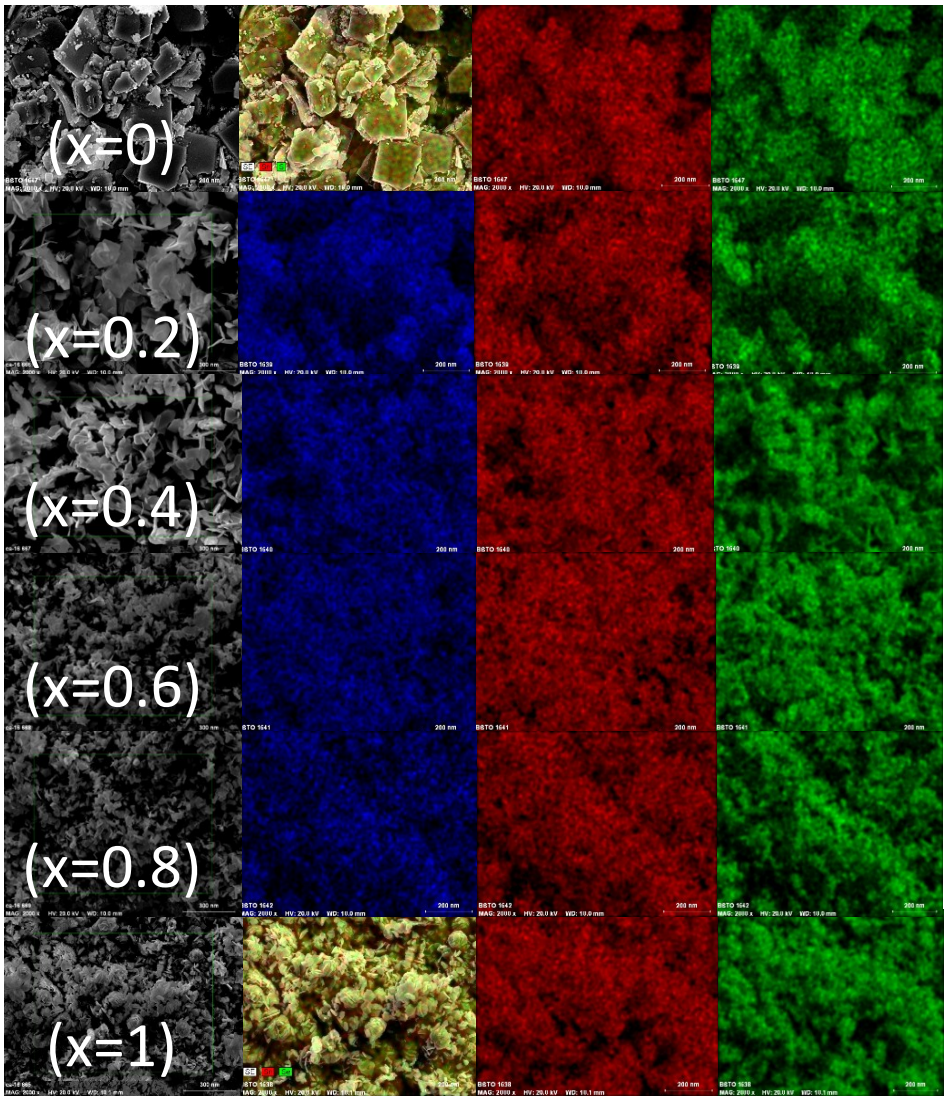
Supplementary Figure S2. p-XRD of residue obtained by the decomposition of (a) complex **(1)** showing formation of SnSe (ICDD # 00-014-0159) and (b) complex **(2)** showing formation of SnS (ICDD # 01-075-2115).



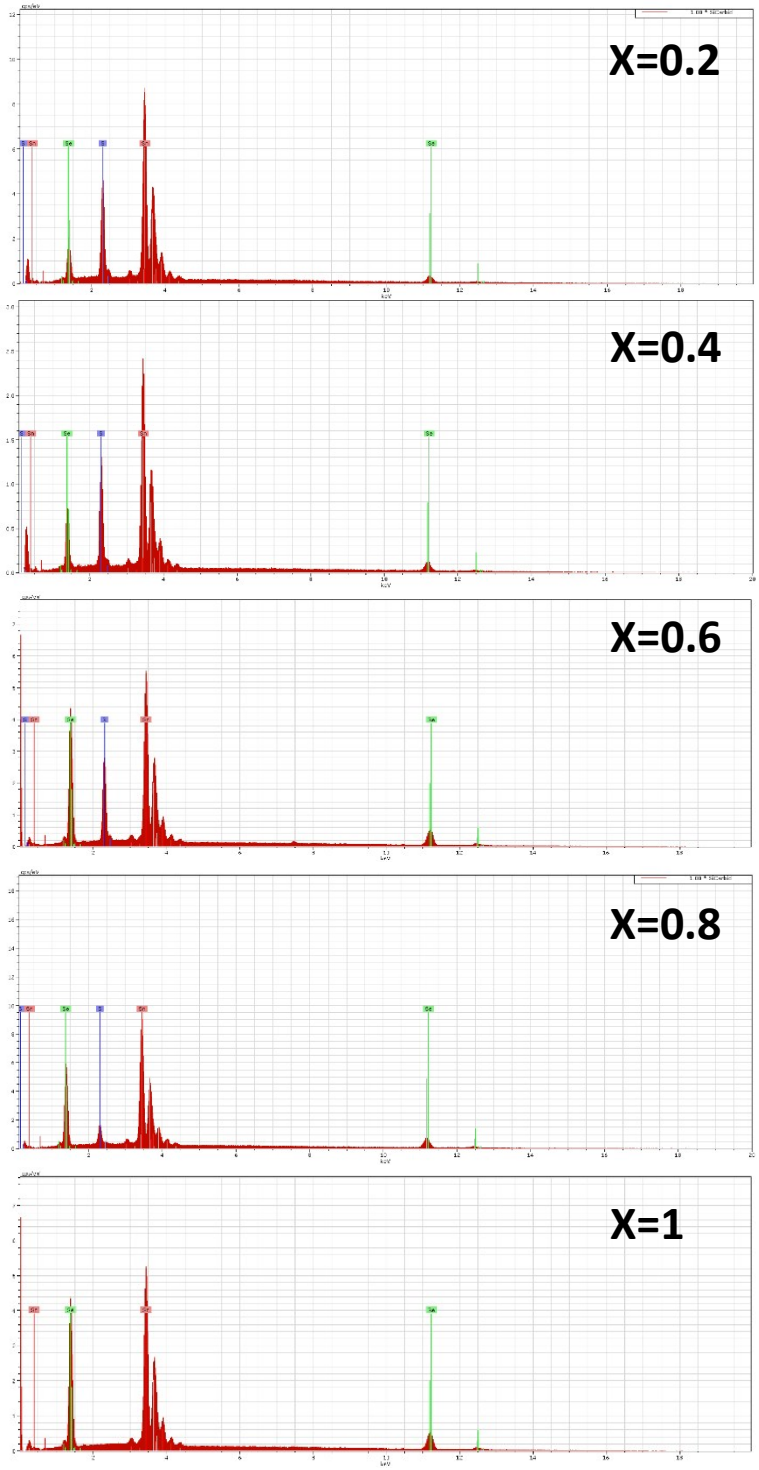
Supplementary Figure S3. EDX analysis to measure the content of Sn, S and Se in the synthesized alloy solid solution.



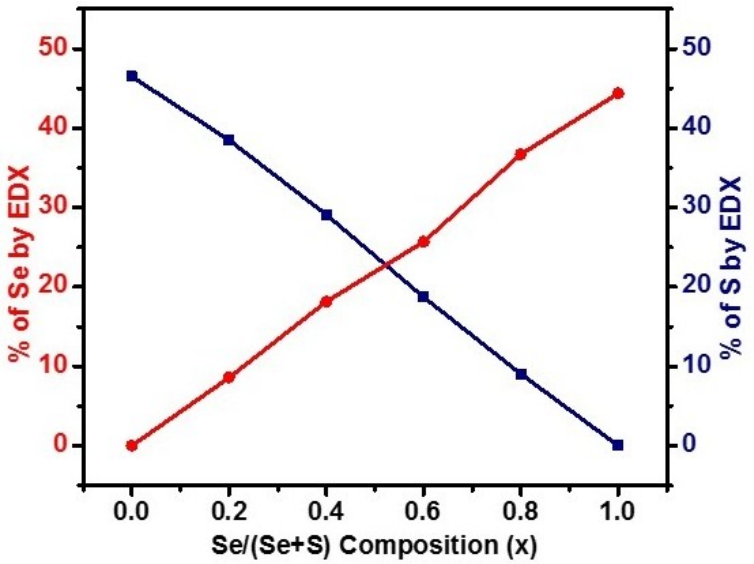
Supplementary Figure S4. Plot showing change in the concentration of Selenium and Sulfur content against Se/(Se+S) composition.



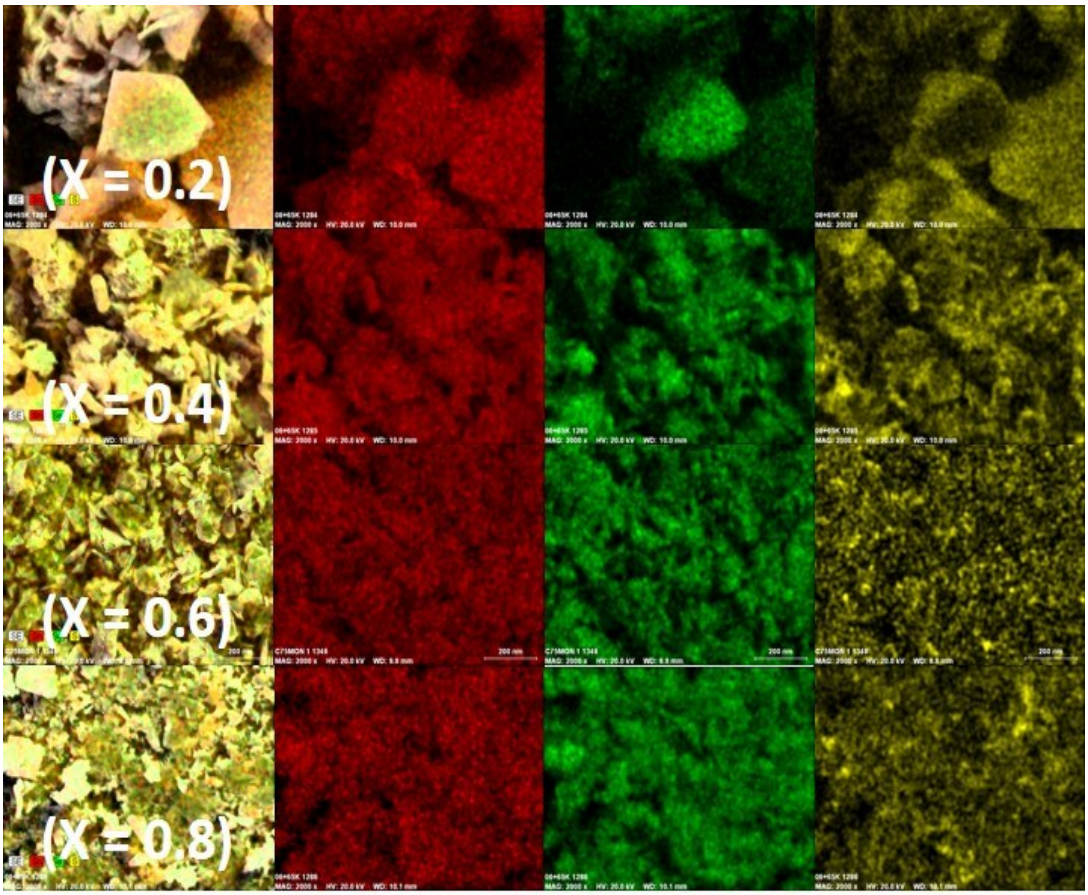
Supplementary Figure S5. Elemental mapping of the samples with different selenium concentration, showing uniform distribution of tin, sulfur and selenium.



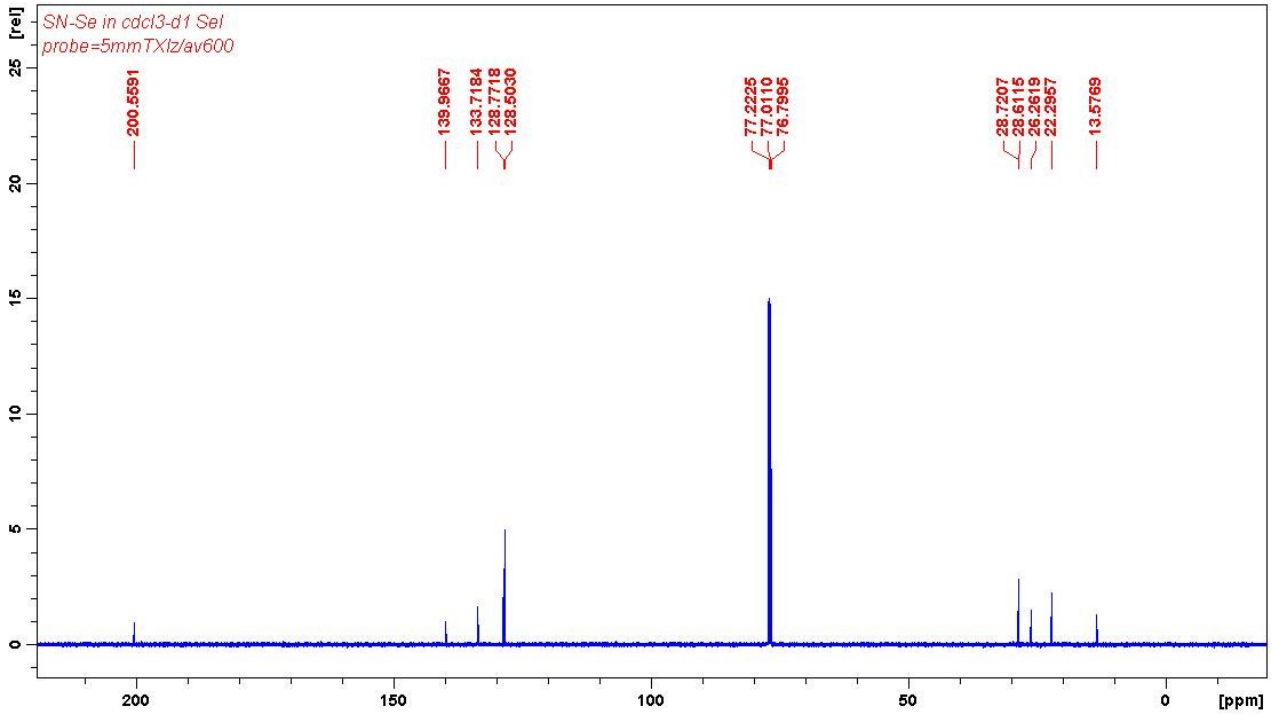
Supplementary Figure S6. EDX analysis to measure the content of Sn, S and Se in the synthesized alloy solid solution.



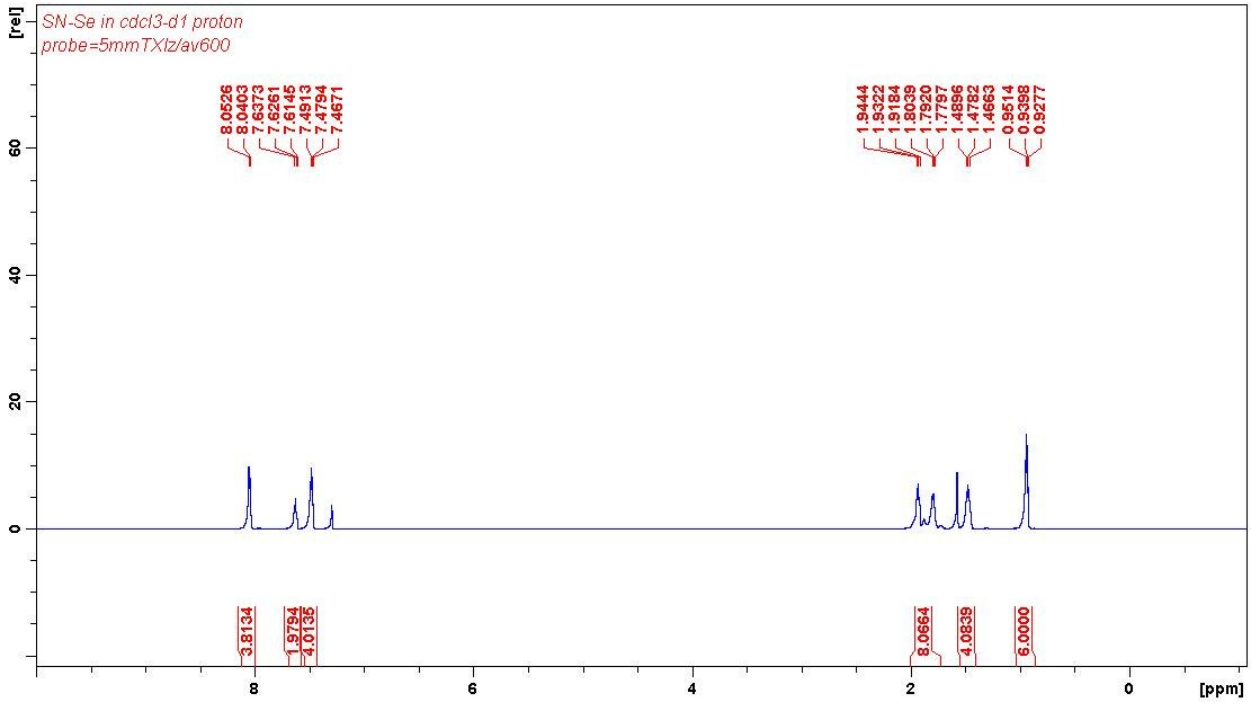
Supplementary Figure S7. Plot showing change in the concentration of Selenium and Sulfur content against Se/(Se+S) composition.



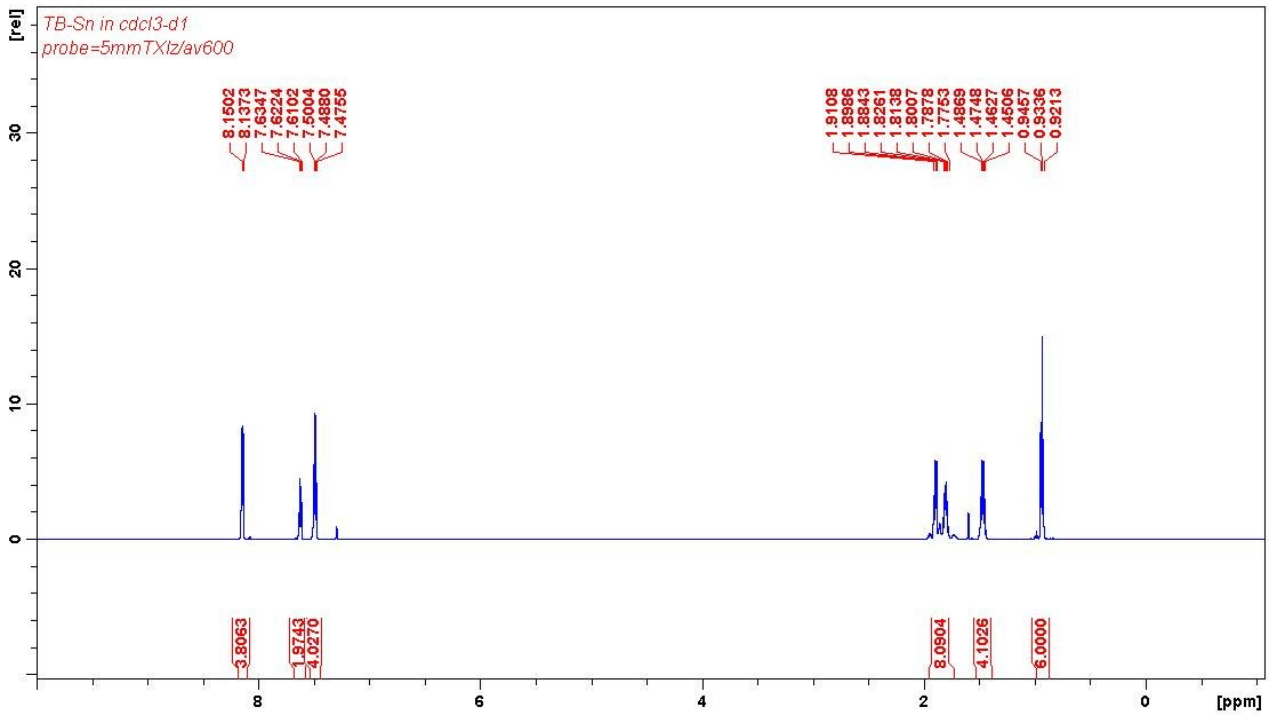
Supplementary Figure S8. Elemental mapping of the samples with different selenium concentration, showing uniform distribution of tin, sulfur and selenium.



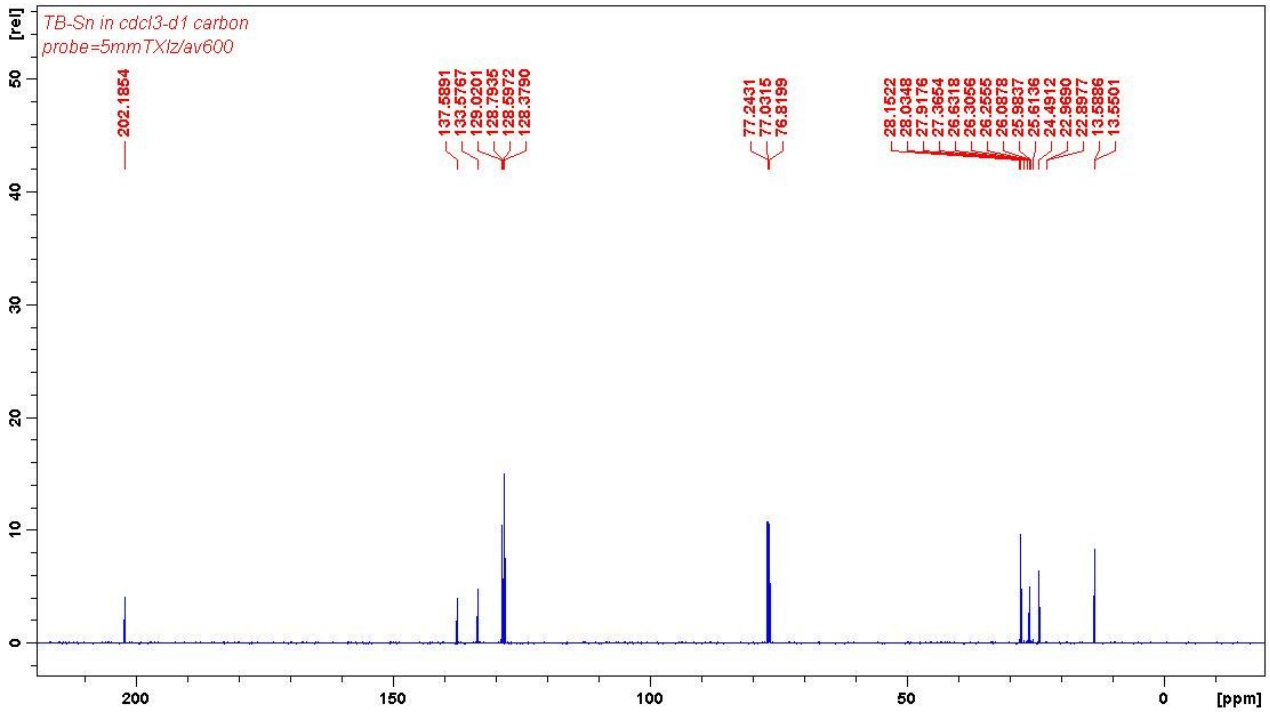
^{13}C-NMR spectrum for *bis*(selenobenzoato)dibutyltin(IV) complex.



^{1}H-NMR spectrum for *bis*(selenobenzoato)dibutyltin(IV) complex.



^{1}H-NMR spectrum for *bis*(thiobenzoato)dibutyltin(IV) complex.



^{13}C-NMR spectrum for *bis*(thiobenzoato)dibutyltin(IV) complex.