

Extended anisotropic phonon dispersions and optical properties of two-dimensional ternary SnSSe

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Supporting Results

Elements	Weight%
Sn	34
S	33
Se	33

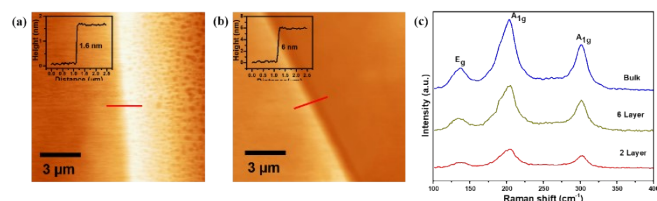


Fig. S2 AFM image of the exfoliated SnSSe flakes with thicknesses of (a) 1.6 nm and (b) 6 nm with scale bars: 3 μm. (c) Raman spectra of different thickness.

The PL spectra were measured at various SnSSe flakes having different thicknesses. The PL intensity is observed to decrease, being anticipated for this material, with the decrease of the flake thicknesses [1, 2]. Herein, the PL peak position scarcely relies on the thickness. As is known, the observed two kinds of

recombination transitions exist in order to photogenerated electron-hole pairs: non-radiative recombination via defect states and radiative recombination inside the SnSSe materials. So, the reduction of the PL intensity in response to thickness might arise from the existence of non-radiative recombination during surface defect states or electron (hole) trap constituted by the uncompensated positive (negative) charge at the dangling bonds on surface [3, 4]. Moreover, further non-radiative recombination arises by virtue of a smaller escape length through surface defect states. On the other hand, a decrease in the number of photogenerated electron-hole pairs upon decrease in SnSSe absorption in thinner flakes is another affecting factor. Possibly, the observed decrease within the PL intensity is sharp than anticipated from the decrease of SnSSe thickness. Thus, non-radiative recombination within surface defect states and a decrease in absorption may provide a low PL quantum yield of thinner SnSSe flakes.

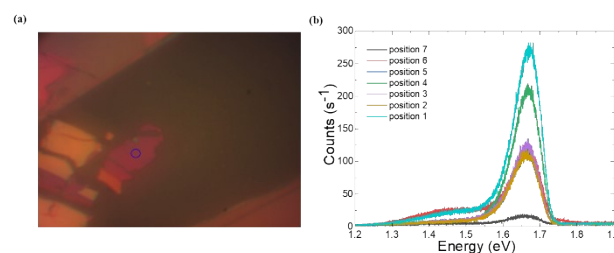


Fig. S3 (a) Optical microscopy image of SnSSe (b) PL spectra of the SnSSe flakes with different thicknesses.

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