

## Supporting information

### Colloidal Tin Sulfide Nanosheets:

#### Formation Mechanism, Ligand-mediated Shape Tuning and Photo-detection

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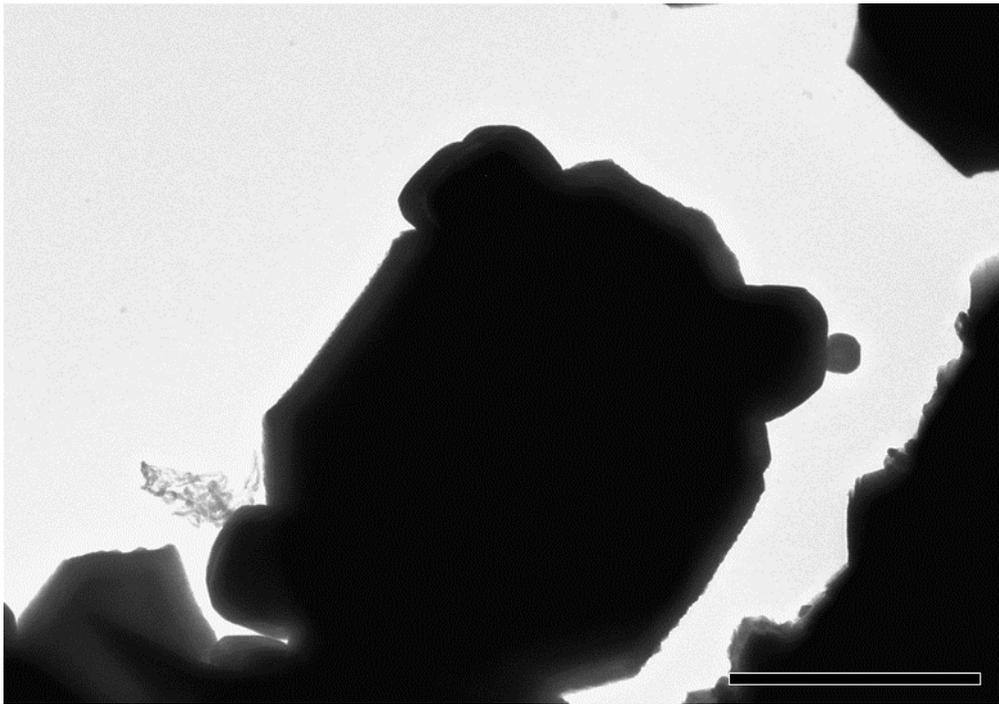
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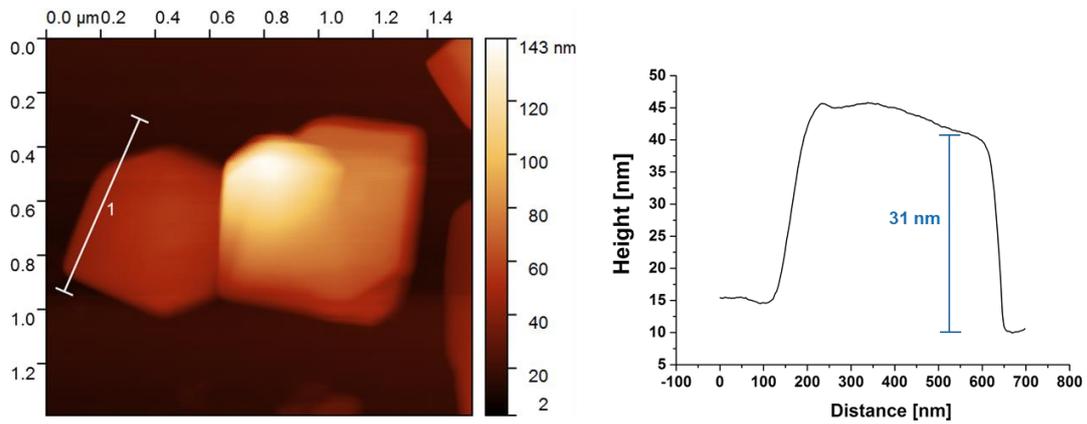
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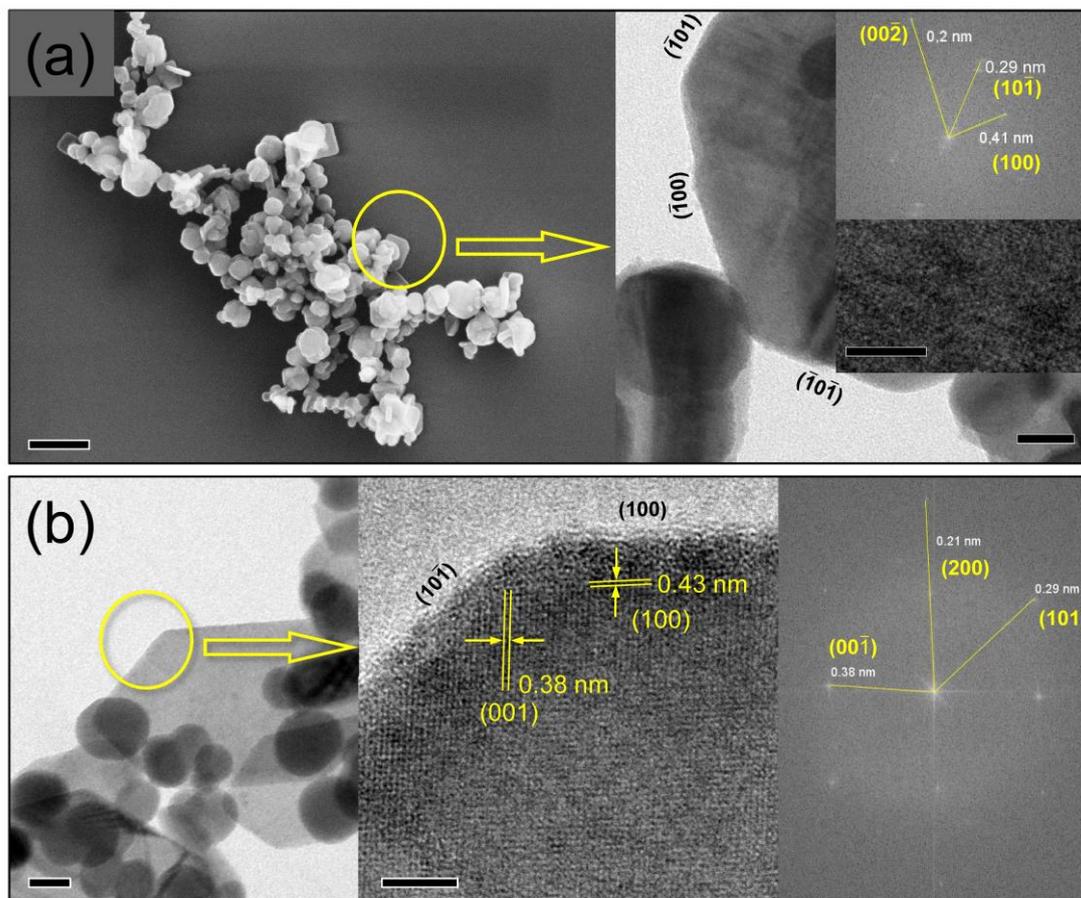
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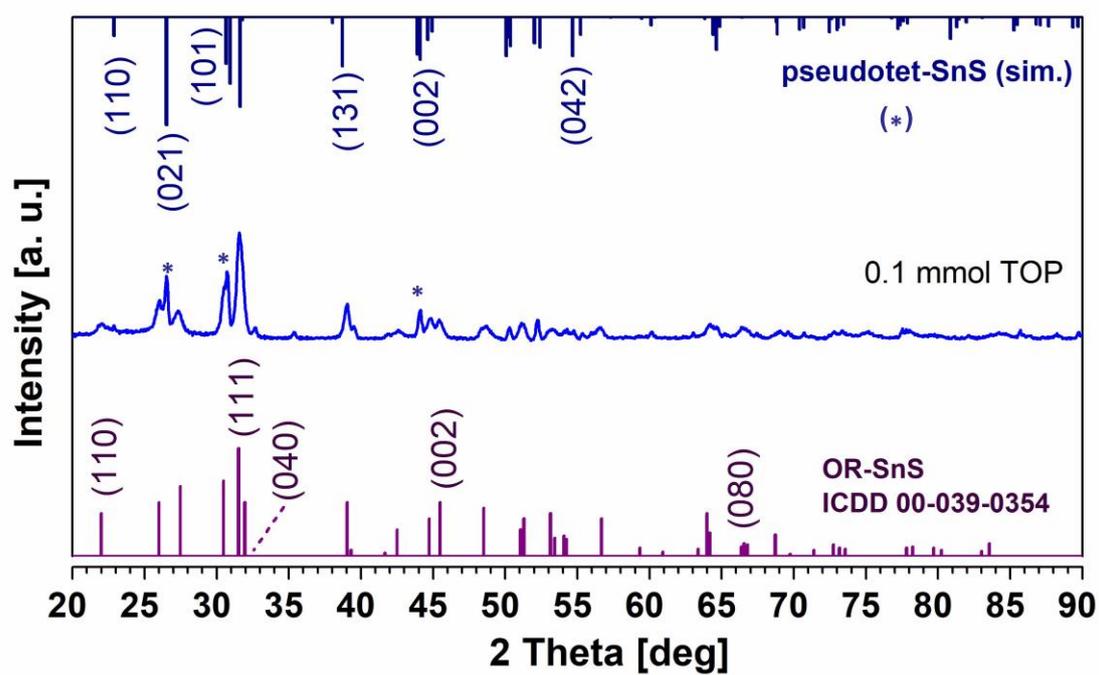
**Figure S1:** TEM image of SnS nanostructures synthesized with 0.25 mmol  $\text{SnCl}_2 \cdot \text{H}_2\text{O}$  (scale bar = 1  $\mu\text{m}$ ).



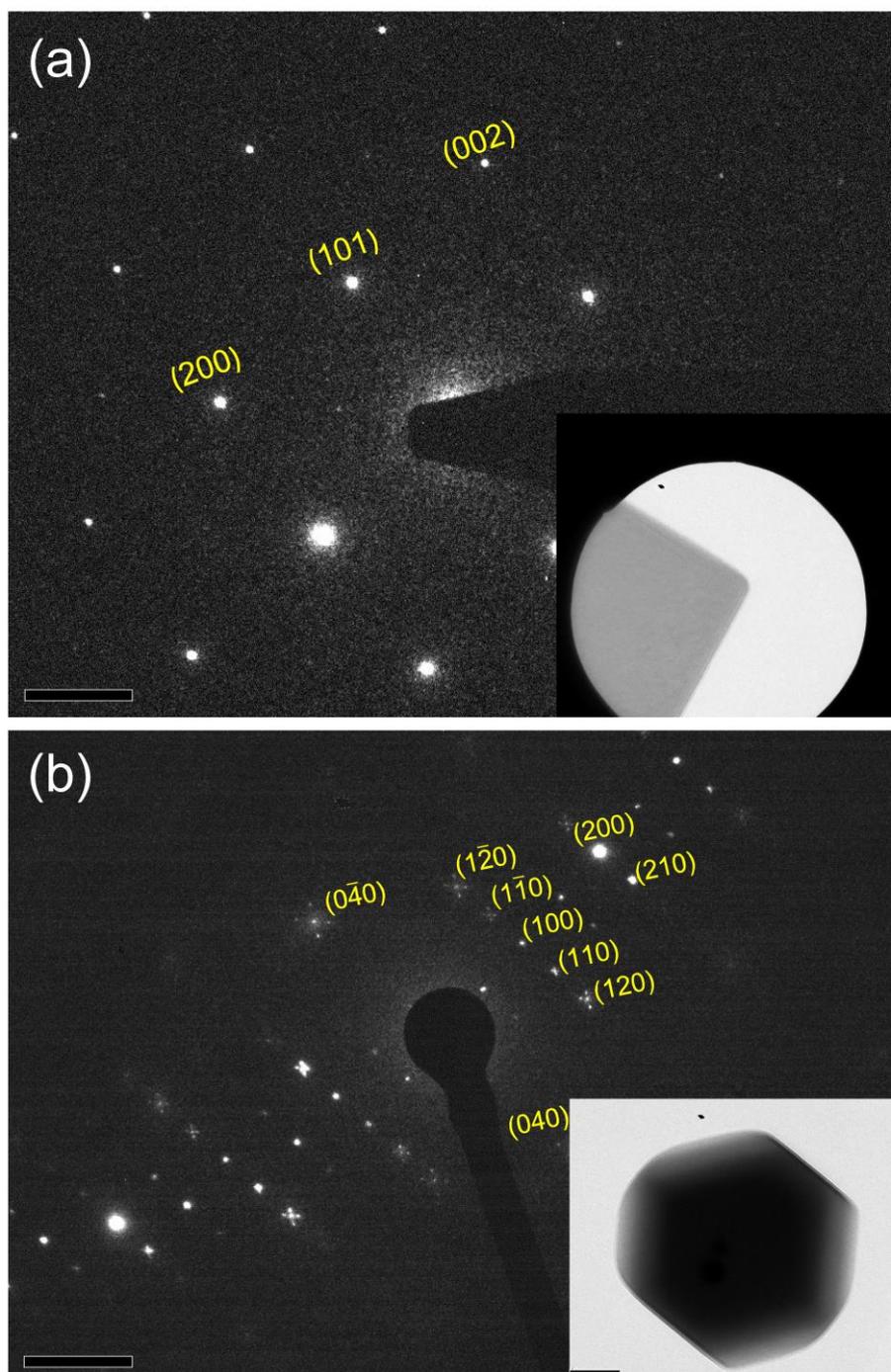
**Figure S2.** AFM image and the cross section of marked line 1 over a single SnS nanosheet demonstrated that the thickness was approximately 31 nm.



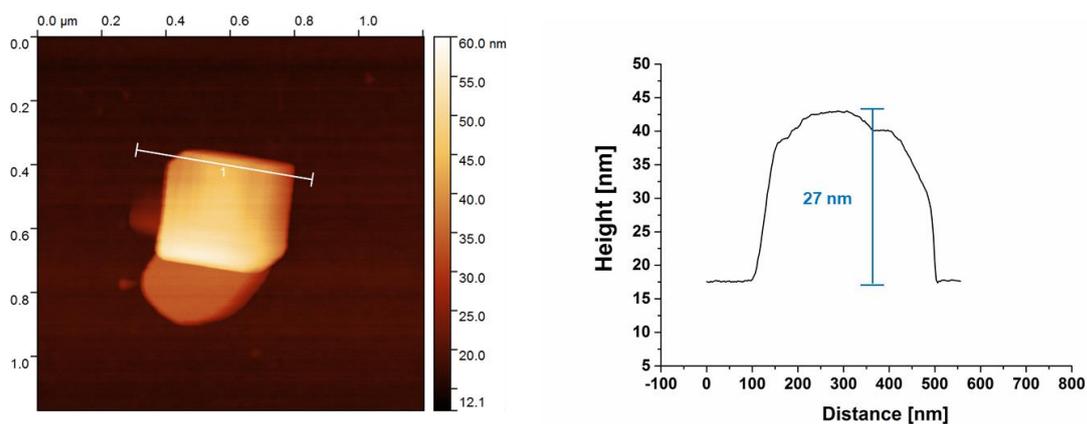
**Figure S3.** (a) SEM image, TEM image, HRTEM image, and resulting FFT of the synthesized nanocrystals without any TOP or OA ligands (Scale bar = 200 nm, 20 nm, 5 nm respectively). The small nanoplatelet shows a square shape with  $(100)$  and  $(001)$  side facets and  $(101)$  truncated facets. (b) TEM image, HRTEM image and resulting FFT of the synthesized hexagonal sheets with only OA (0.64 mmol) and no TOP (Scale bar=20 nm, 5 nm respectively). The sheet shows a hexagonal shape with elongated edges.



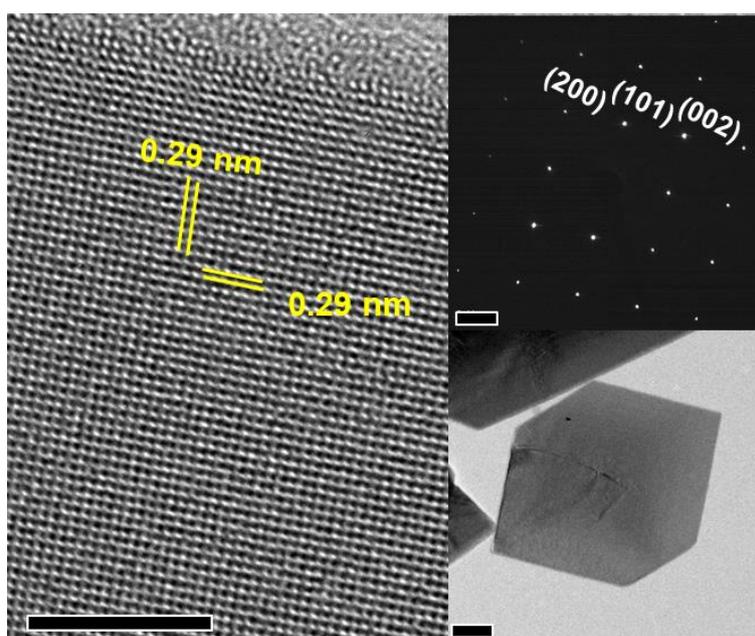
**Figure S4.** X-ray diffraction patterns (XRD) with the synthesized SnS nanostructures prepared in capillaries. This sample was produced by using 0.1 mmol TOP in the synthesis.



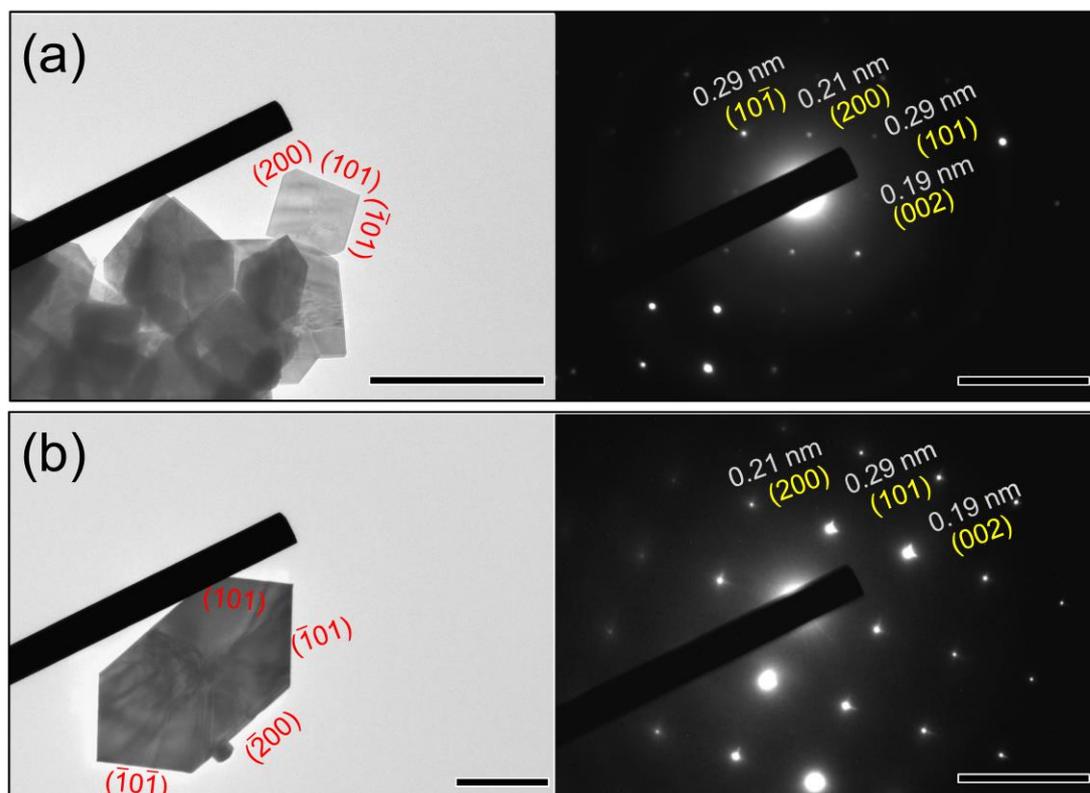
**Figure S5.** (a, b) Electron diffraction patterns of a single nanosheet (main product, Scale bar = 5  $\mu\text{m}$ ) and of a single nanoparticle (PT-type byproducts in the synthesis, Scale bar=2  $1/\text{nm}$ , inset: Scale bar = 50 nm).



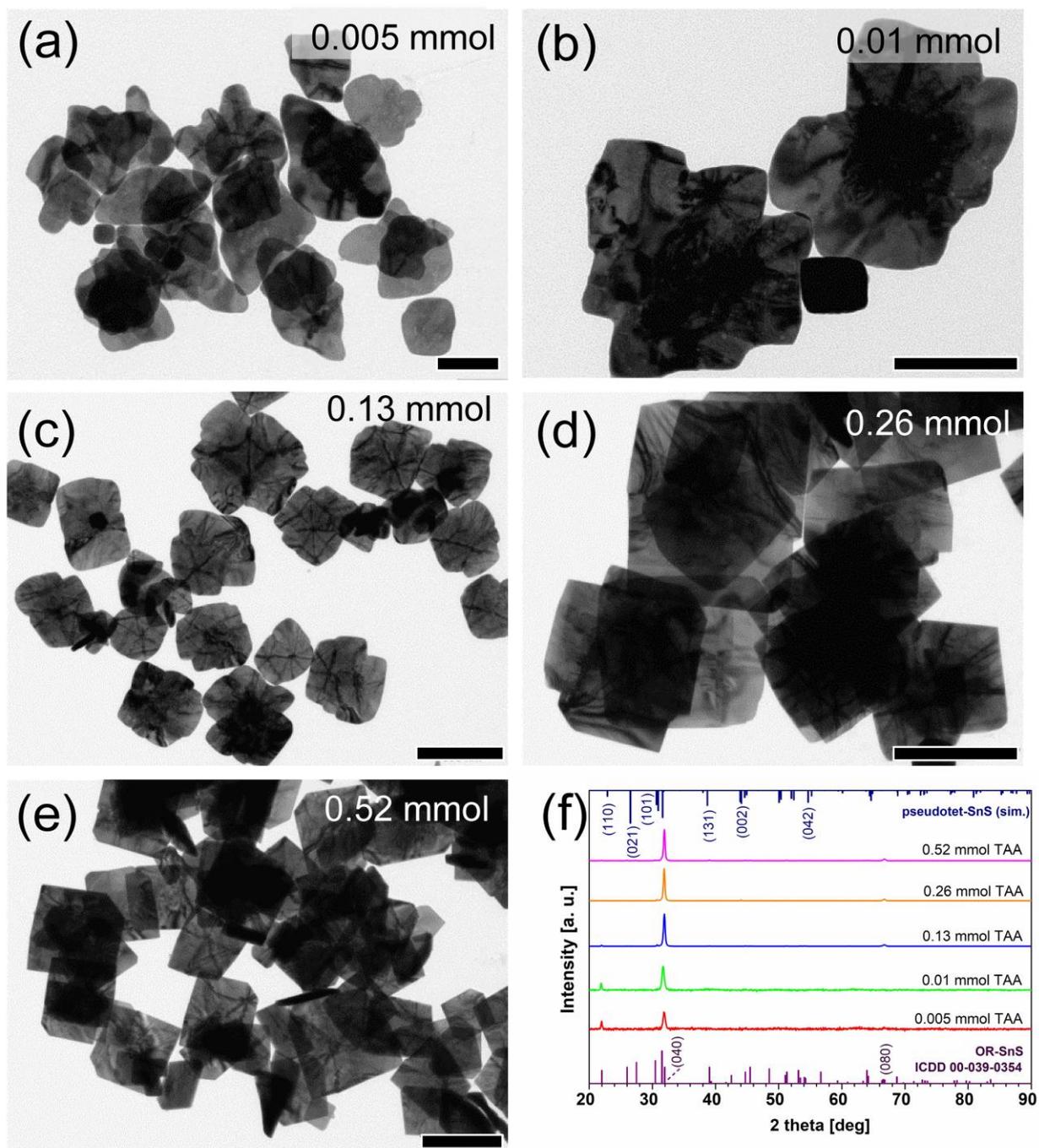
**Figure S6.** AFM image and the cross section of marked line 1 over a single SnS nanosheet demonstrated that the thickness was approximately 27 nm, which was slightly larger than the one measured based on XRD data (26 nm). The SnS NSs were synthesized with high TOP amount (2.0 mmol) with other parameters constant.



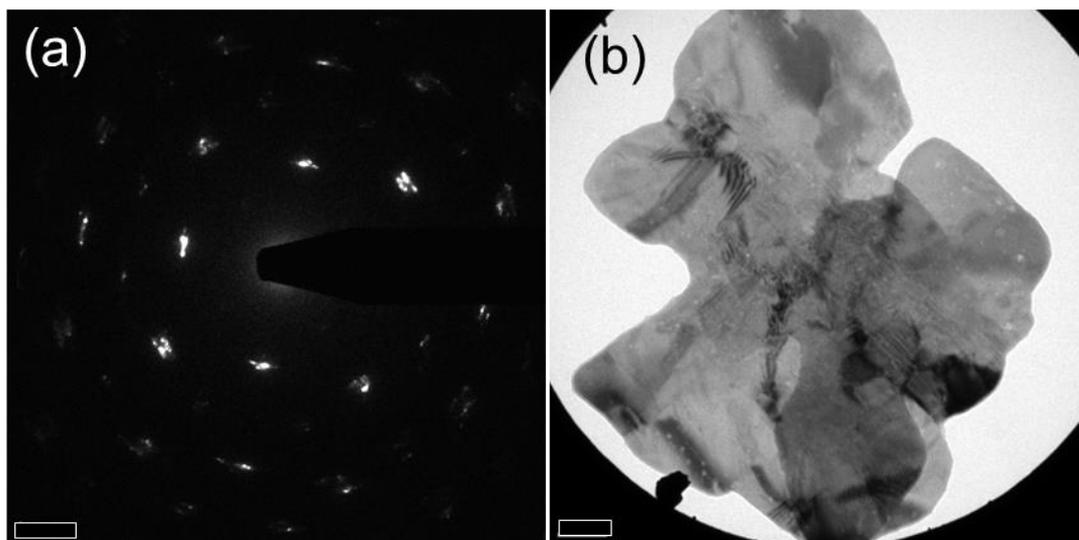
**Figure S7.** HR-TEM image of a single SnS nanosheet, together with measured lattice fringes (Scale bar=5 nm, inset: Scale bar=2 1/nm for the SAED pattern, and 50 nm for the TEM images).



**Figure S8.** TEM images and SAED pattern of a square nanosheet synthesized with no OA and 1.0 mmol TOP (a), and a hexagonal nanosheet synthesized with 6.4 mmol OA and 1.0 mmol TOP (b). Scale bar=500 nm for both TEM images, Scale bar=20  $\mu\text{m}$  for both SAED patterns. Rotations of SAED pattern in respect to TEM image have been performed.



**Figure S9.** (a-e) Shape and size transformation of 2D SnS nanoparticles to nanosheets with TAA amount varied from 0.005 mmol to 0.01, 0.13, 0.26, 0.52 mmol. (f) Powder XRD patterns of SnS nanosheets from a-e. Scale bar = 200 nm, 200 nm, 500 nm, 500 nm, 500 nm respectively.



**Figure S10.** Electron diffraction pattern (a) and TEM image (b) and EDS analysis of the irregular shaped SnS nanosheets synthesized with 0.01 mmol TAA. Scale bar=5  $\mu\text{m}$ , 50 nm for a, b.