## **Supporting information**

## Understanding the formation mechanism and the 3D structure of $Mo(S_xSe_{1-x})_2$ nanoflowers

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## Loss of flower-like morphology

When the precursors were changed, the flower-like morphology of the particles was lost. Figure S1 presents TEM images showing the morphology of particles produced with different precursors. When the DBS and DBSe were replaced by elemental sulfur and selenium, the synthesis yielded spread-out tangled sheets, as shown in figure S1a. When the MoO<sub>2</sub>(acac)<sub>2</sub> was replaced by MoCl<sub>5</sub>, the synthesis yielded large stacked flat sheets, as shown in figure S1b. When the MoO<sub>2</sub>(acac)<sub>2</sub> was replaced by sodium molybdate dihydrate, the synthesis yielded round tangled particles, as shown in figure S1c. When the MoO<sub>2</sub>(acac)<sub>2</sub>, DBS and DBSe were replaced by MoCl<sub>5</sub>, elemental sulfur and elemental selenium, respectively, the synthesis again yielded large stacked, flat sheets, as shown in figure S1d. When MoO<sub>3</sub> was used as the molybdenum precursor, no Mo(S<sub>x</sub>Se<sub>1</sub>. x)<sub>2</sub> product was observed. Using ammonium molybdate as the Mo source yielded spread tangled sheets, much like the ones presented in figure S1a.



Figure S1 TEM images of  $Mo(S_xSe_{1-x})_2$  synthesized using different precursors. (a)  $Mo(S0_8Se_{0.2})_2$  using elemental sulfur and selenium. (b)  $Mo(S_{0.5}Se_{0.5})_2$ using  $MoCl_5$ . (c)  $Mo(S_{0.5}Se_{0.5})_2$  using sodium molybdate. (d)  $Mo(S_{0.4}Se_{0.6})_2$  using  $MoCl_5$  and elemental sulfur and selenium.