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Fast Colloidal Synthesis of $SnSe_2$ Nanosheets for Flexible Broad-band Photodetection

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Table S1. Comparison of the methods for the previously reported $SnSe_2$ nanosheets.

methods	Temperature (°C)	time	yield	reference
solvothermal	180	36 hours	-	28
CVD	600	15 minutes	-	22
solvothermal	180	24 hours	-	29
solid phase sintering	800	3 days	-	24
solvothermal	220	48 hours	-	21
CVD	750	15 minutes	-	27
solvothermal	180	12 hours	-	30
mechanical exfoliation	600	24 hours	-	23
hot injection	280	5 minutes	17 mg	this work

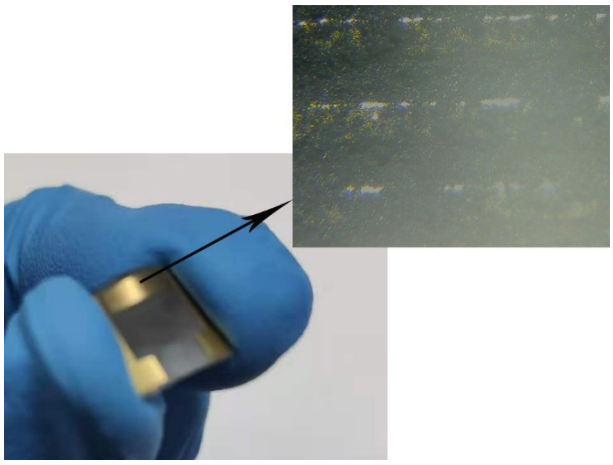

Figure S1. The optical and microscopic images of $SnSe_2$ nanosheets devices on PET substrate.

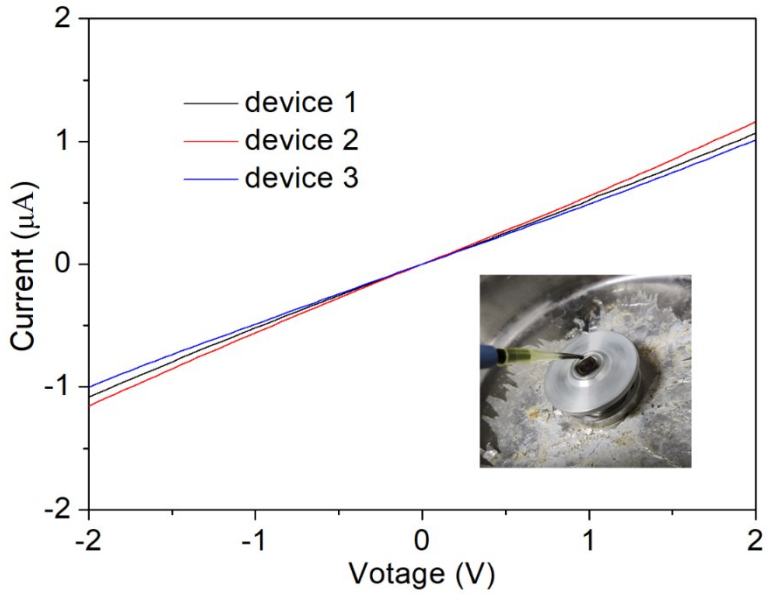

Figure S2. The I-V curves of three devices fabricated with the same method, the inset is the photograph of the experimental process.

To check the repeatability of the device. Three devices were fabricated with the same method and the I-V curves were measured in dark condition. As seen in Figure S2, little difference is detected between three curves, demonstrating that the fabricated $SnSe_2$ nanosheets based photodector has high repeatability.

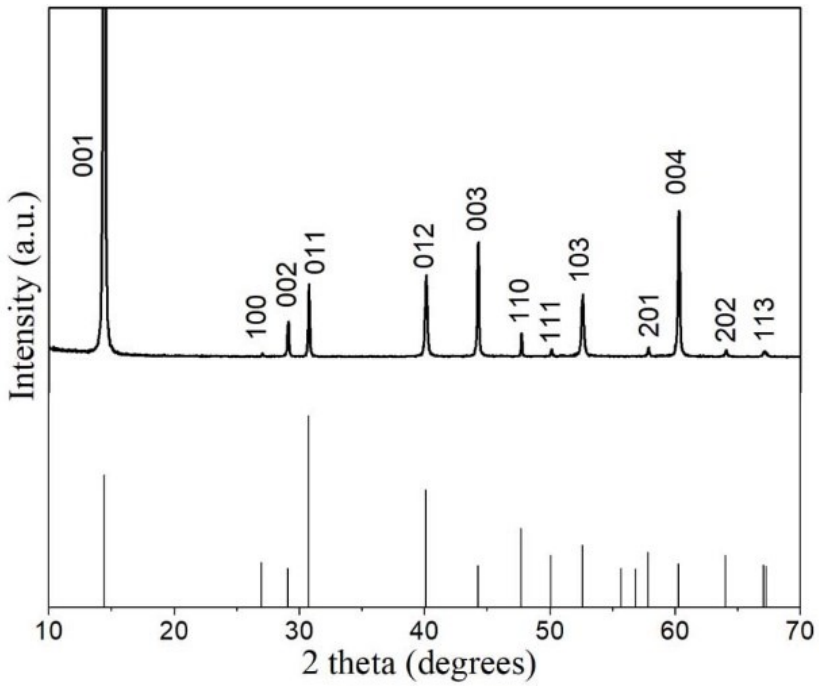

Figure S3. The XRD pattern of the as-synthesized $SnSe_2$ nanosheets.

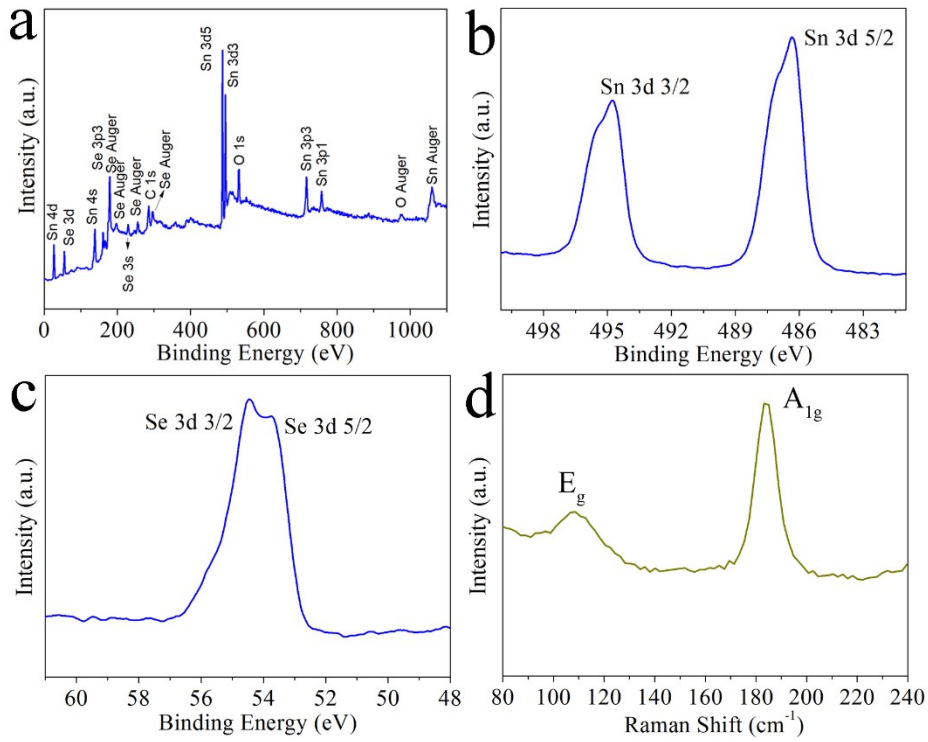

Figure S4. (a) XPS survey spectrum, (b) high-resolution of Sn 3d, (c) Se 3d and (d) Raman spectra of nanosheets showing Eg and A1g modes of vibration.

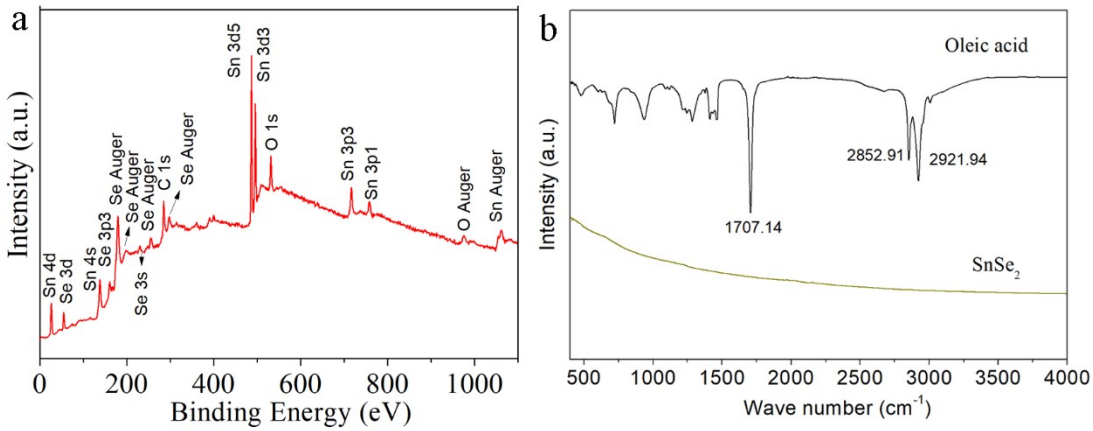

Figure S5. (a) XPS survey spectrum of the $SnSe_2$ nanosheets annealed at 400 °C for 30 minutes protected by Ar atmosphere .(b) FTIR spectra of the annealed $SnSe_2$ nanosheets (bottom) and the oleic acid (top), respectively.

To investigate the origin for the O elemental signal, the XPS and FTIR spectra of the sample (annealed at 400 °C for 30 minutes protected by Ar atmosphere) were measured. As seen in Figure S5a, the O elemental signal is still existent, but no oleic acid signal is detected by a fourier transformed infrared (FTIR) spectroscope (Figure S5b). These results suggest that the O elemental signal mainly comes from the adsorbed air.

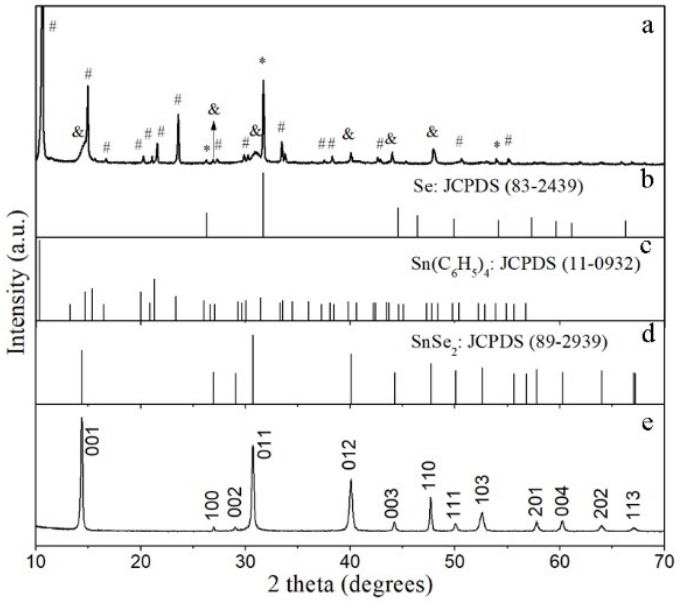

Figure S6. (a) XRD pattern of the products synthesized without oleic acid (#: $Sn(C_6H_5)_4$, &: $SnSe_2$, *: Se), (b) JCPDS Card No. 83-2439, (c) JCPDS Card No. 11-0932, (d) JCPDS Card No. 89-2939, (e) XRD pattern of the samples synthesized with 0.2 ml oleic acid.

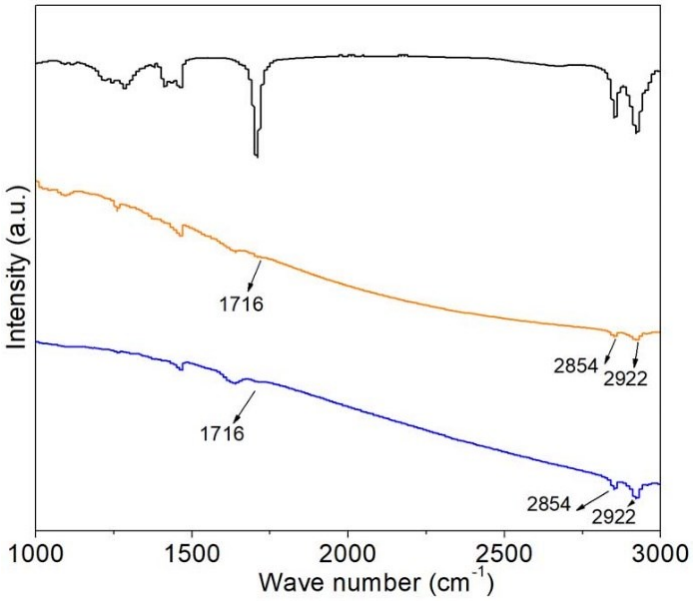

Figure S7. FTIR spectra of the oleic acid (top), $SnSe_2$ nanosheets synthesized with 0.5 (middle) and 0.2 ml oleic acid (bottom), respectively.

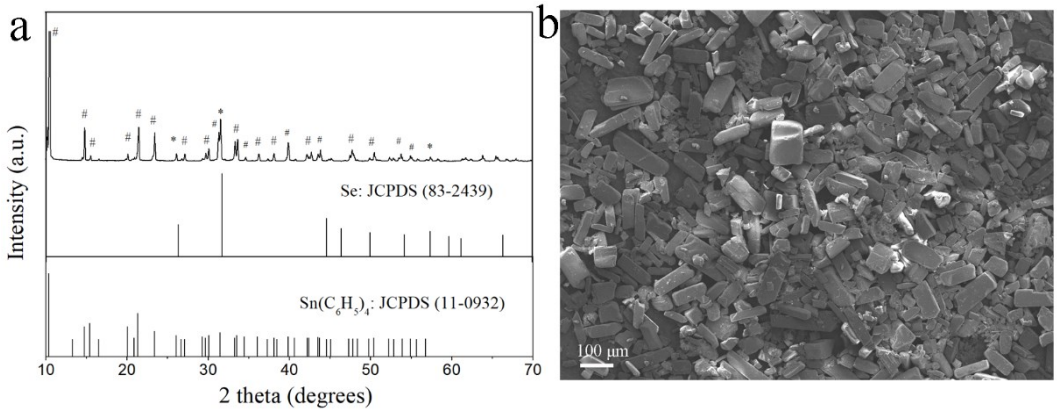

Figure S8. (a) XRD pettern (#: Sn(C6H5)4, *: Se) and (b) SEM image of the products produced at 280 °C for 5 minutes (protected by Ar atmosphere) by mixing precursor sources of tetraphenyl tin with dibenzyldiselenide in quartz tube in the absence of ODE and oleic acid.