

Supporting information:

One-Step Synthesized PbSe Nanocrystal Inks Decorated 2D MoS₂ Heterostructure for High Stability Photodetectors with Photoresponse Extend to Near-Infrared Region

Mingfa Peng,^a Yi Tao,^b Xuekun Hong,^a Yushen Liu,^b Zhen Wen*^b and Xuhui Sun*^b

^a School of Electronic and Information Engineering, Jiangsu Province Key Laboratory of Advanced Functional Materials, Changshu Institute of Technology, Changshu, Jiangsu 215500, P. R. China

^b Institute of Functional Nano & Soft Materials (FUNSOM), and Jiangsu Key Laboratory for Carbon-based Functional Materials and Devices, Soochow University, Suzhou, Jiangsu 215123, P. R. China.

*Corresponding Author: Z. Wen: wenzhen2011@suda.edu.cn, X. Sun:

xhsun@suda.edu.cn

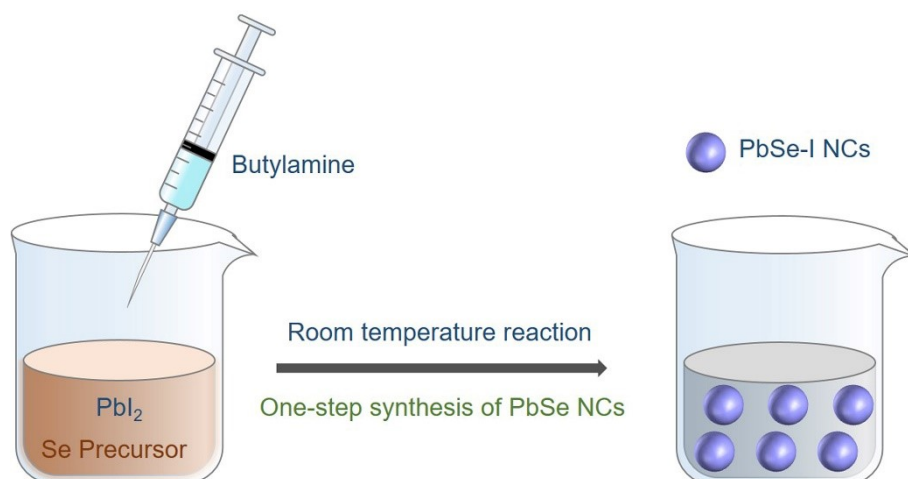


Fig. S1 Schematic illustration of one-step synthesis of PbSe nanocrystal inks.

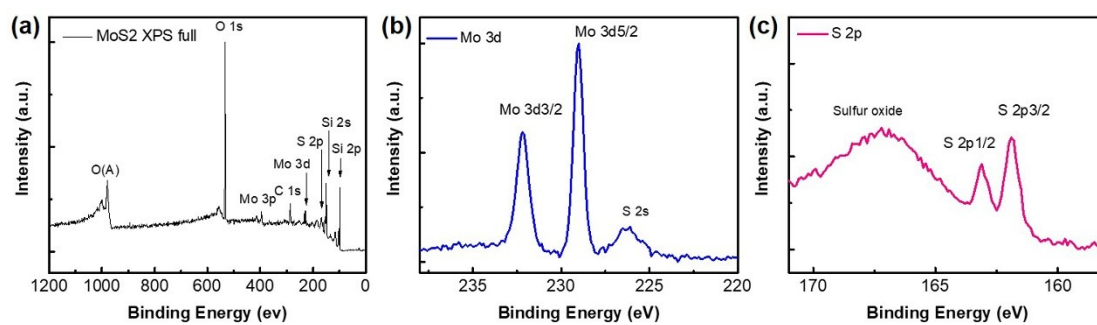


Fig. S2 XPS spectra of (a) full spectra, (b) Mo 3d and (c) S 2p of 2D MoS₂.

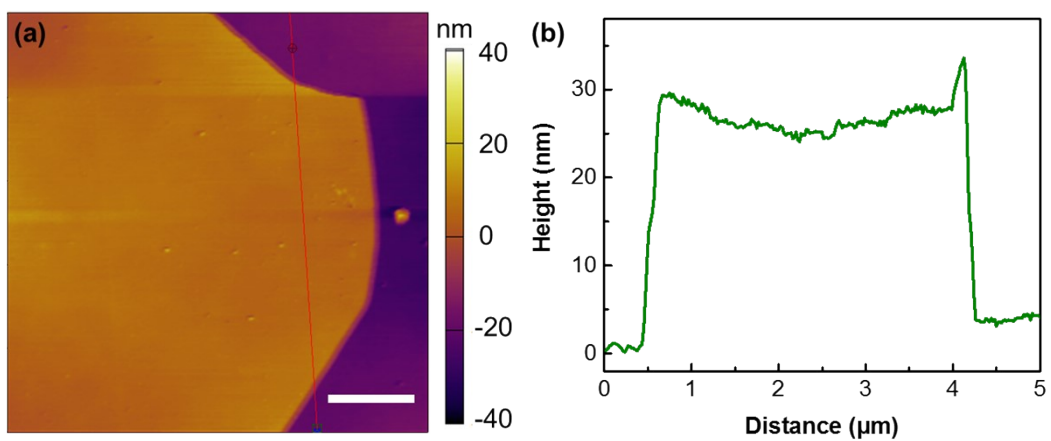


Fig. S3 (a) AFM image and (b) the height profile of the 2D MoS₂.

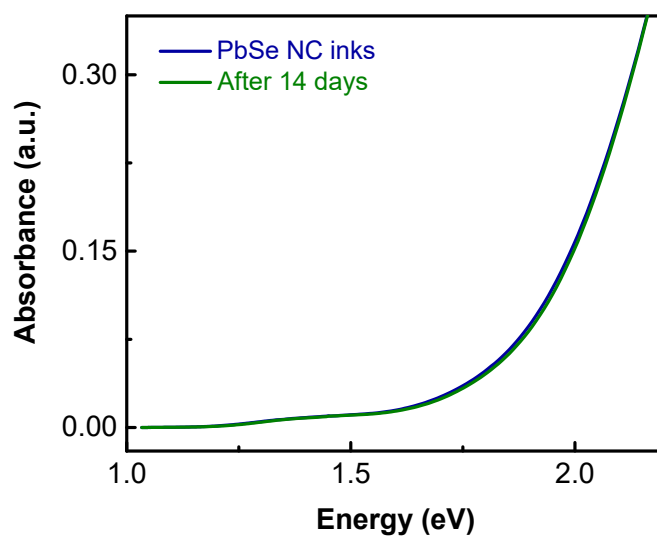


Fig. S4 Absorbance spectra of the one-step synthesized PbSe NC inks and after 14 days stored in air.

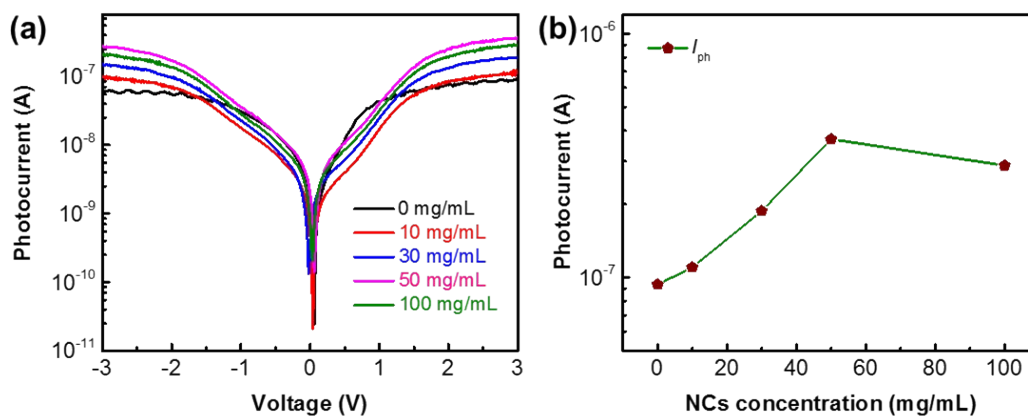


Fig. S5 The photoresponse performance of PbSe/MoS₂ heterostructure photodetector with different concentration of PbSe NCs solution.

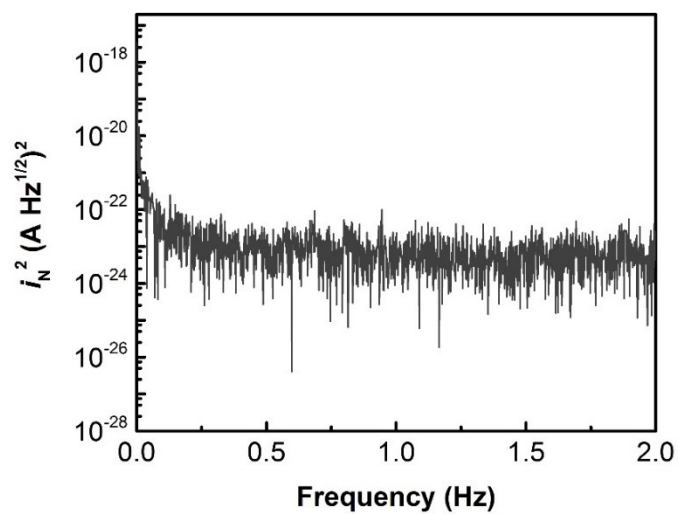


Fig. S6 Noise power density of the PbSe/MoS₂ heterostructure photodetector.

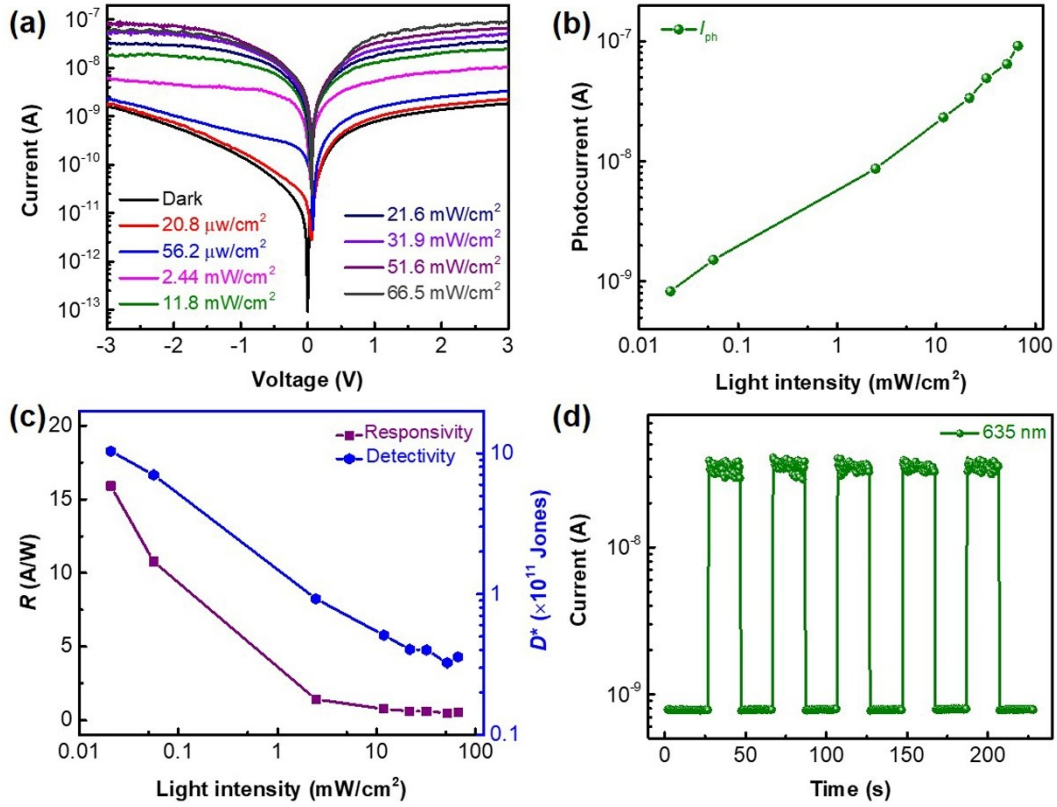


Fig. S7 Optoelectronic performance of the pristine 2D MoS₂ photodetector under 635 nm light illumination. (a) I - V curves of the photodetector with different incident light intensity. (b) The dependence of the photocurrent with the incident light intensity. (c) The calculated R and D^* of the photodetector as a function of the incident light intensity. (d) I -Time curve of the photodetector with the light intensity of $51.6 \text{ mW}/\text{cm}^2$.

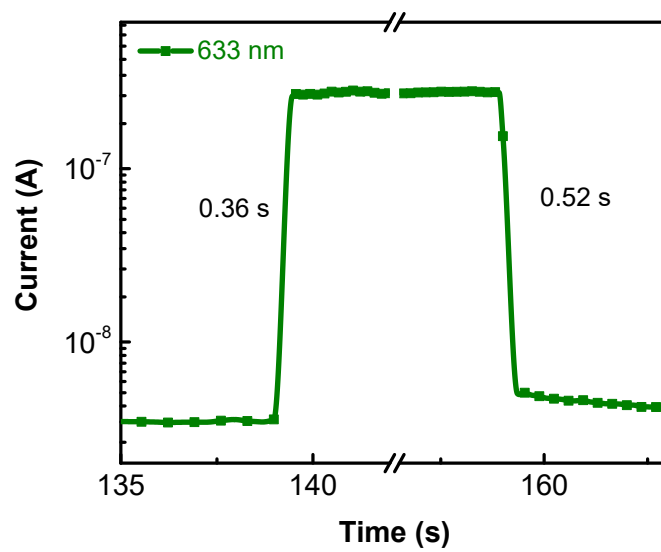


Fig. S8 Response time of the PbSe/MoS₂ heterostructure photodetector under 635 nm light illumination.

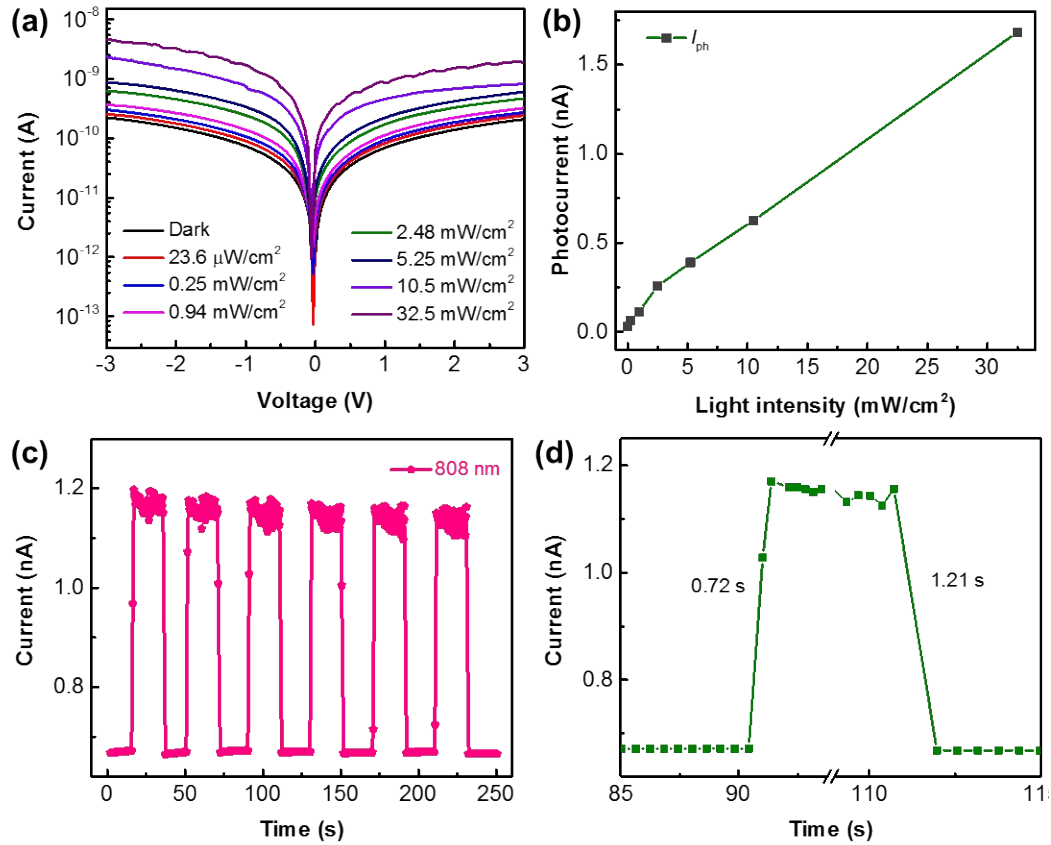


Fig. S9 Optoelectronic performance of the PbSe photodetector under 808 nm light illumination. (a) *I-V* curves of the photodetector with different incident light intensity illumination. (b) Relationship between the photocurrent and incident light intensity. (c) *I-Time* curve of the photodetector with the light intensity of $32.5 \text{ mW}/\text{cm}^2$. (d) Response time of the pristine PbSe photodetector.

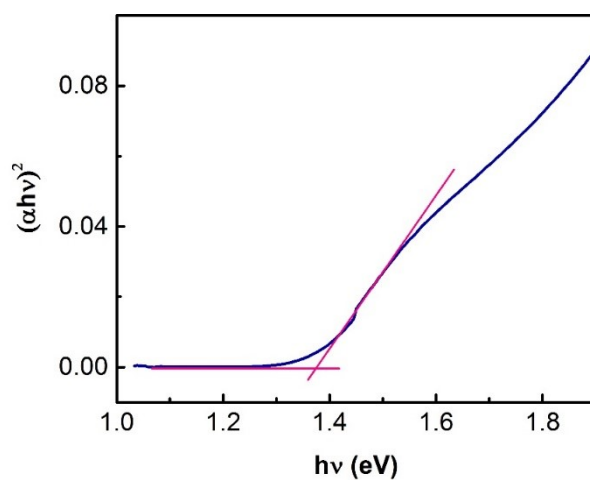


Fig. S10 Tauc plot of the one-step synthesized PbSe nanocrystal inks.

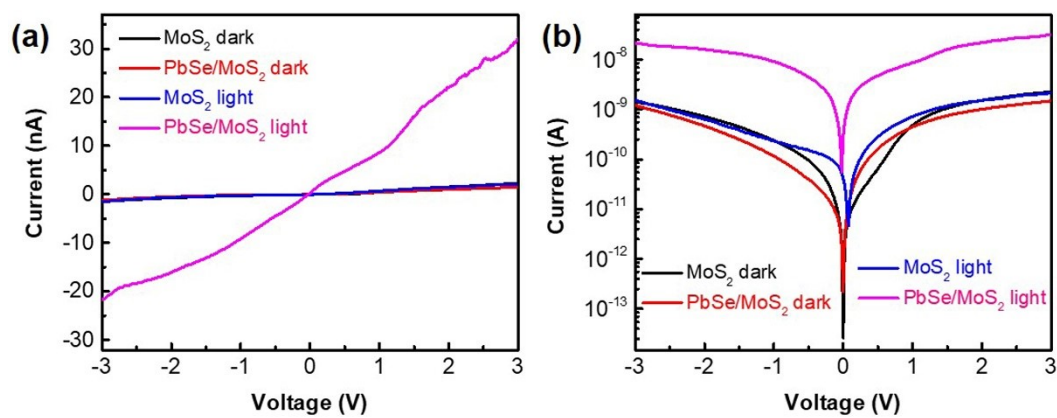


Fig. S11 (a) I - V curves and (b) semi-log I - V curves of the pristine 2D MoS₂ and PbSe/MoS₂ photodetector with 808 nm light illumination and under dark condition.