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Supporting Information

2D Bi_2Se_3-ZnO nanoparticles heterojunction ultrafast photodetector for enhanced detection in the UV to telecommunication wavelength

Sanju Nandi[1], Nil Kantha Das[1], Sirsendu Ghosal[1], Debabrata Sahu[1], M. Meyyappan[2], P.K. Giri[1,2*]

[1]Department of Physics, Indian Institute of Technology Guwahati, Guwahati 781039, India

[2]Centre for Nanotechnology, Indian Institute of Technology Guwahati, Guwahati, India

[*]Corresponding Author: giri@iitg.ac.in

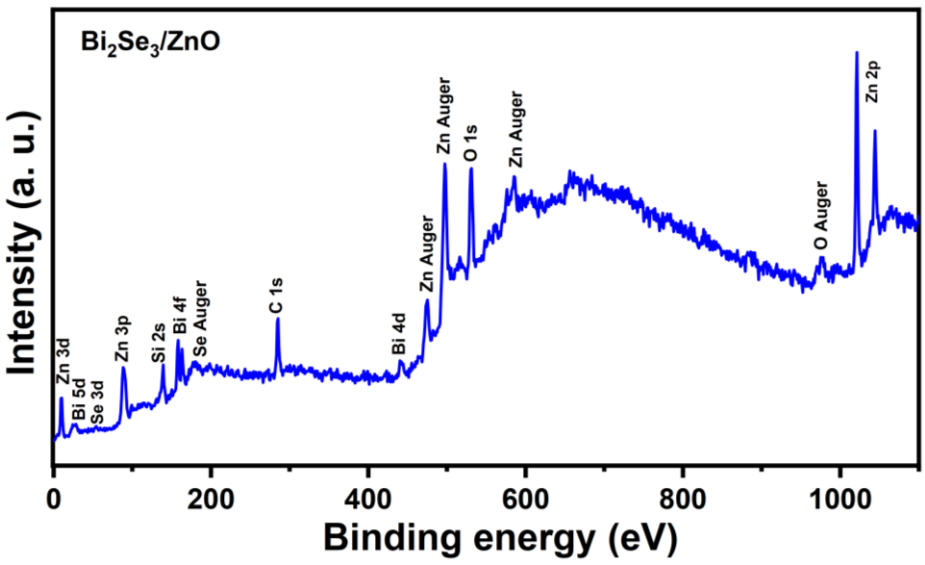

Fig. S1. XPS survey spectra of Bi_2Se_3-ZnO heterostructure.

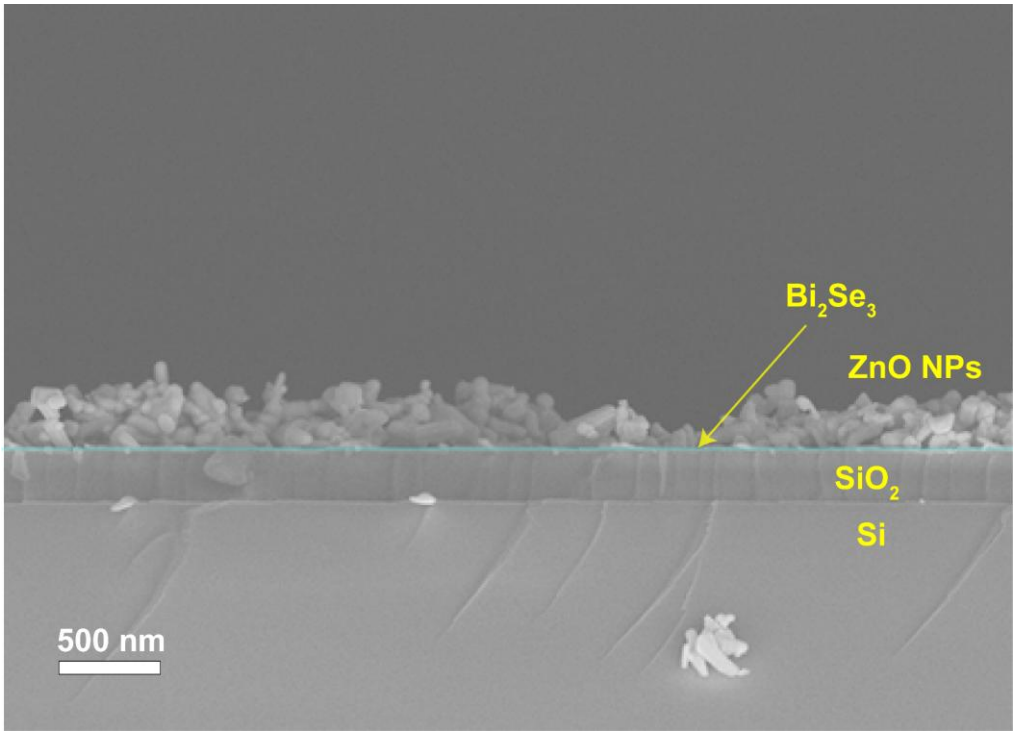

Fig. S2. Cross-sectional FESEM of Bi_2Se_3-ZnO heterostructure on SiO_2-Si substrate.

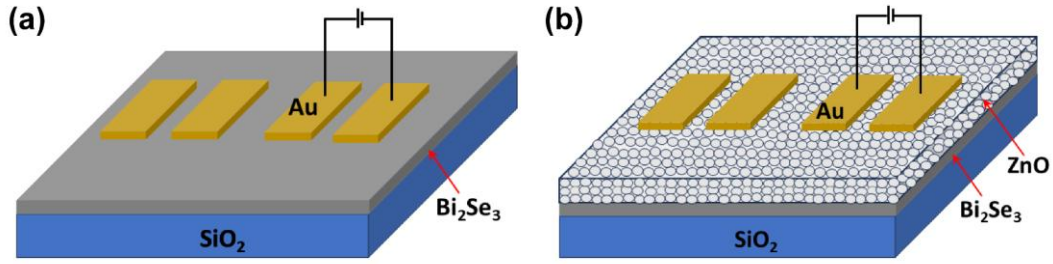

Fig. S3 (a) Schematic of the bare Bi_2Se_3 PD, and (b) Schematic of the Bi_2Se_3-ZnO PD.

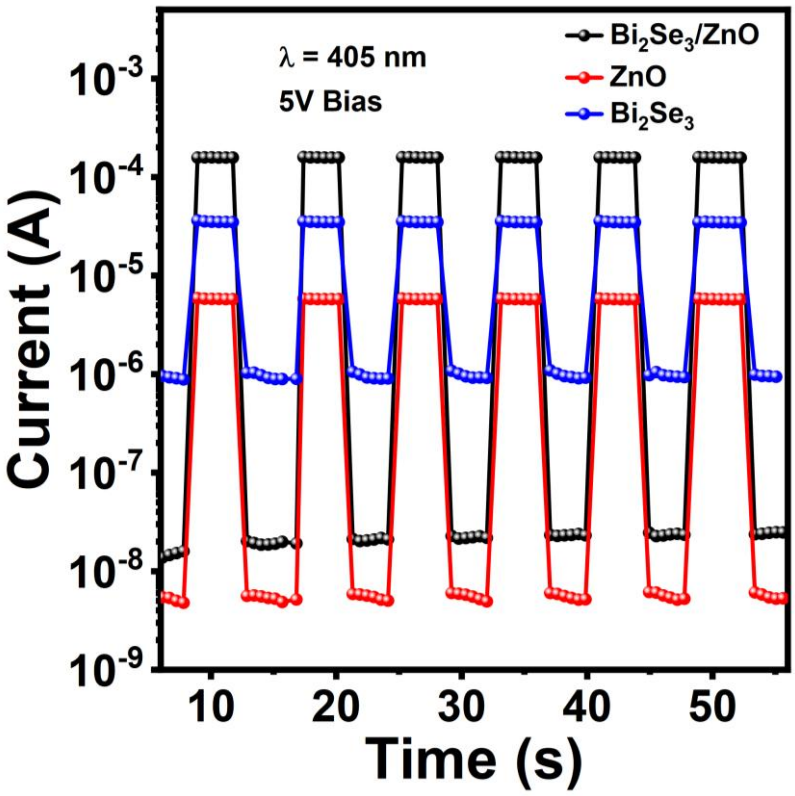

Fig. S4 Comparison of I–t characteristics of the Bi_2Se_3-ZnO heterojunction PD, bare ZnO NPs PD and bare Bi_2Se_3 PD under dark conditions and 405 nm laser illumination with an intensity of 54.9 mW/cm^2.

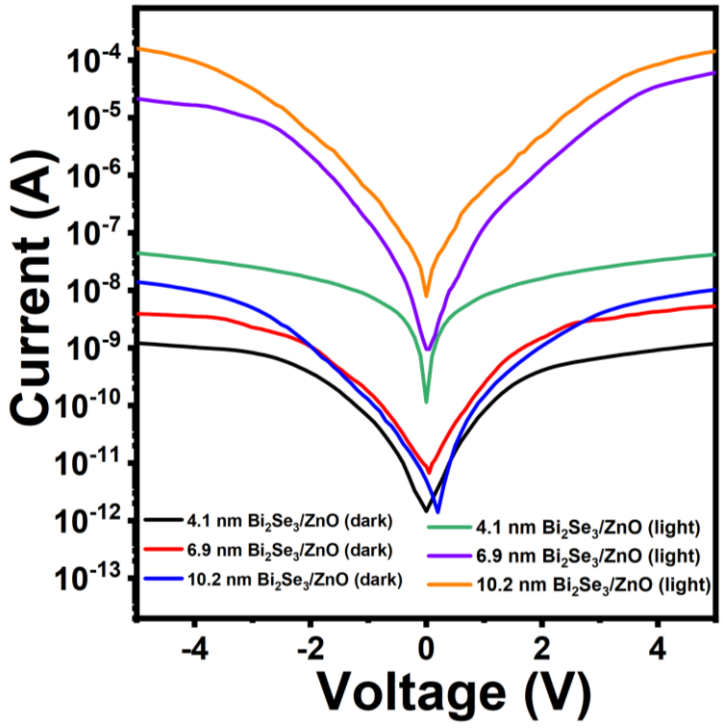

Fig. S5 I-V characteristics of the Bi_2Se_3-ZnO PD for various film thickness values of Bi_2Se_3.

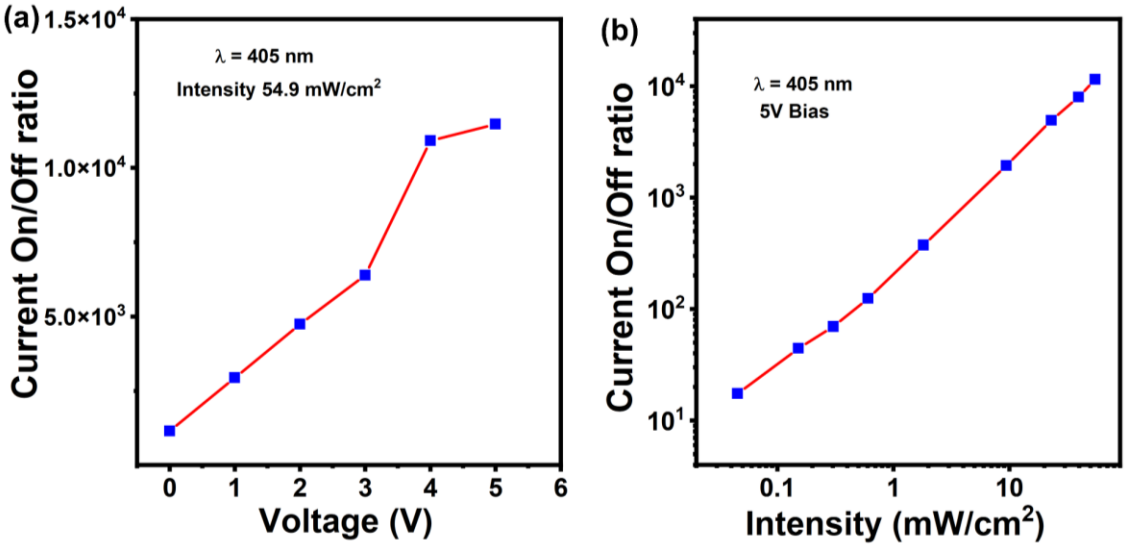

Fig. S6 (a) Current on/off ratio at different voltages of the Bi_2Se_3-ZnO PD, and (b) Current on/off ratio of the Bi_2Se_3-ZnO PDS at different illumination intensities.

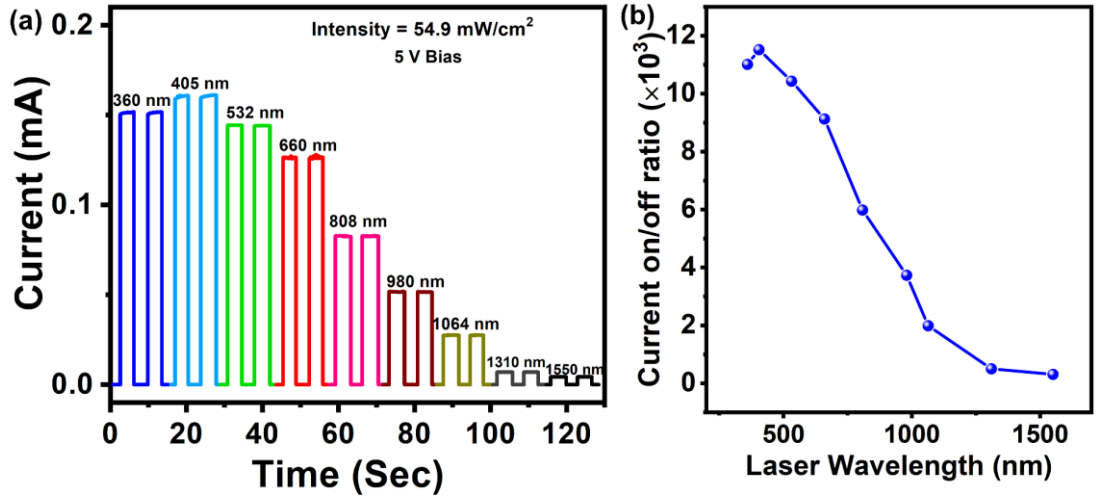

Fig. S7 (a) Photocurrent response, and (b) current on/off ratio under different laser illumination conditions of the Bi_2Se_3-ZnO PD.

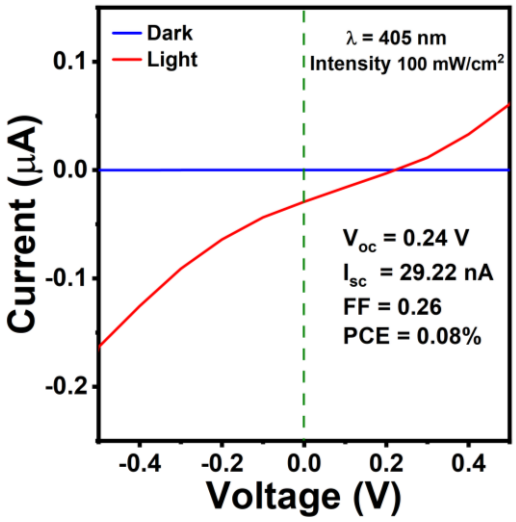

Fig. S8 Photovoltaic behavior of the Bi_2Se_3-ZnO PD heterostructure measured with 405 nm illumination at 1 Sun intensity (100 mW/cm^2) to measure open-circuit voltage, short-circuit current, and power conversion efficiency.

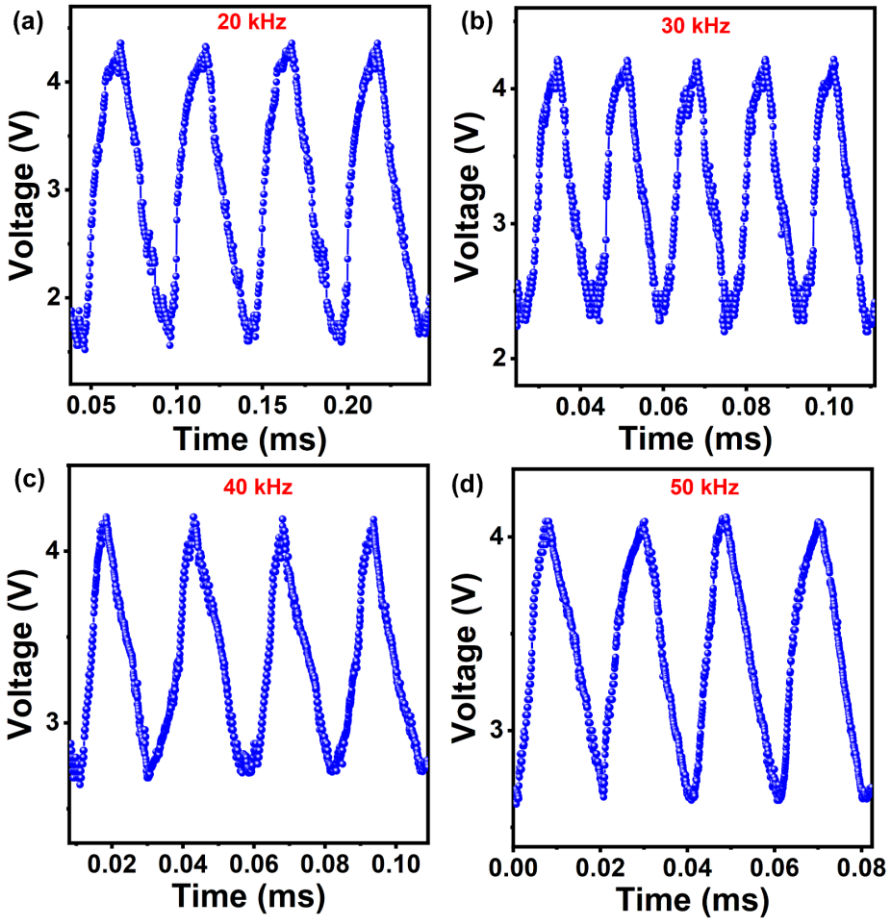

Fig. S9 (a-d) Puled photoresponse of the Bi_2Se_3-ZnO PD at frequencies of 20, 30, 40 and 50 kHz, respectively.

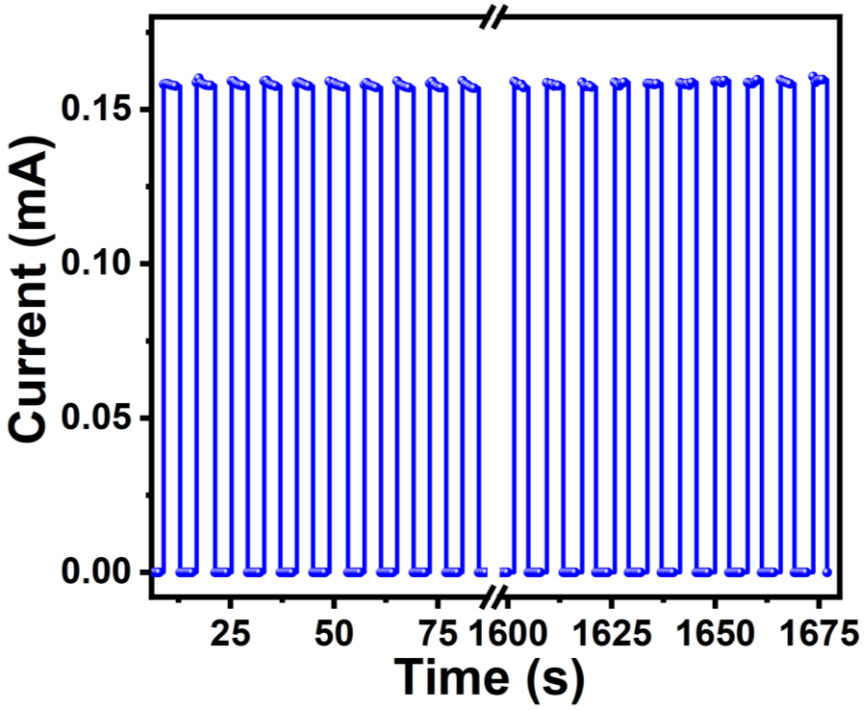

Fig. S10 Photo sensing repeatability for 165 cycles, suggesting the excellent device stability.

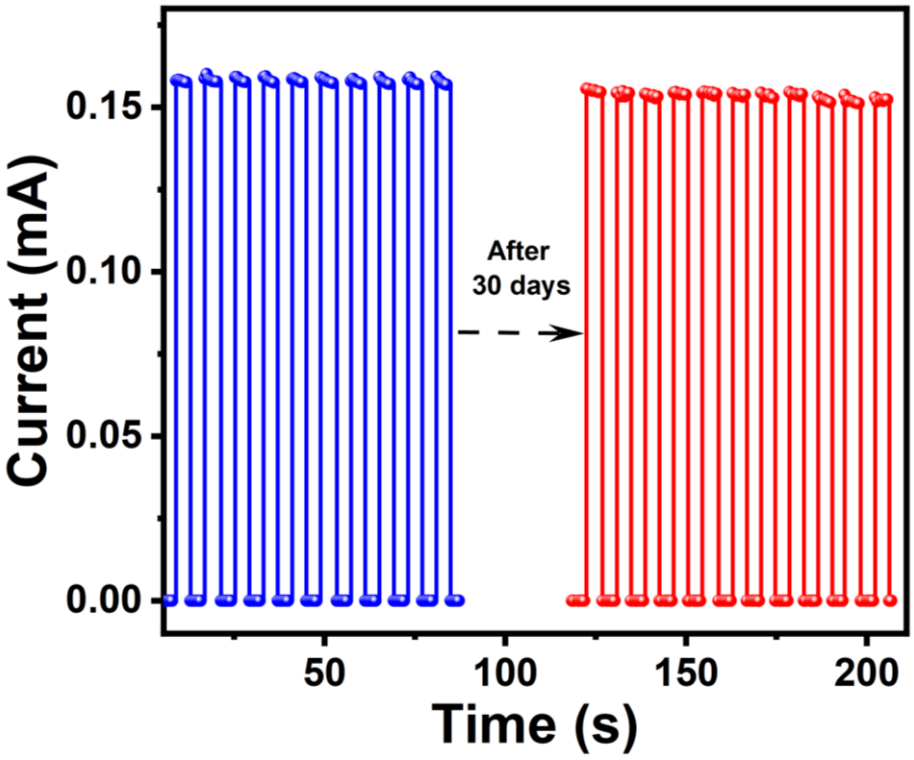

Fig. S11 Photo sensing repeatability after 30 days of storage in ambient conditions, suggesting the excellent long-term stability.

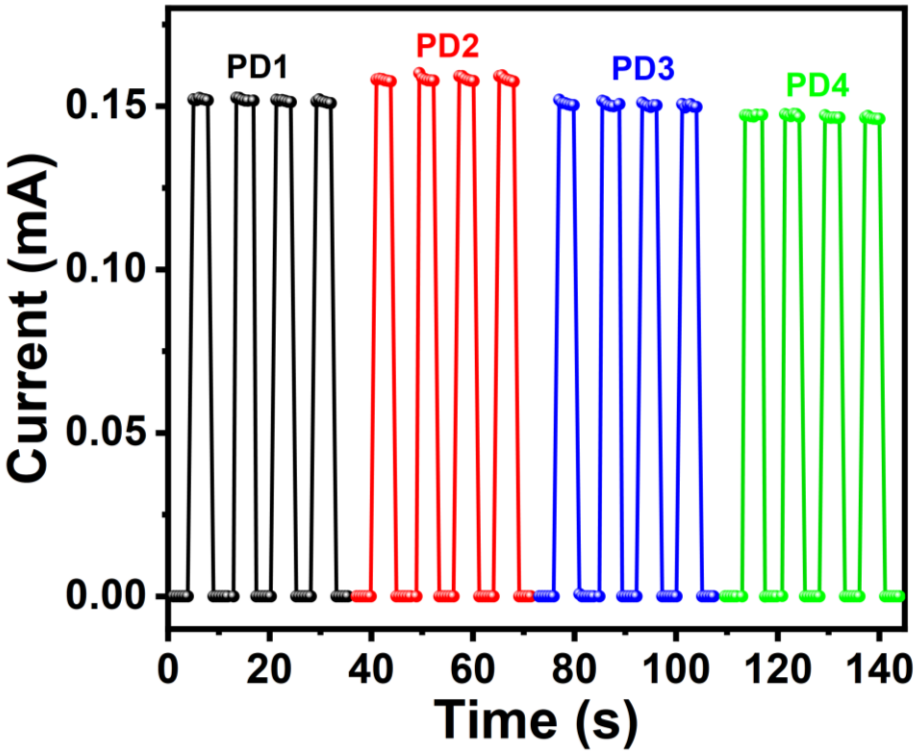

Fig. S12 Photoresponse characteristics of four identical Bi_2Se_3-ZnO PD devices (PD1, PD2, PD3, PD4).

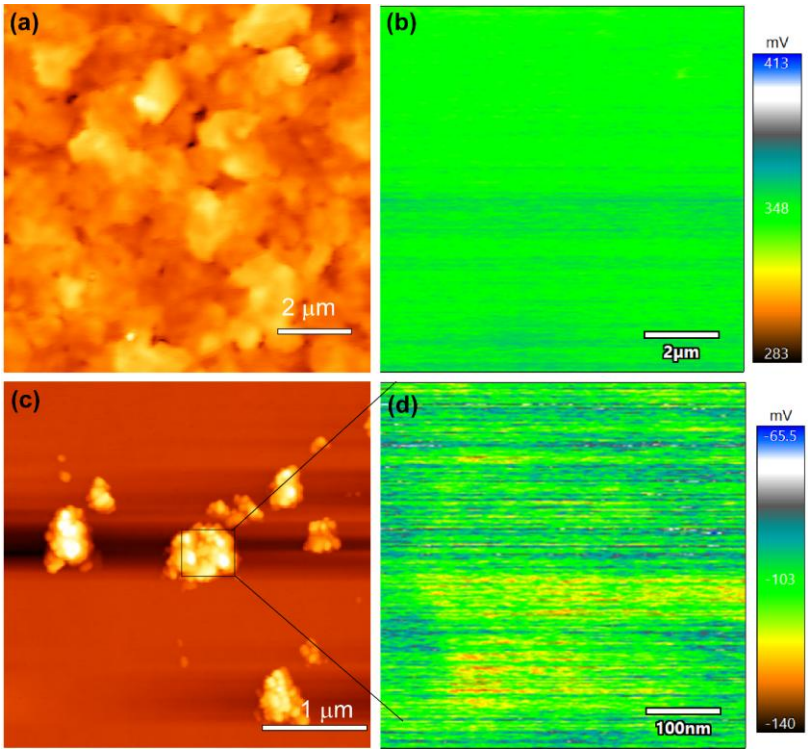

Fig. S13 (a) AFM image of the Bi_2Se_3 thin film and (b) its corresponding surface potential image. (c) AFM image of the ZnO NPs and (d) its corresponding surface potential image.