Supplementary information for:

Mixed-dimensional quasi-1D BiSeI nanowire-2D GaSe nanosheet p-n heterojunction for fast response optoelectronic devices

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S1. Characterization of GaSe and BiSeI.

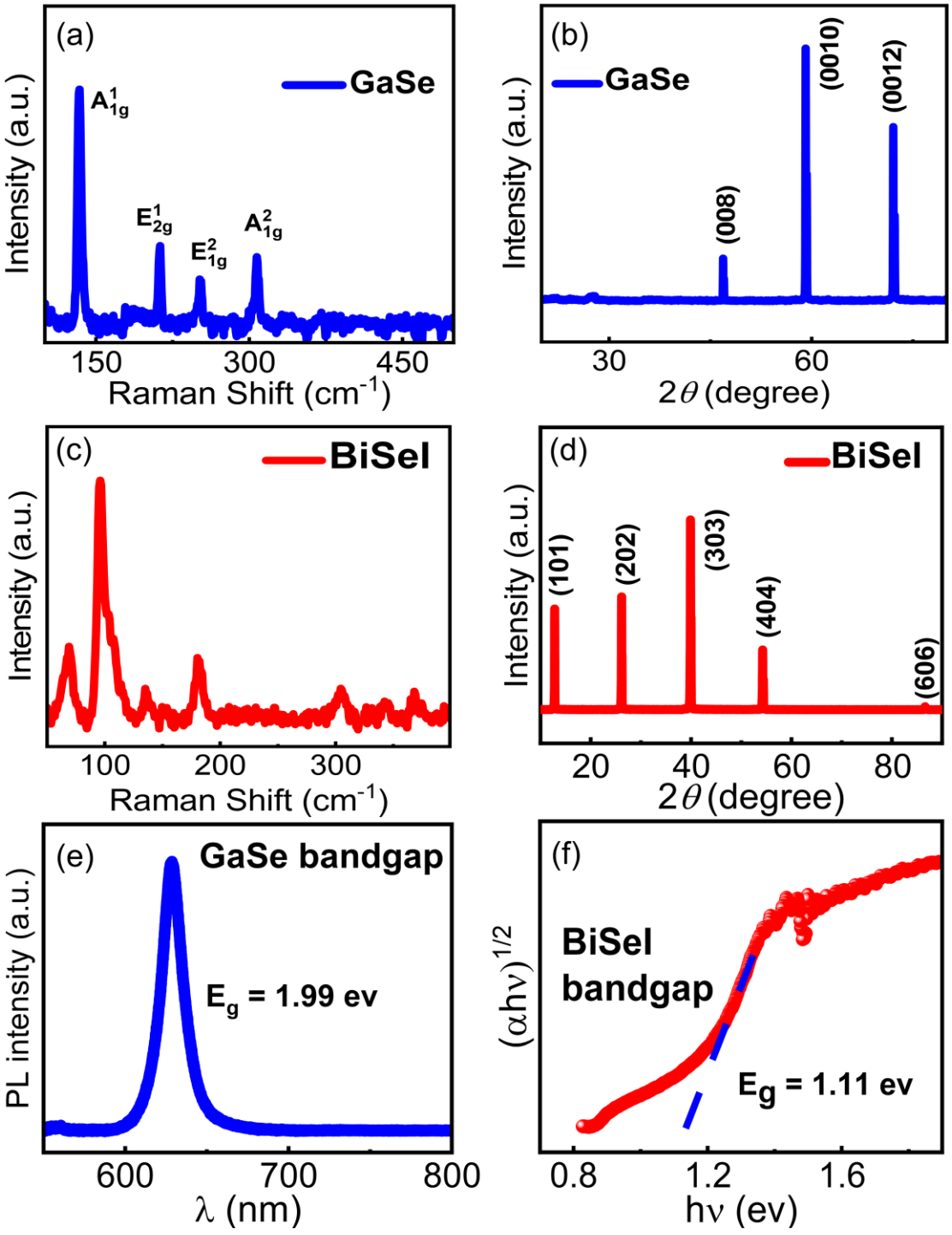

Figure S1. Characterization of GaSe and BiSeI. (a, c) Raman spectra showing the characteristic peaks of GaSe and BiSeI. (b, d) X-ray diffraction patterns of GaSe and BiSeI single crystals. (e) The photoluminescence (PL) spectrum of GaSe single crystal. (f) The absorption spectrum of BiSeI crystal.

S2. The output and transfer characteristic of individual GaSe and BiSeI.

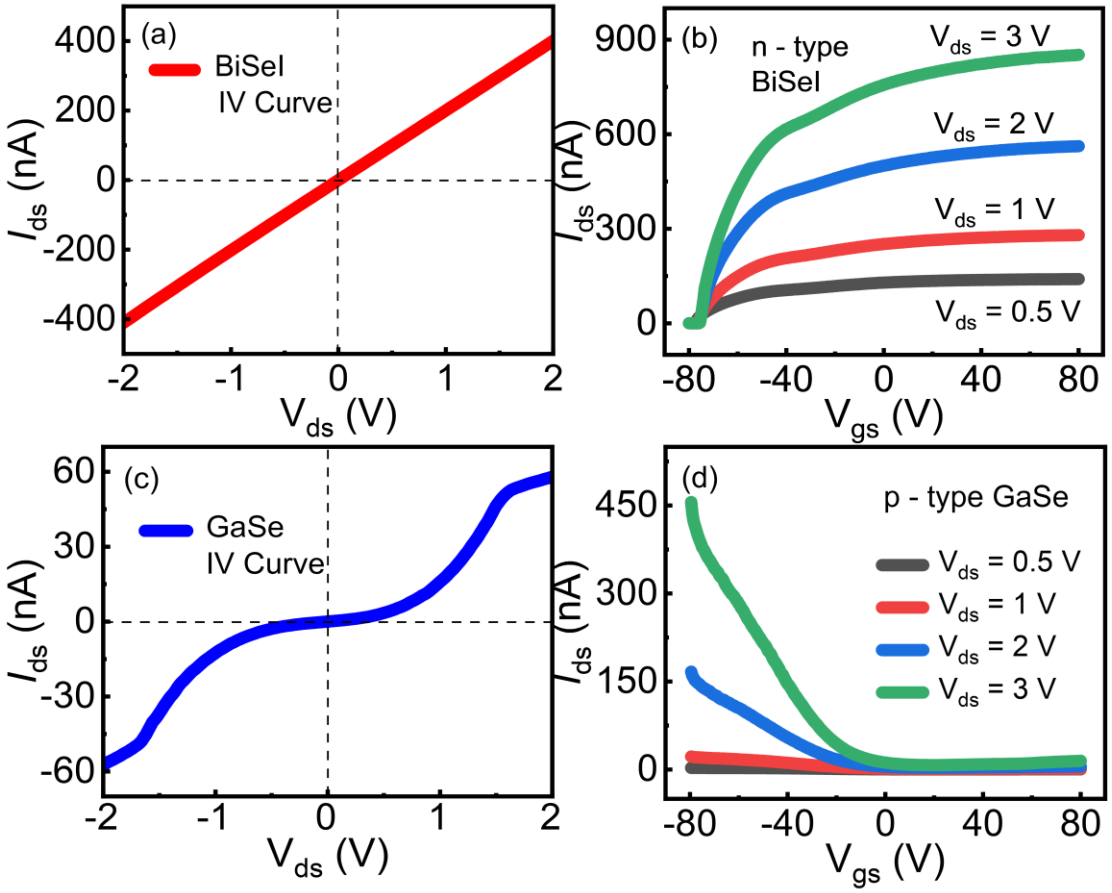

Figure S2. The output and transfer characteristic of individual GaSe and BiSeI. (a, c) The output characteristic of individual GaSe and BiSeI. (b, d) The transfer characteristic of the GaSe and BiSeI single crystals.

S3. Thickness measurements of the three devices.

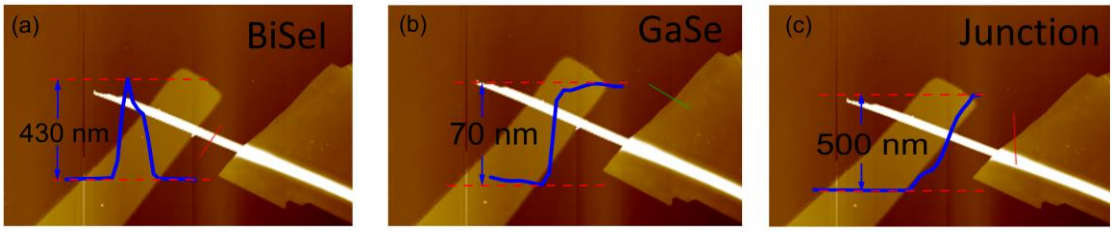

Figure S3. Atomic Force Microscope (AFM)-based thickness measurements of the three devices. The thickness of (a) BiSeI, (b) GaSe and (c) BiSeI/GaSe heterojunction in the present study is 430 nm, 70 nm and 500 nm, respectively.

S4. Optoelectronic testing of BiSeI/GaSe heterojunction.

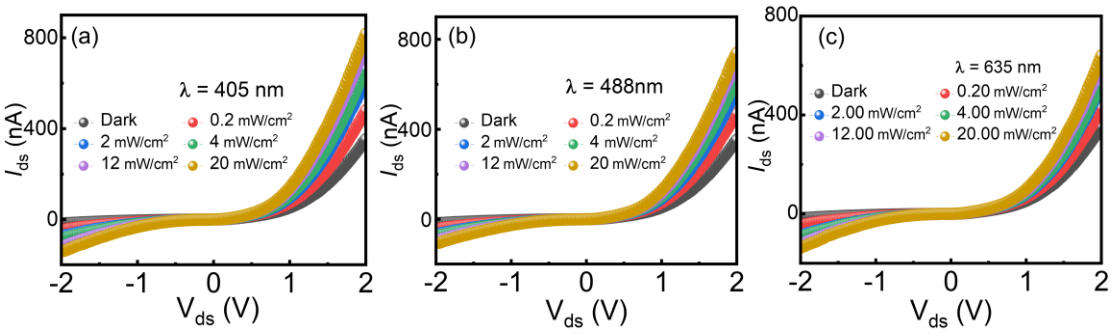

Figure S4. Optoelectronic testing of BiSeI/GaSe heterojunction. The $I-V$ curves under (a) 405 nm, (b) 488nm and (c) 635 nm laser illumination at V_{ds} = ±2 V with the power density from 0.2 to 20 mW/cm^2.

S5. The energy band diagrams for GaSe/BiSeI heterojunction.

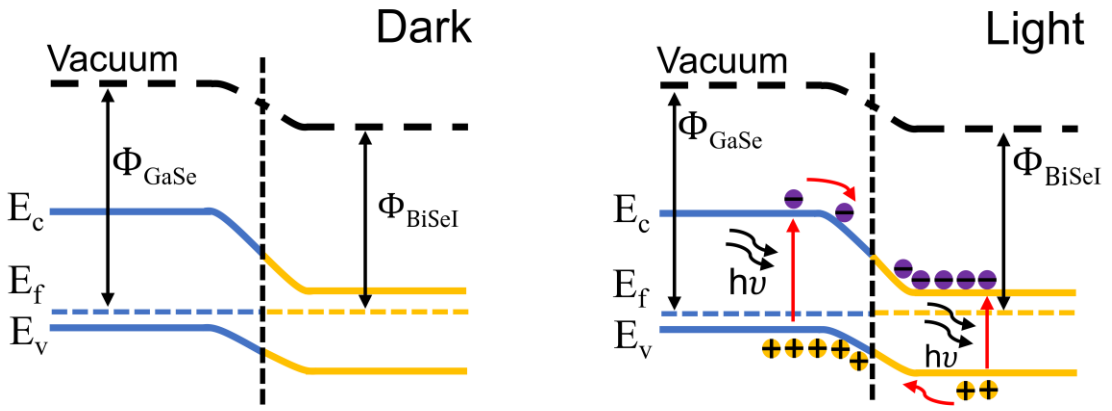

Figure S5. The energy band diagrams for GaSe/BiSeI heterojunction. (a, b) The energy band diagrams for GaSe/BiSeI heterojunction in the dark and light, respectively. Here Φ, E_f, E_c and E_v are the work function, Fermi levels, the energy position of conduction band and valence band, respectively.