Supporting Information

Spread of in-plane Anisotropy in CsPbBr₃/ReS₂ heterostructures by Proximity Effect

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- Supporting Figures S1 to S10
- Note 1



Figure S1. Schematic of two-step method to grow CsPbBr3/ReS2 heterostructure and the

classical optical images of bare ReS2 flake and heterostructures.



Figure S2. Optical images of CsPbBr₃/ReS₂ heterostructures. The scale bars are 20 µm.



Figure S3. SEM image of CsPbBr₃/ReS₂ heterostructures.



Figure S4. EDS elemental mappings of CsPbBr₃/ReS₂ heterostructures.



Figure S5. EBSD inverse pole figure (IPF) map of CsPbBr₃ flake at the heterojunction area.



Figure S6. (a) The optical image shows the oriented growth of heterostructures. (b) The

statics of CPB's rotation angle relative to the dashed line in the (a).

Note S1. Estimation of depletion width of CPB/ReS₂ heterostructure by solving the Poisson's equation

Based on the assumption of uniform dopant concentration in the depletion region. By solving Poisson's equation, we can get the depletion width $W=x_p+x_n$, $x_p=\sqrt{\frac{2\epsilon_1\epsilon_2N_2V_{bi}}{qN_1(\epsilon_1N_1+\epsilon_2N_2)}}$, $x_n=\sqrt{\frac{2\epsilon_1\epsilon_2N_1V_{bi}}{qN_2(\epsilon_1N_1+\epsilon_2N_2)}}$,¹ where the doped carrier density in CsPbBr₃ (N₁) and ReS₂(N₂) have been reported in the order of 10¹⁵ (or 10¹⁶) cm⁻³ and 10¹⁹ cm⁻³, respectively.^{2–5} The relative dielectric constant of CPB and ReS₂ have been reported for ~30 and ~2.2 respectively.^{6,7} And the built-in potential V_{bi} is taken to be 0.1eV. For N₁ = 10¹⁶ or 10¹⁵, we get the estimation of depletion width about (x_p = 181 nm, x_n = 0.18 nm) or (x_p = 576 nm, x_n = 0.06) respectively, indicating the total charge depletion of the CPB.



Figure S7. Normalized time-resolved PL decay spectra of bare CsPbBr3, ReS2 and CPB/ReS2

heterojunction.



Figure S8. (a) Optical image of CsPbBr₃/ReS₂ heterostructure and the insert image shows the thickness of the CsPbBr₃. (b) PL spectrum of CPB at the heterojunction excited with 532 nm laser. (c) Raman spectrum of the bare ReS₂. (d) Polar plot of the angle-resolved Raman intensity of 213 cm⁻¹ which belongs to the A_g mode of ReS₂ in figure (a). (f) Polar plot of the angle-resolved PL intensity of the heterojunction in figure (e).



Figure S9. ReS₂ as an optical filter. (a) The schematic of a configuration (upper) and optical image (lower) of ReS₂/CPB/SiO₂-Si heterostructure fabricated by transferring mechanically exfoliated ReS₂ on CPB synthesized by hot-plate method; (b) Polar plot of angle-resolved PL intensity of ~ 523 nm peak, which shows a roughly isotropic round shape.



Figure S10. Interference Effect. (a) Optical image of CPB/ReS₂ heterostructures. (b) and (c) are AFM images for CPB nanoflakes denoted as A, B and C in (a). (d) Polar plot for Angle-resolved Raman intensity of ReS₂ to determine b-axis. (e-f) Polar plot of the angle-resolved

PL intensity of CPB nanoflakes A, B and C, respectively.

References

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