

Electronic Supplementary Information (ESI)

Highly Sensitive UV Photodetector Based on Solution-processed Bismuth Oxyiodide Epitaxial Thin Films

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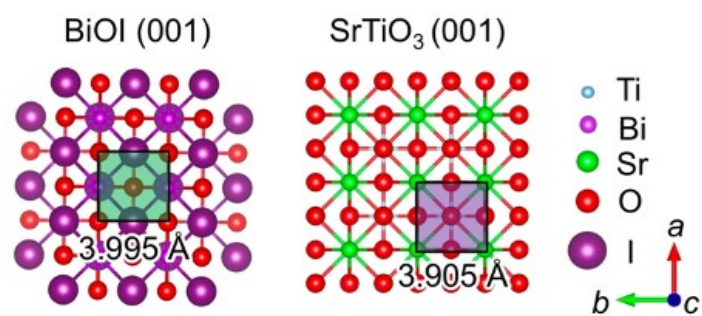


Figure S1. Crystal structures of STO (001) plane and BiOI (001) plane drawn by VESTA.

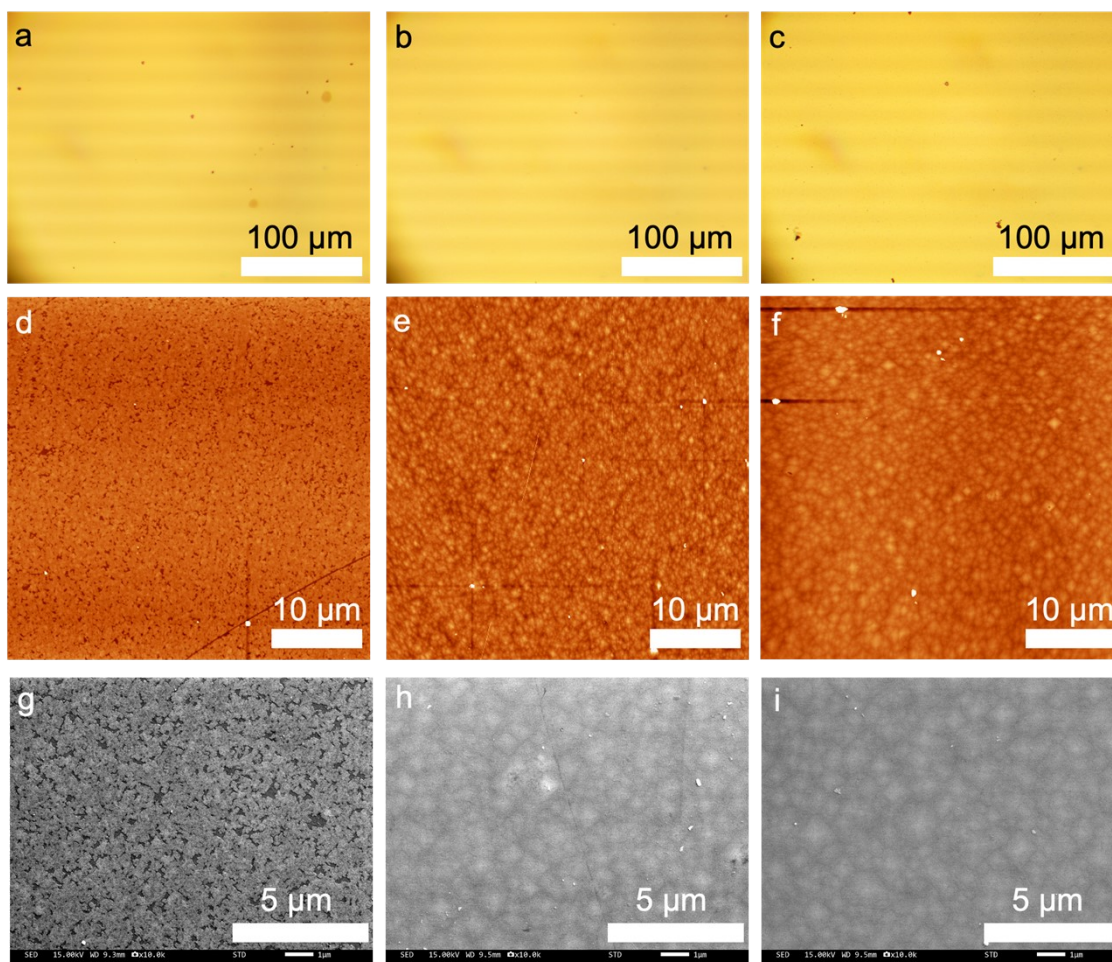


Figure S2. a)-c) Wide-scale optical images, d)-f) AFM images, and g)-i) local-scale SEM images of BiOI thin films synthesized with various time: (a, d, g) 5 min, (b, e, h) 10 min, and (c, f, i) 15 min.

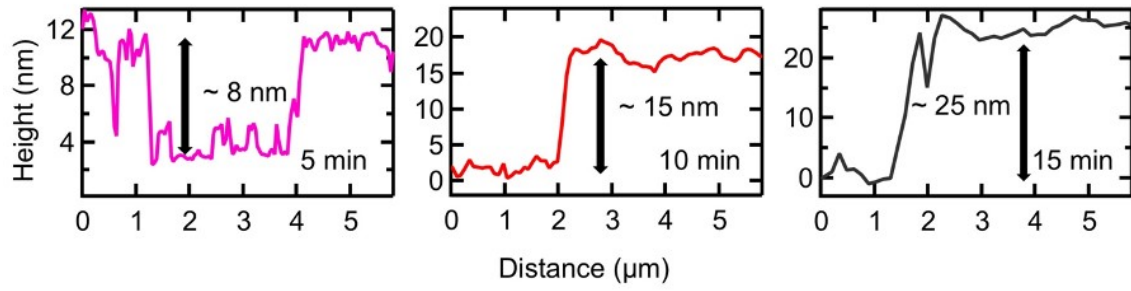


Figure S3. Height profiles for BiOI thin films synthesized with various time.

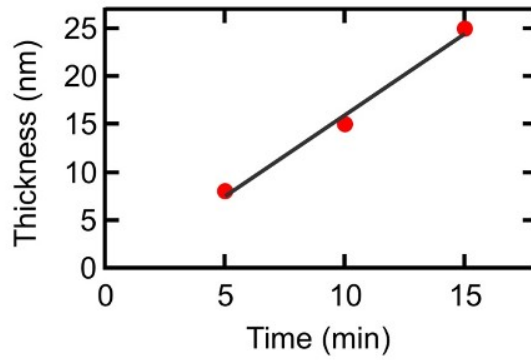


Figure S4. Thickness of BiOI epitaxial thin films as a function of deposition time.

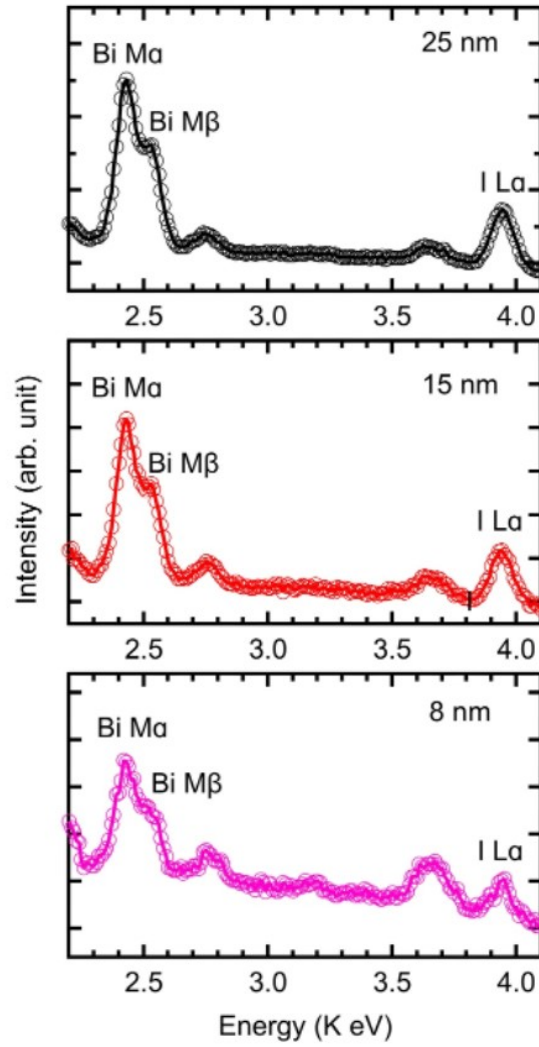


Figure S5. Energy dispersive X-ray spectra for BiOI epitaxial thin films with different thickness.

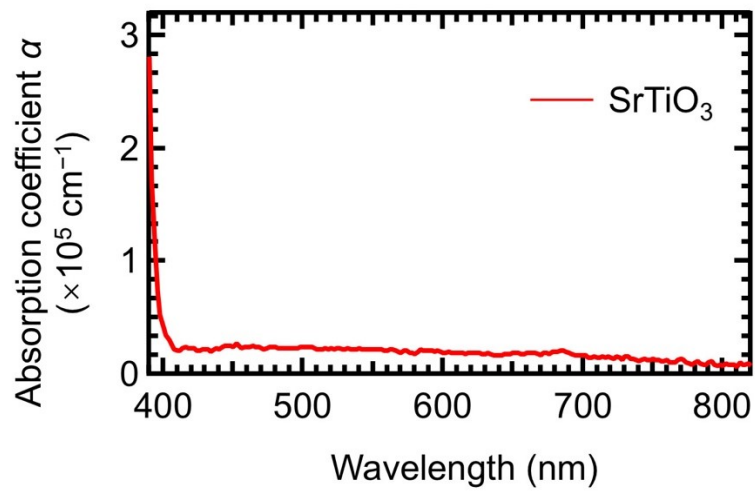


Figure S6. Absorption spectrum of STO substrate.

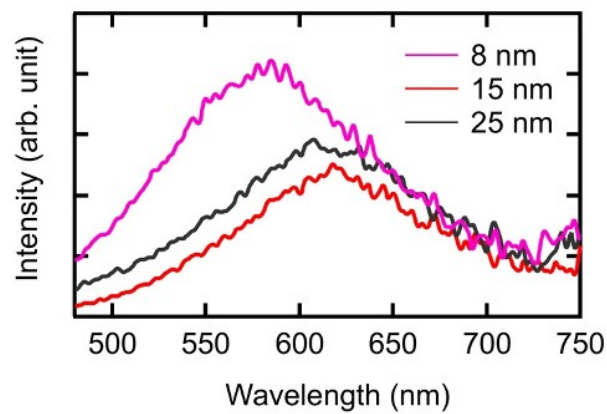


Figure S7. Steady-state PL spectra of BiOI epitaxial thin films under the excitation wavelength of 450 nm.

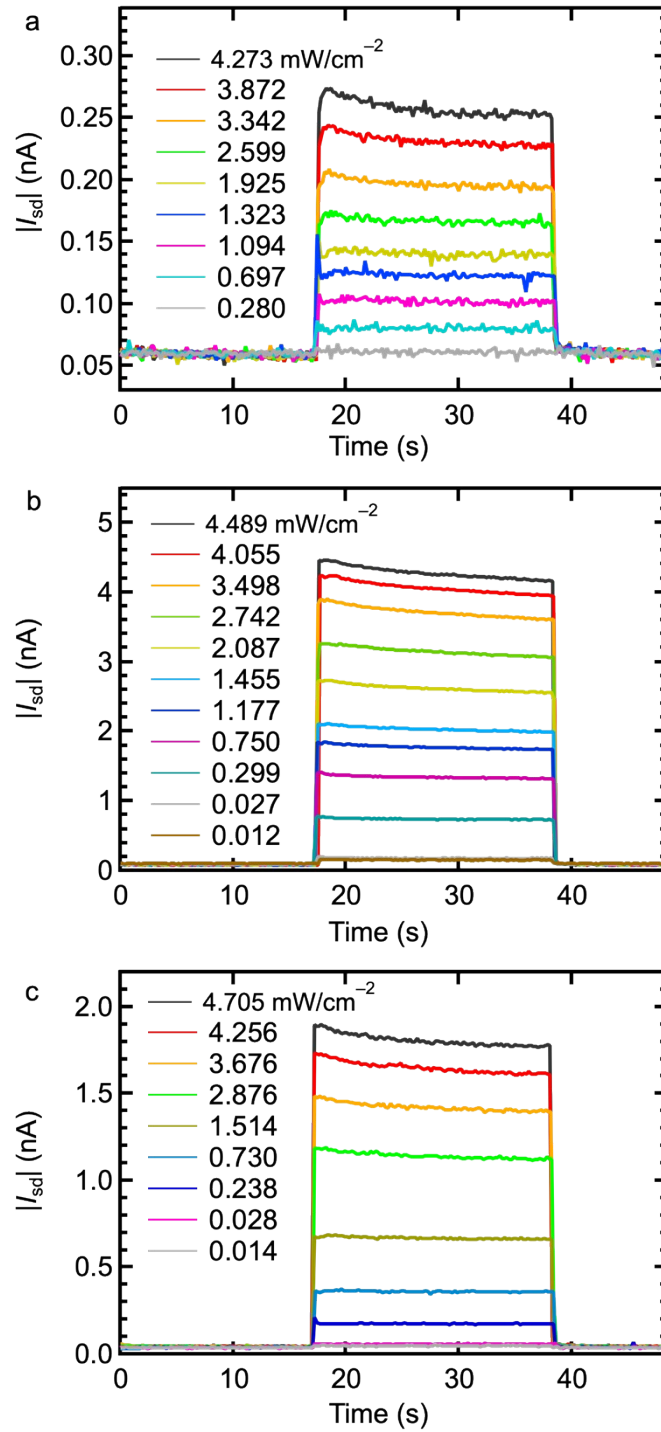


Figure S8. Time-resolved photoresponse of BiOI photodetectors with thickness of a) 8 nm b) 15 nm and c) 25 nm to on-off illumination of 405 nm light with various power density at $V_{ds} = -10$ V.

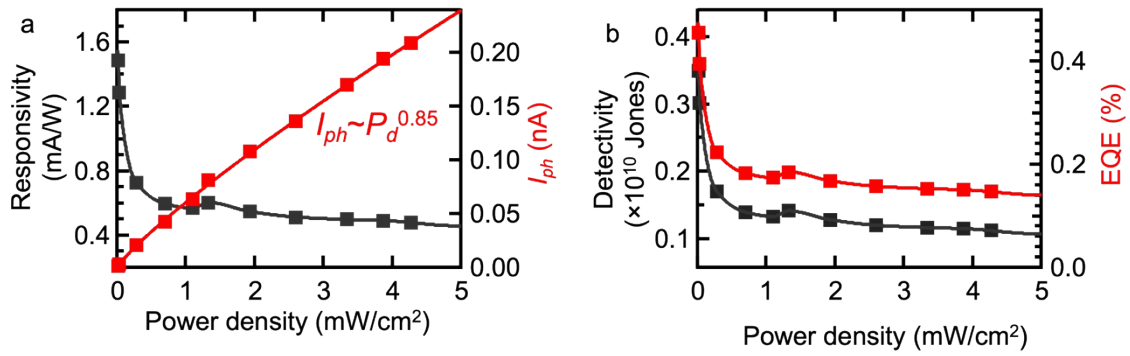


Figure S9. Optoelectrical properties of 8 nm BiOI photodetector under the illumination with various power density. a) I_{ph} , R . b) D^* and EQE as the function of light power density. The dots and lines denote the experimental and fitting results, respectively.

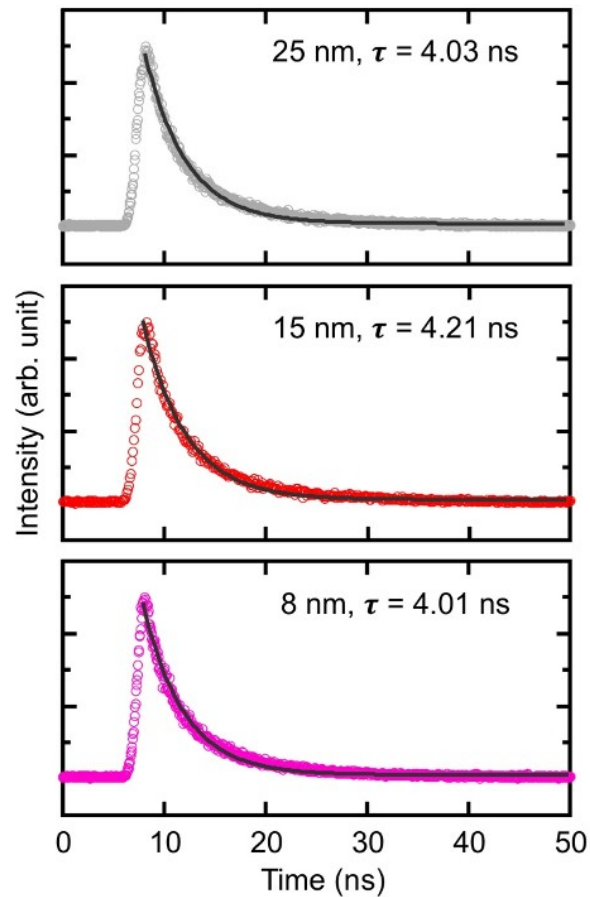


Figure S10. Time-resolved PL spectra monitored at 550 nm excited by 450 nm solid laser for BiOI epitaxial thin films with various thickness.

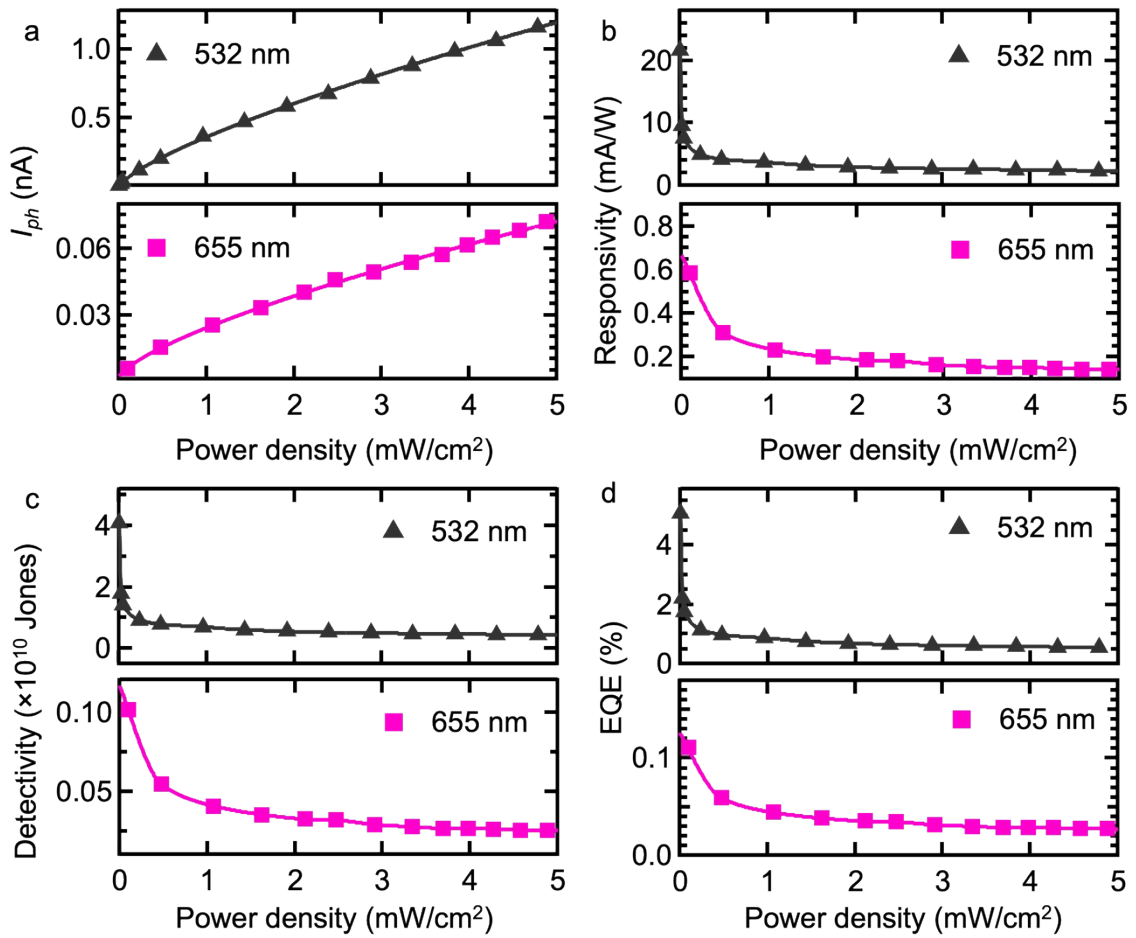


Figure S11. Optoelectrical properties of 15 nm BiOI photodetector under the illumination with various wavelength and power density. a)-d) I_{ph} , R , D^* and EQE as the function of light power density. The dots and lines denote the experimental and fitting results, respectively.

Table S1. Photoelectric properties based on Epitaxial Growth BiOI films compare with other commercial and 2D materials.

Materials	Format & Size	Responsivity [mA W ⁻¹]	Detectivity [Jones]	EQE [%]	Spectral range	Ref
BiOI	Square Nanoplates (~ 120 μm)	26	8.2×10^{11}	6.9	473 nm	S1
BiOCl	Nanosheet-like film, centimeter scale	0.057	-	-	350 nm	S2
hBN	2D material	9.2	3.96×10^{10}	-	226 nm	S3
GaN	film	50	-	-	365 nm	S4
BiOBr	Square Nanoplates (~ 100 μm)	50	6.3×10^{10}	13	473 nm	S5
BiOI	Epitaxial thin films, centimeter scale	43.5	8.7×10^{10}	13	405 nm	This work

References

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- S5 P. Liu, L. Yin, L. Feng, Y. Sun, H. Sun, W. Xiong, C. Xia, Z. Wang and Z. Liu. *Sci. China Mater.* 2021, **64**, 189–197.