

Electronic Supplementary Information for

Extended linear detection range of $\text{Bi}_{0.5}\text{Na}_{0.5}\text{TiO}_3$ thin film based self-powered UV photodetector via current and voltage dual indicators

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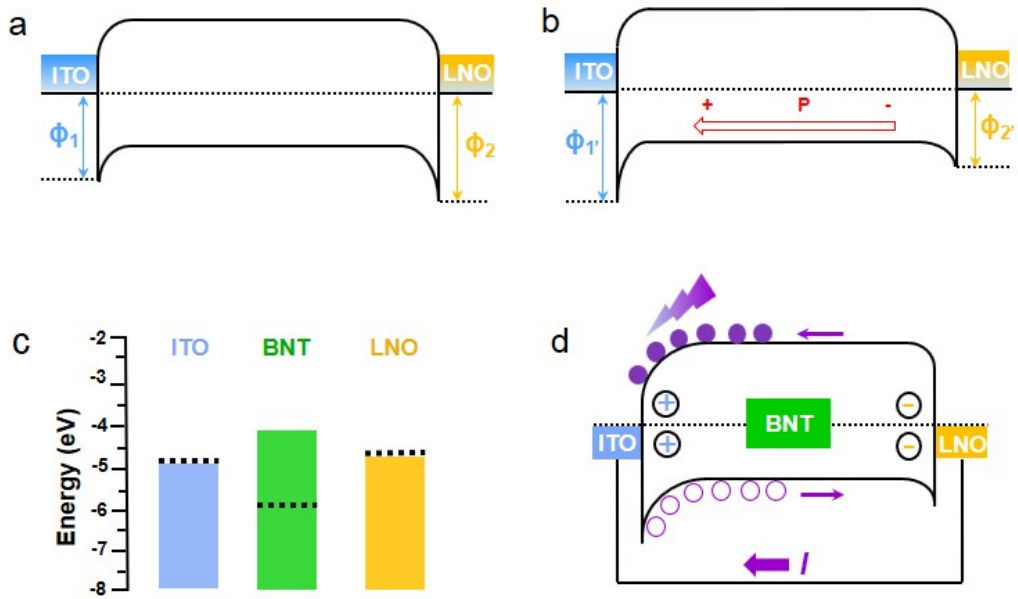


Fig. S1 Energy band diagrams of the device and the corresponding physical mechanism. (a) Energy-band diagram of ITO/BNT/LNO thin film without spontaneous polarization. (b) Energy-band diagram of ITO/BNT/LNO thin film in the presence of spontaneous polarization. (c) Energy-level diagram of ITO, BNT and LNO. (d) Physical mechanism of the ITO/BNT/LNO/glass UV photodetector.

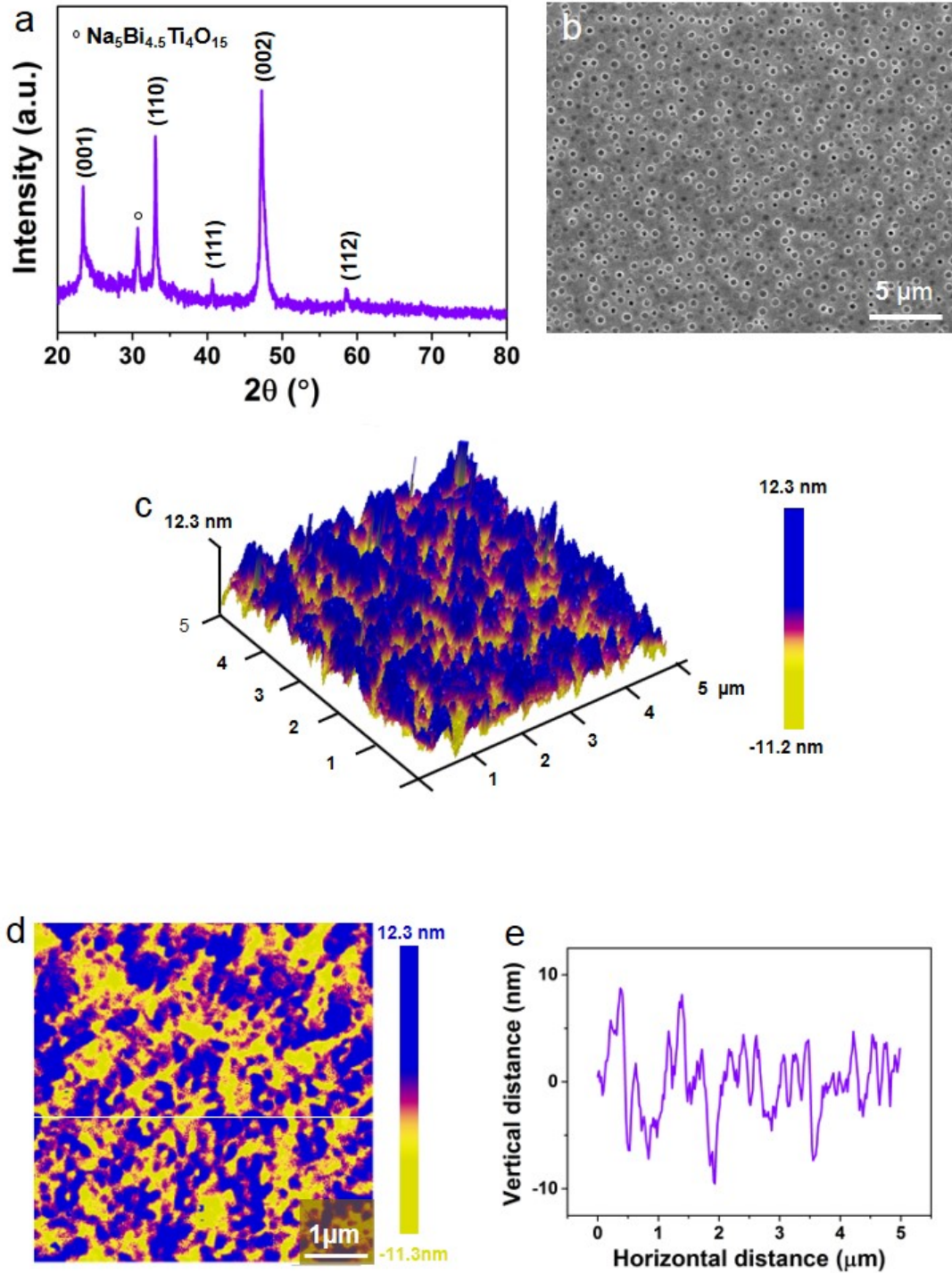


Fig. S2 Characterization of the device. (a) XRD image of the BNT thin film. (b) SEM image of the BNT thin film. (c) 3D AFM image of the BNT thin film. (d) AFM topographic image of the BNT thin film. (e) The cross-sectional height trace of the BNT thin film corresponding the white line on topographic image.

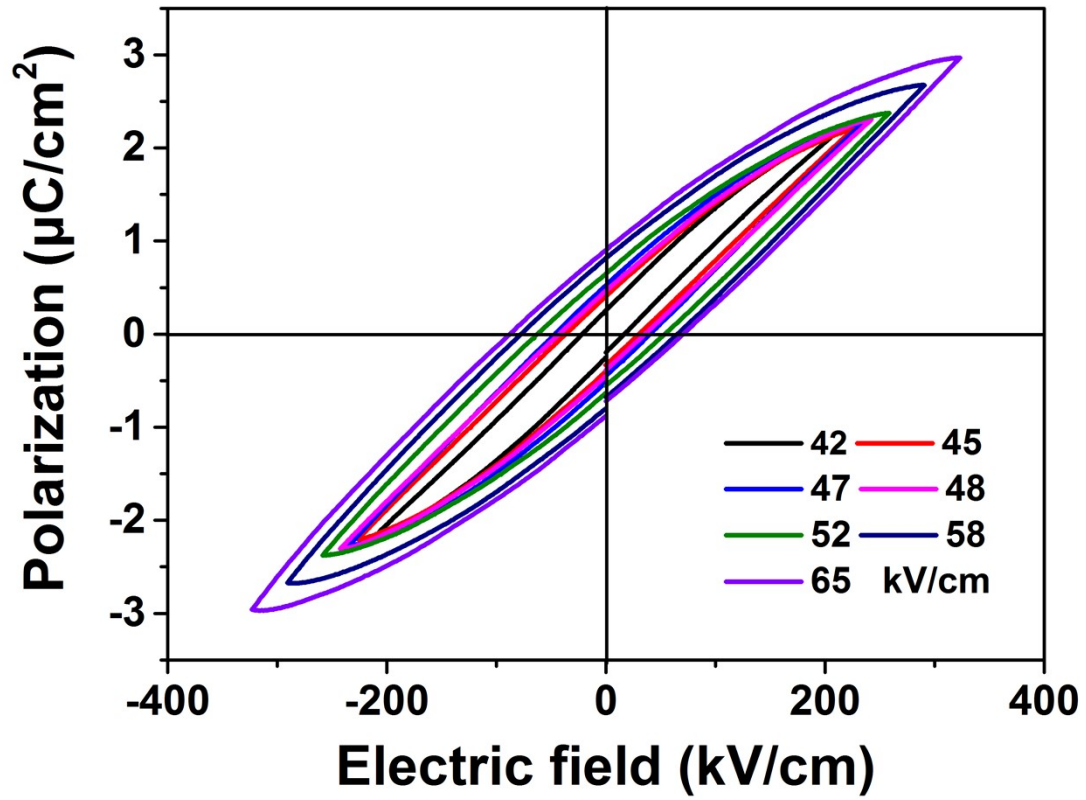


Fig. S3 The P-E loop of the $\text{Bi}_{0.5}\text{Na}_{0.5}\text{TiO}_3$ thin film at different electric field strength.

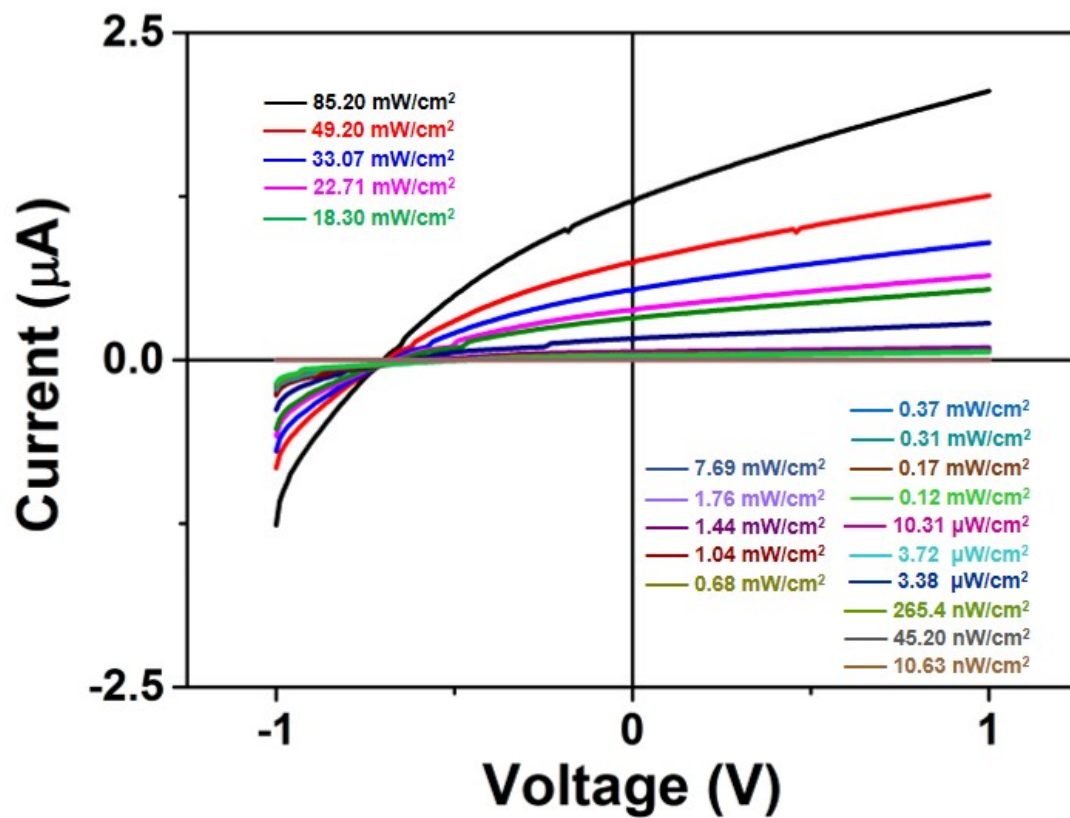


Fig. S4 I-V curves at different light intensities of 365 nm UV light.

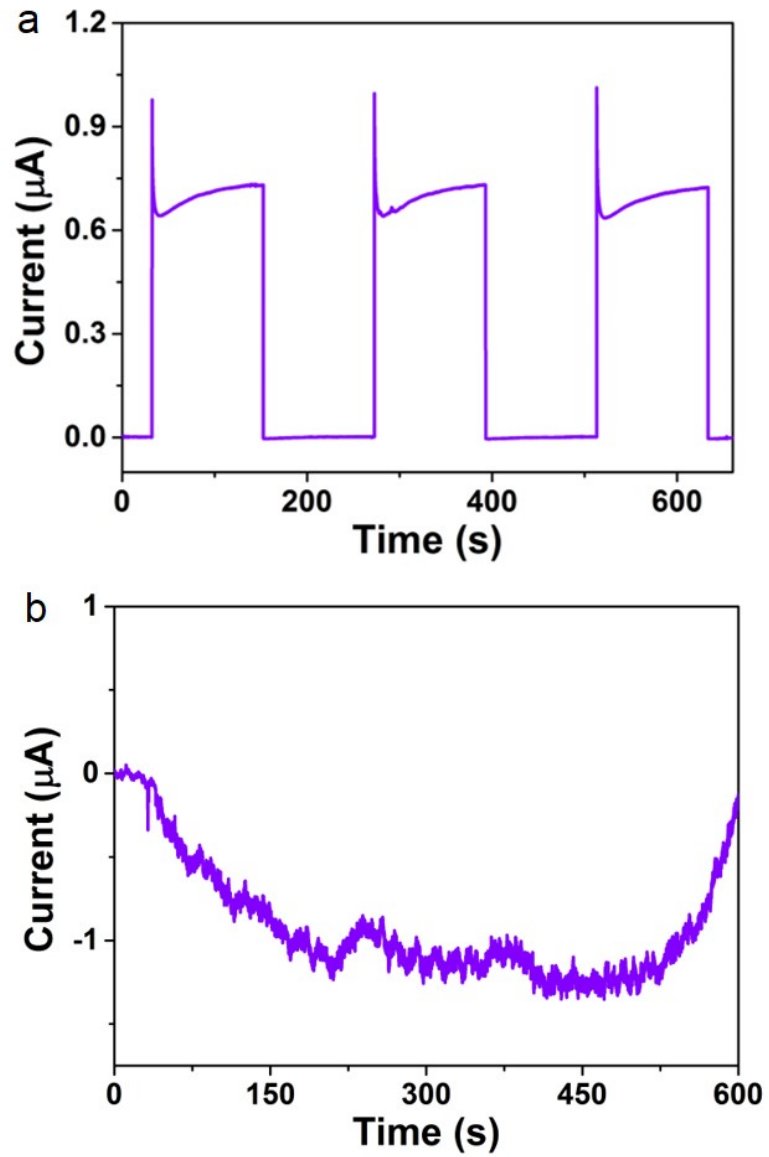


Fig. S5 I-t curves of BNT thin film and LNO thin film. (a) I-t curve of the BNT film. (b) I-t curve of the LNO film.

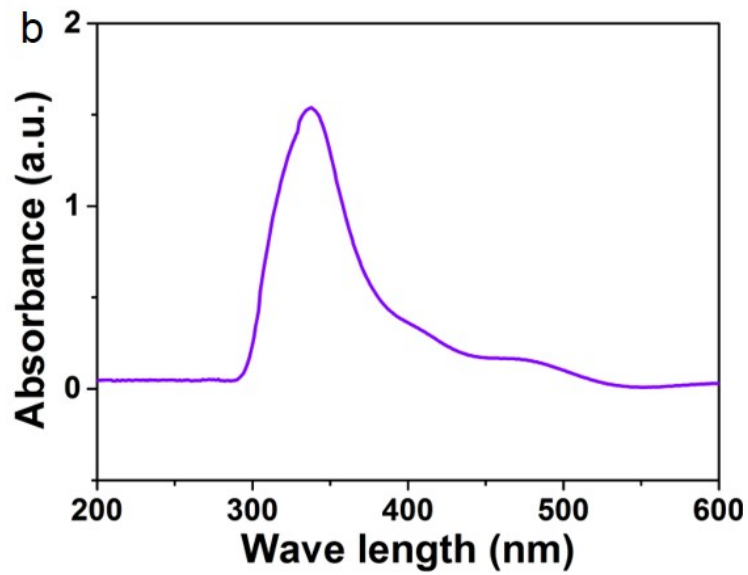
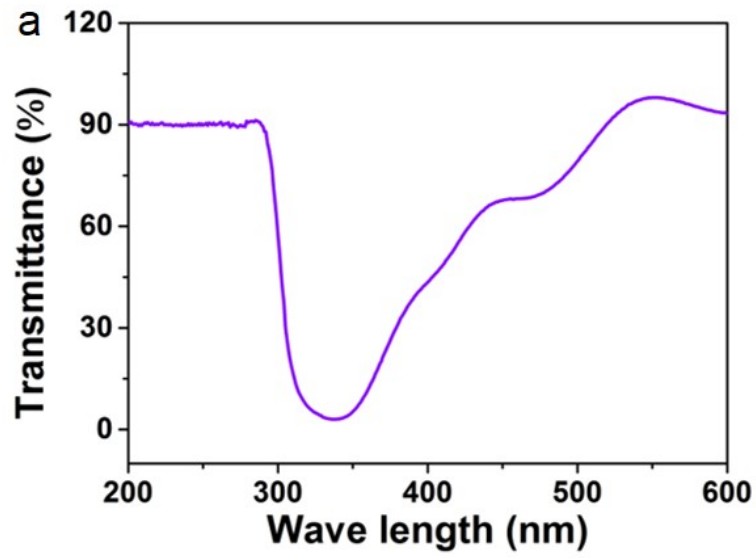


Fig. S6 Absorption spectrum and transmittance of BNT thin film. (a) Transmittance of BNT film in the range of 200-600 nm. (b) Absorption spectrum of BNT film in the range of 200-600 nm.

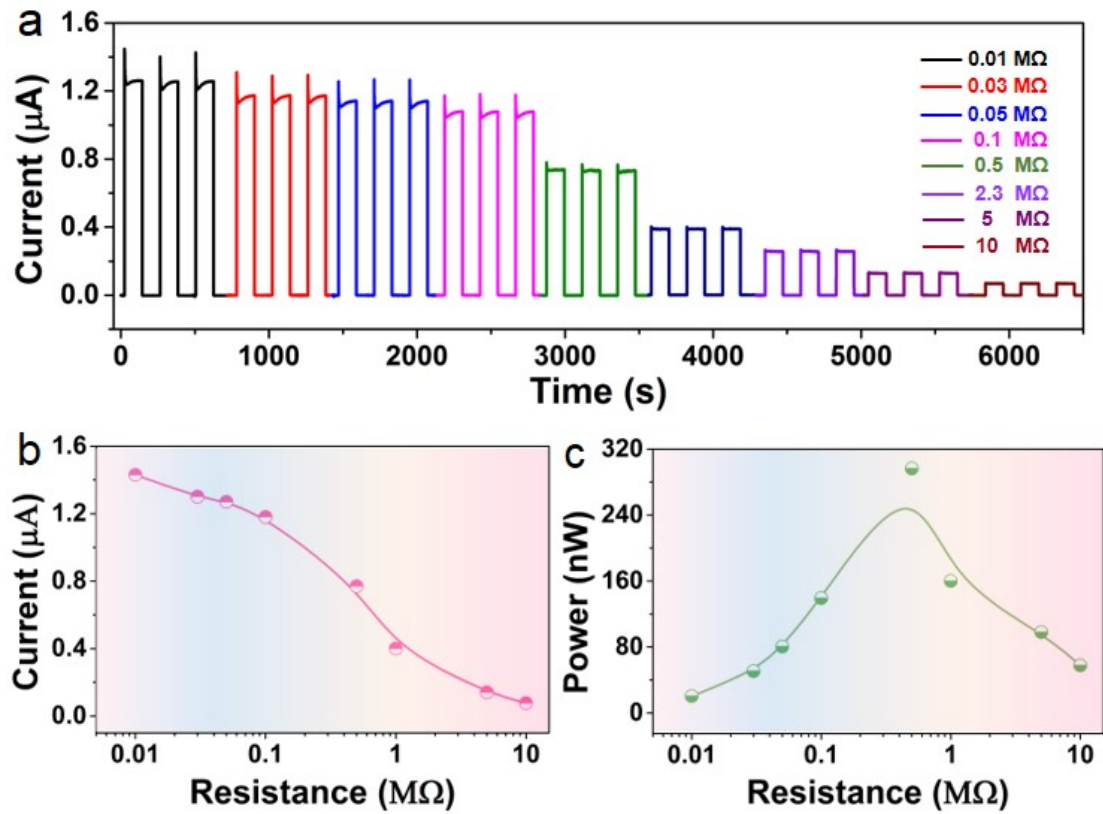


Fig. S7 I-t curve and output power of the device in series with different external resistors. (a) Series-resistance-dependent I-t characteristic curve of the BNT self-powered UV photodetector under 365 nm UV light. (b) Dependence of the output current of the BNT self-powered UV photodetector on the external load resistance. (c) Dependence of the output power of the BNT self-powered UV photodetector on the external load resistance.

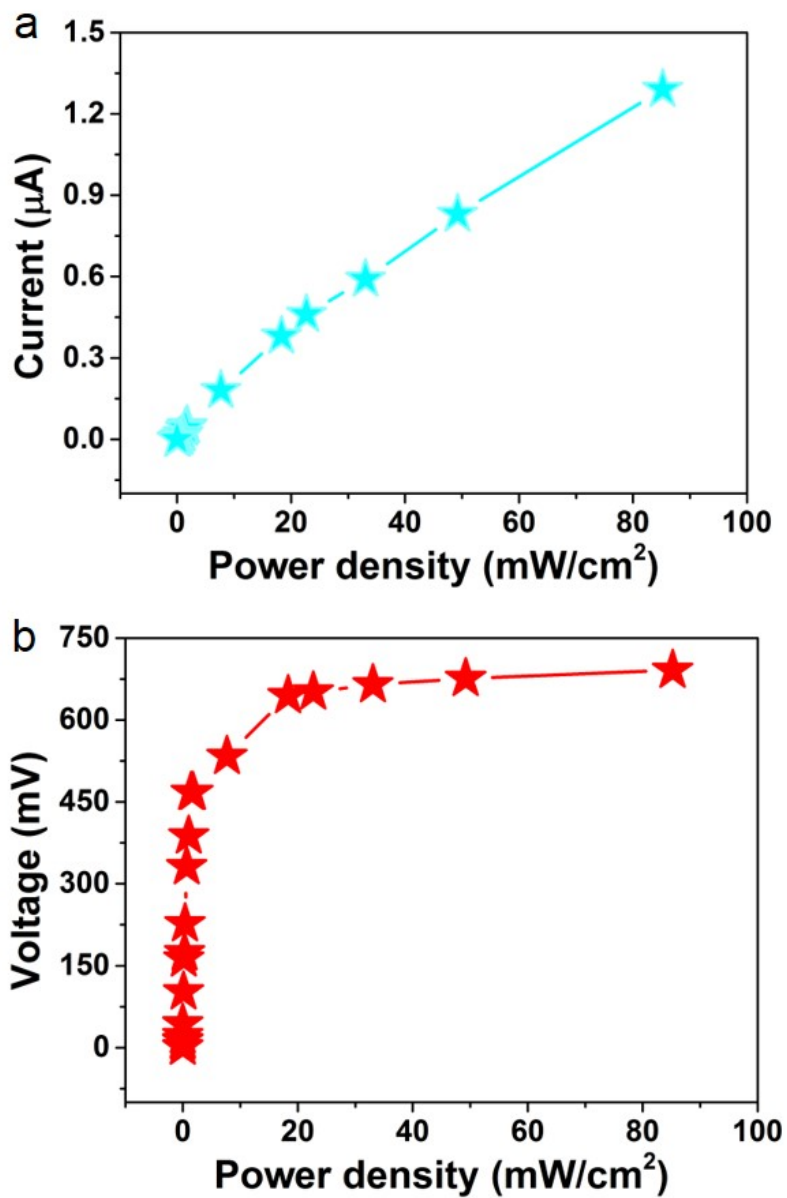


Fig. S8 Variation curve of short-circuit current and open-circuit voltage of the device with the different light intensities of 365 nm UV light. (a) Variation curve of short-circuit current with light intensity. (b) Variation curve of open circuit voltage with light intensity.

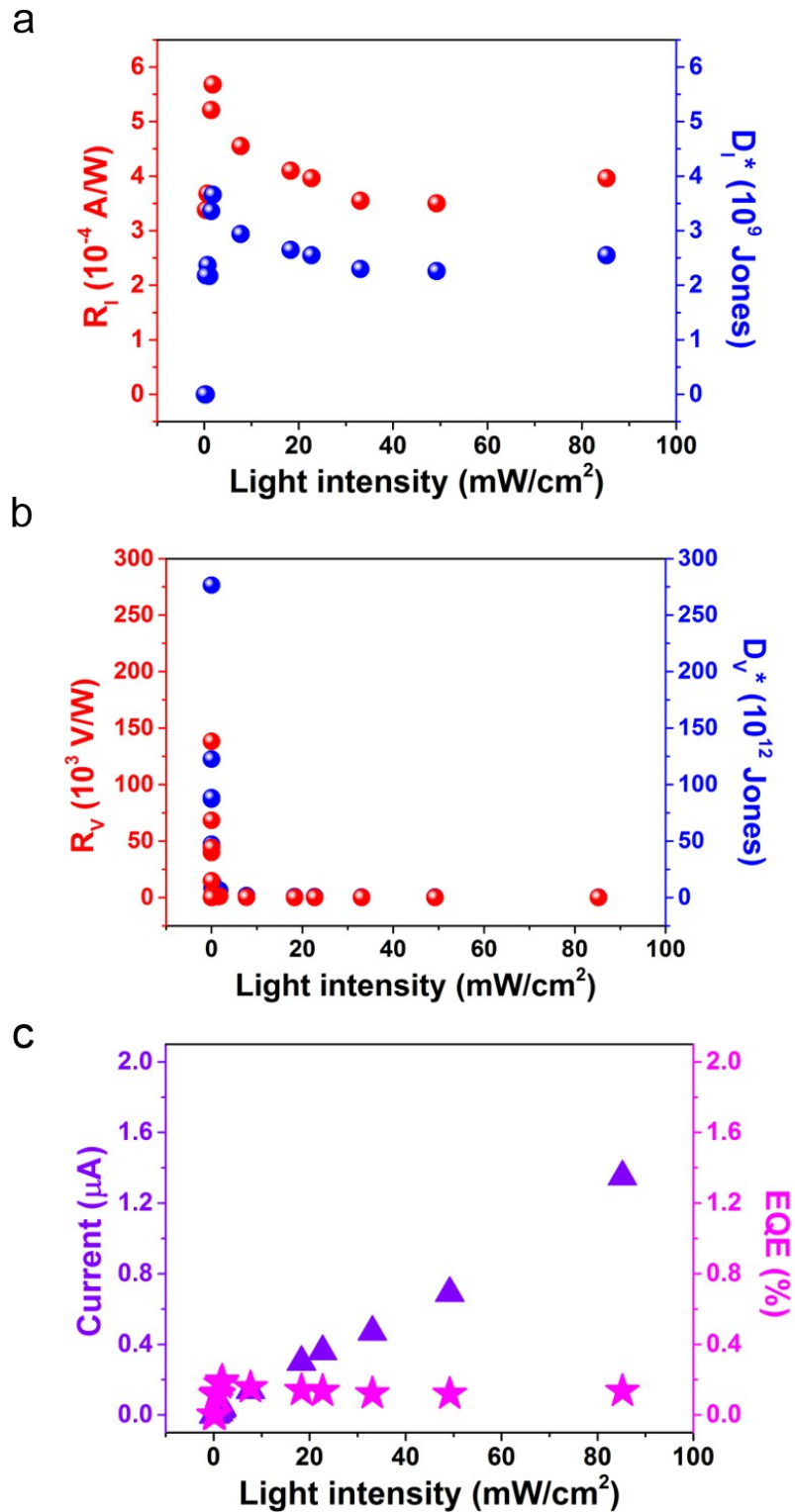


Fig. S9 Responsiveness, specific detectivity and external quantum efficiency of the device under different light intensities at 365 nm. (a) Variation of current responsivity (R_I) and specific detectivity (D_I) of BNT UV photodetector with light intensity. (b) Variation of voltage responsivity (R_V) and specific detectivity (D_V) of the photodetector with light intensity. (c) Variation of photocurrent and external quantum efficiency of the photodetector with light intensity.

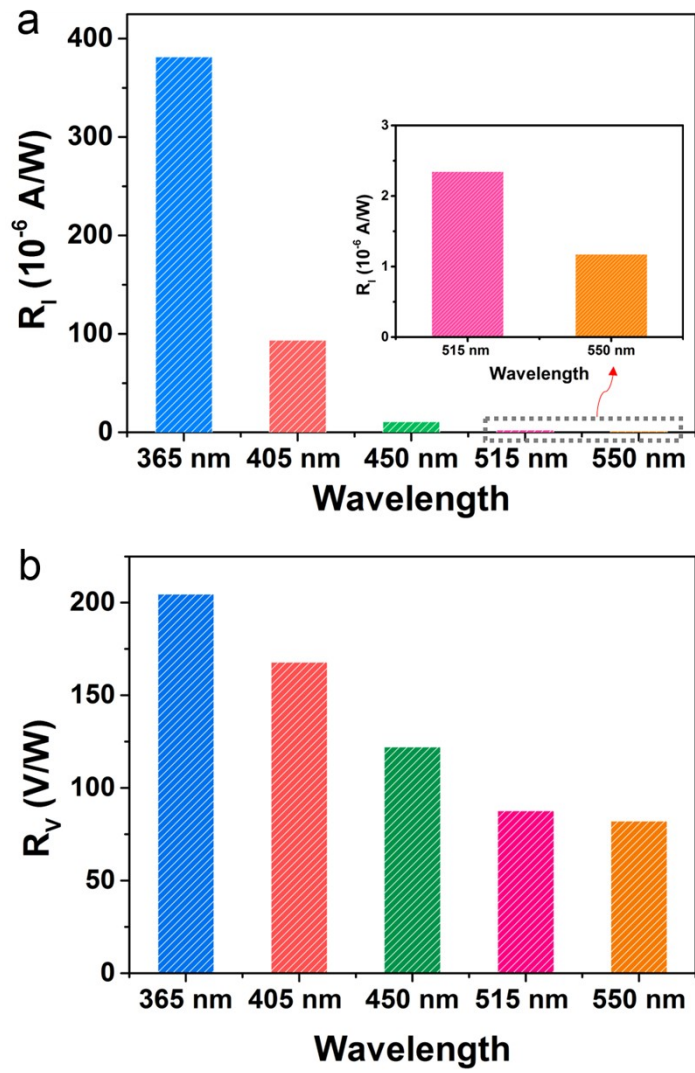


Fig. S10 Responsiveness of the device under different wavelengths. (a) Current responsivity at different wavelengths. (b) Voltage responsivity at different wavelengths.

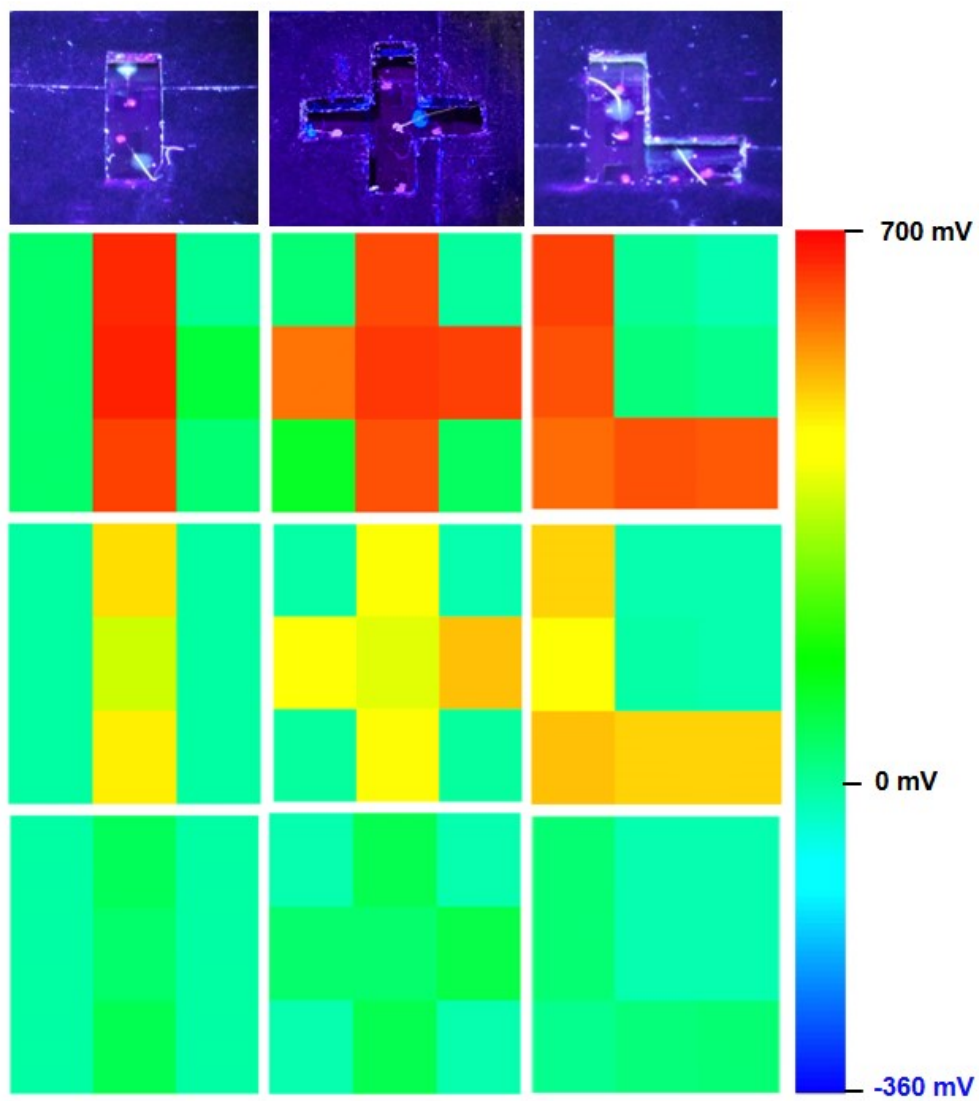


Fig. S11 "1", "+", and "L" shaped pixels of the BNT thin film under 365 nm UV light with light intensity of 85.20 mW/cm², 1.4 mW/cm², and 0.12 mW/cm², respectively.

85.2 mW/cm²

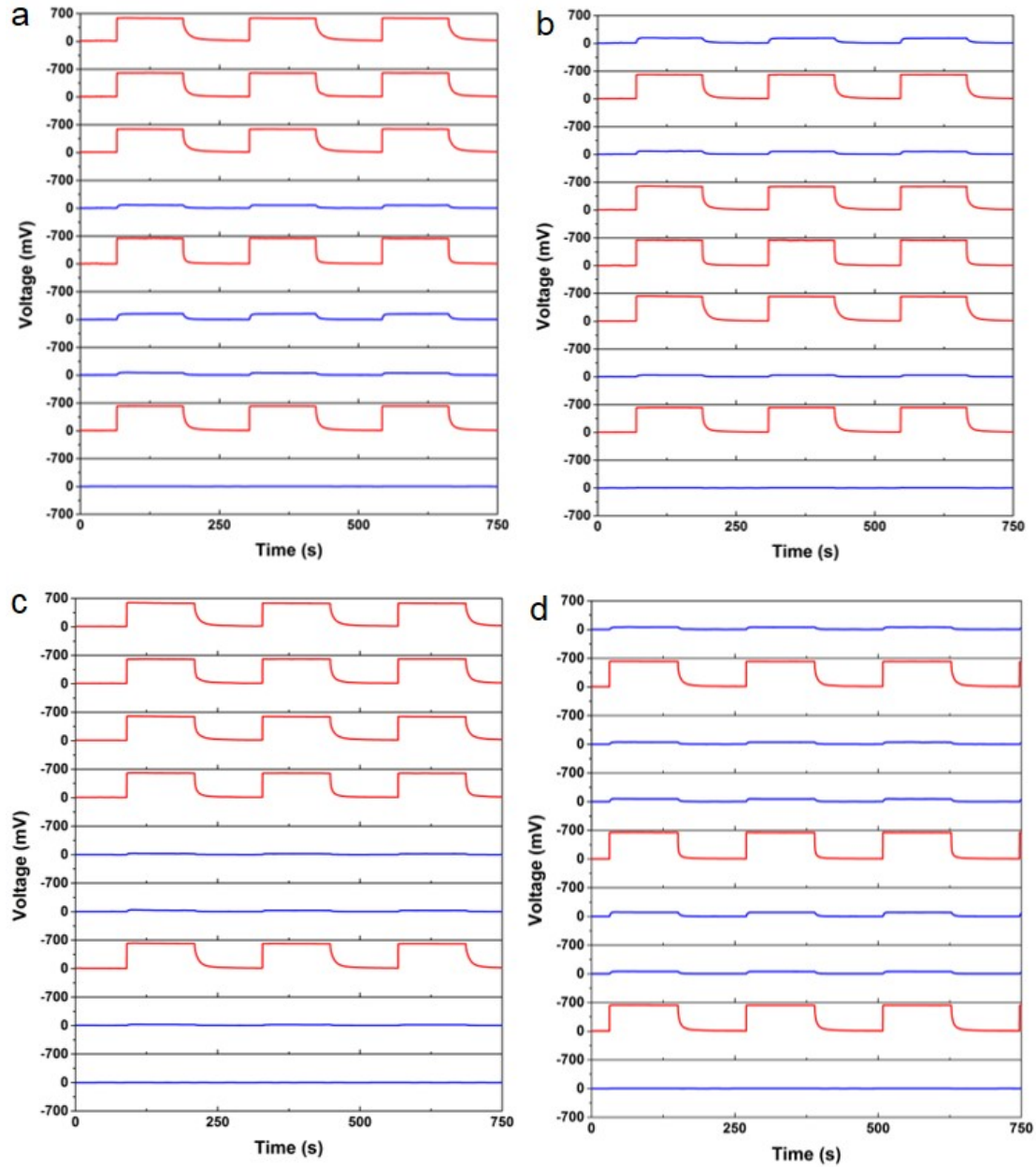


Fig. S12 Data plots of different shaped pixels of the device under 365 nm UV light intensity of 85.2 mW/cm². (a) V-t curve of "T" shaped pixel under 365 nm UV light with light intensity of 85.2 mW/cm². (b) V-t curve of "+" shaped pixel under 365 nm UV light with light intensity of 85.2 mW/cm². (c) V-t curve of "L" shaped pixel under 365 nm UV light with light intensity of 85.2 mW/cm². (d) V-t curve of "1" shaped pixel under 365 nm UV light with light intensity of 85.2 mW/cm².

1.44 mW/cm²

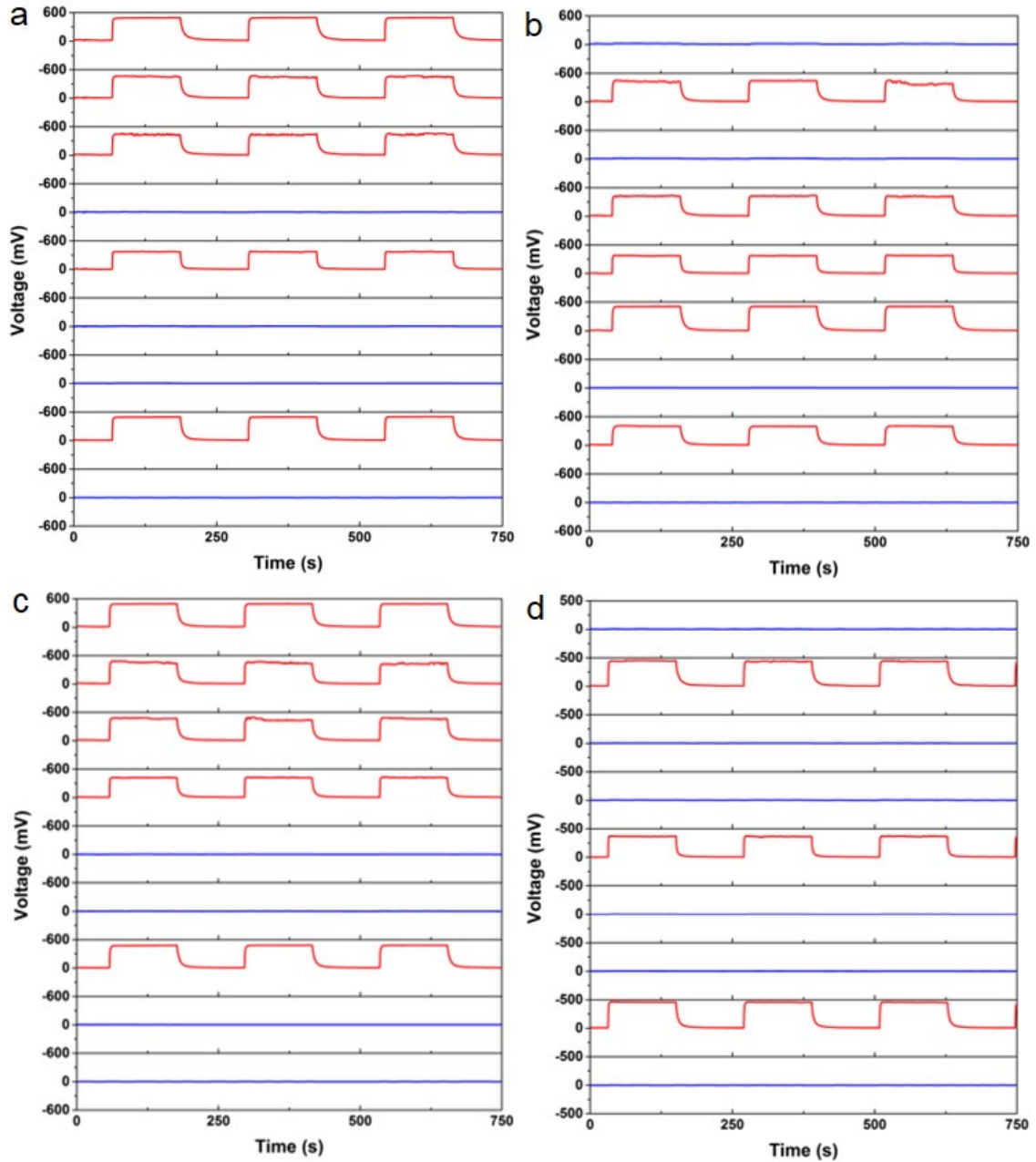


Fig. S13 Data plots of different shaped pixels of the device under 365 nm UV light intensity of 1.44 mW/cm². (a) V-t curve of "T" shaped pixel under 365 nm UV light with light intensity of 1.44 mW/cm². (b) V-t curve of "+" shaped pixel under 365 nm UV light with light intensity of 1.44 mW/cm². (c) V-t curve of "L" shaped pixel under 365 nm UV light with light intensity of 1.44 mW/cm². (d) V-t curve of "1" shaped pixel under 365 nm UV light with light intensity of 1.44 mW/cm².

0.12 mW/cm²

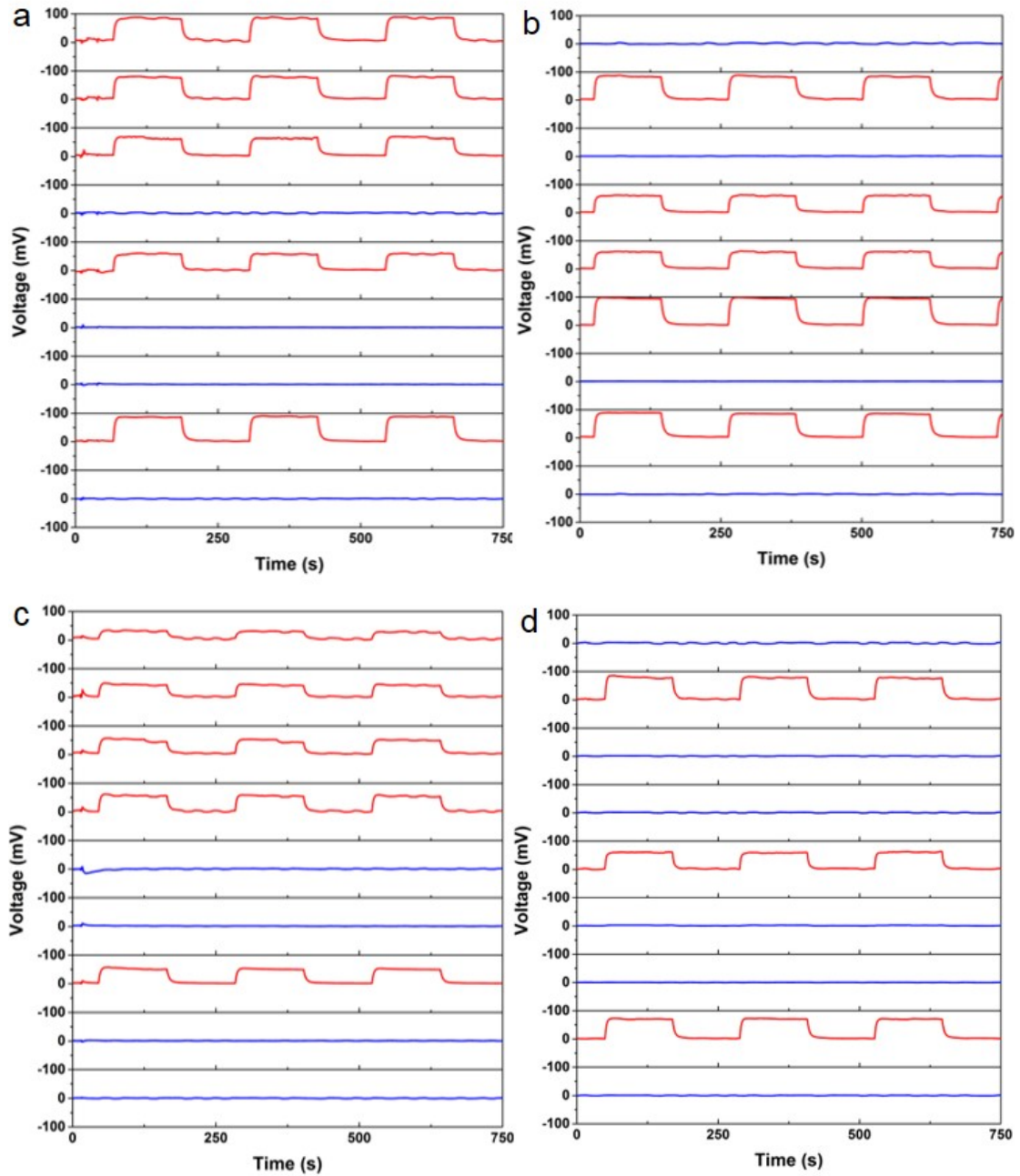


Fig. S14 Data plots of different shaped pixels of the device under 365 nm UV light intensity of 85.2 mW/cm². (a) V-t curve of "T" shaped pixel under 365 nm UV light with light intensity of 0.12 mW/cm². (b) V-t curve of "+" shaped pixel under 365 nm UV light with light intensity of 0.12 mW/cm². (c) V-t curve of "L" shaped pixel under 365 nm UV light with light intensity of 0.12 mW/cm². (d) V-t curve of "1" shaped pixel under 365 nm UV light with light intensity of 0.12 mW/cm².

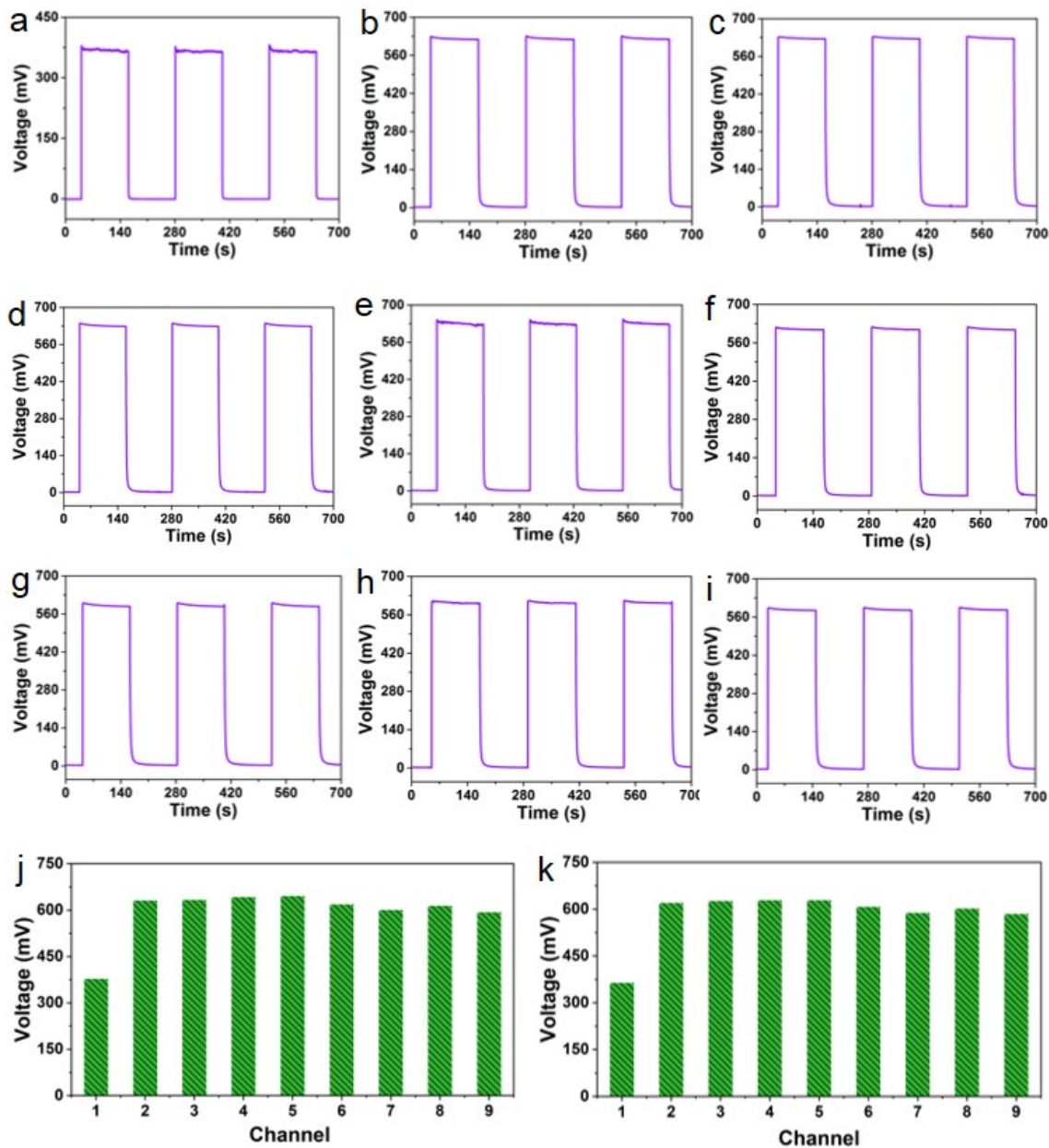


Fig. S15 V-t curves of nine channels and comparison of tip and plateau voltages at different channels. (a to i) V-t curves of nine channels of the ITO/BNT/LNO/glass self-powered photodetector device under 365 nm UV light. (j) Comparison of tip voltages of nine channels. (k) Comparison of platform voltages of nine channels.

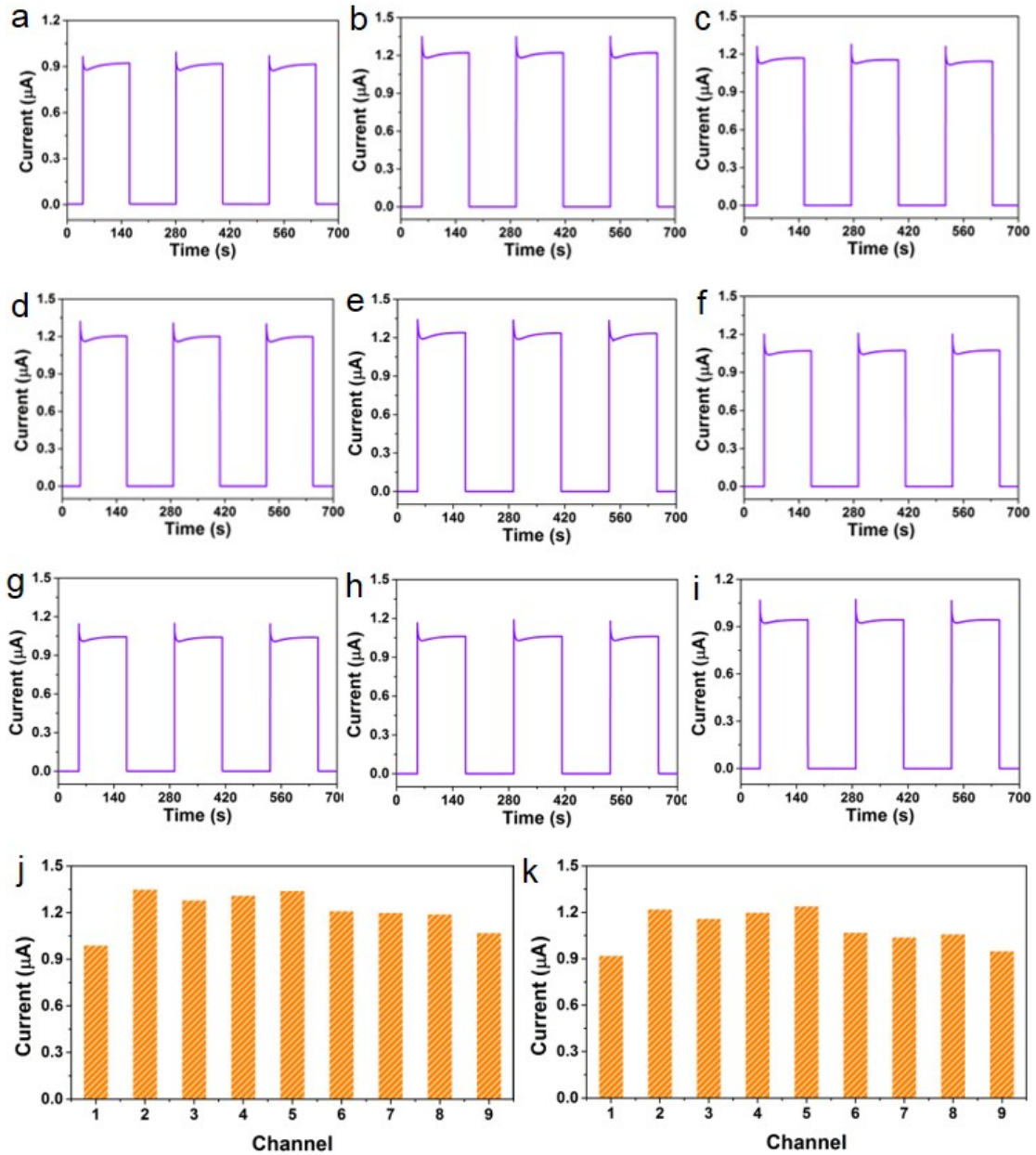


Fig. S16 I-t curves of nine channels and comparison of tip and plateau current at different channels. (a to i) I-t curves of nine channels of the ITO/BNT/LNO/glass self-powered photodetector device under 365 nm UV light. (j) Comparison of tip currents of nine channels. (k) Comparison of platform currents of nine channels.

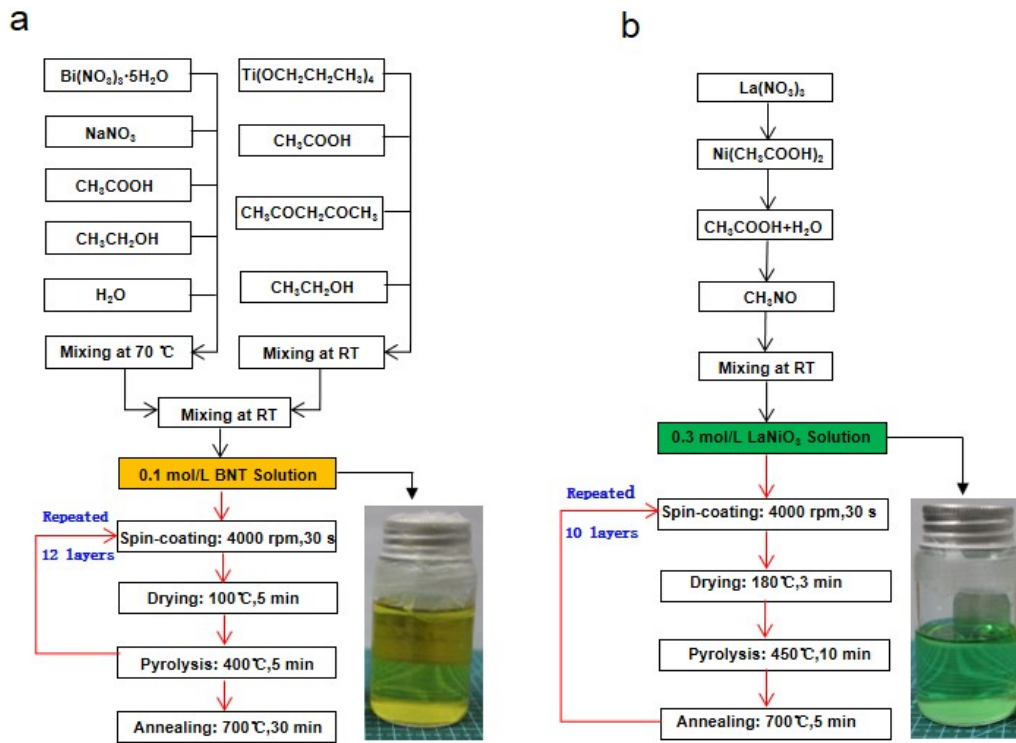


Fig. S17 The preparation process of BNT and LNO soliquid and the process of coating film. (a) The preparation process of the BNT sol and the growth process of the BNT thin film. (b) The preparation process of LNO sol and the growth process of the LNO thin film.