Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.
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Supporting Information

A Synergetic Enhancement Strategy of Light Utilization and Carrier Transfer for UV Photodetection Associated with the Artificial Resonance Nano-Cavities

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Supplementary Figures and Tables

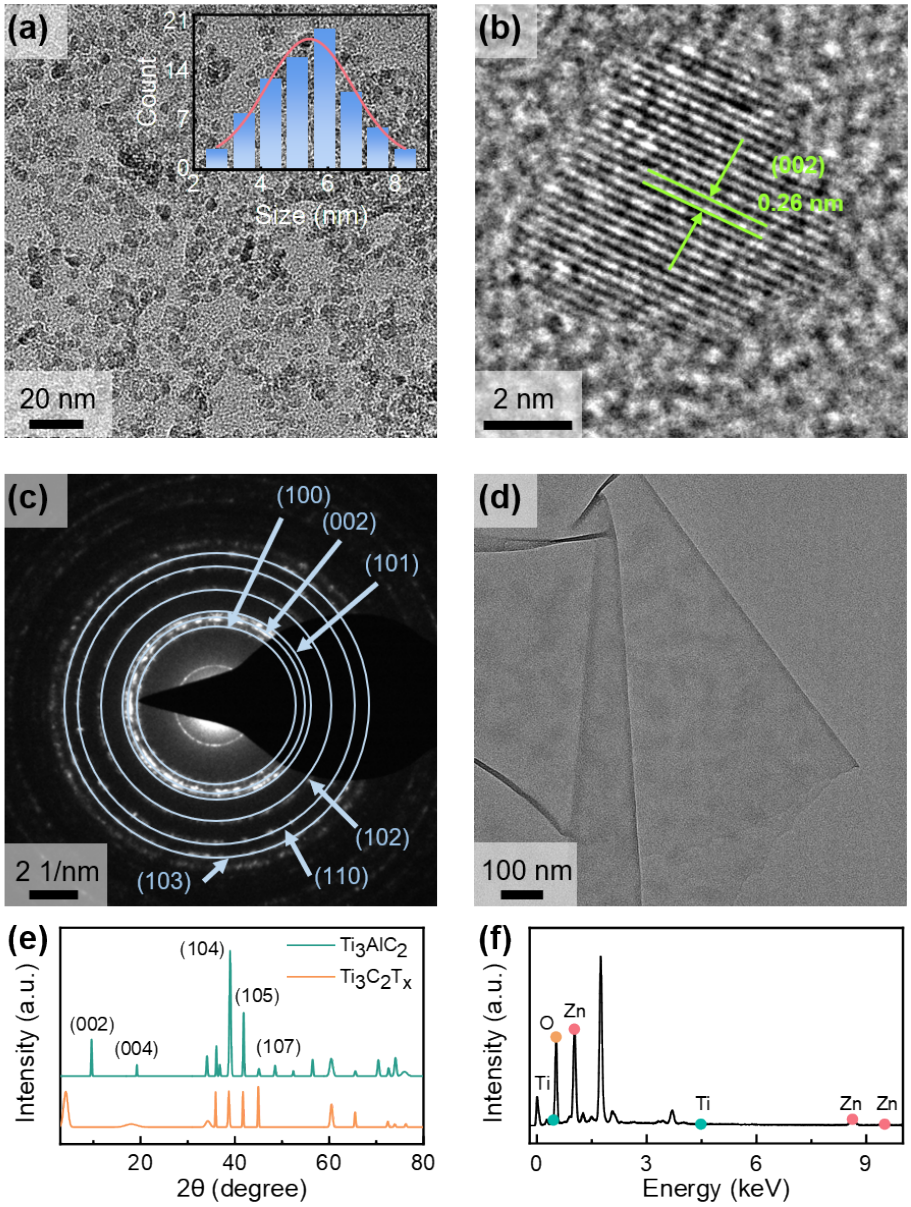

Fig. S1. (a) Transmission electron microscopy (TEM) image, (b) high-resolution transmission electron microscopy (HRTEM) image, and c selected area electron diffraction (SAED) patterns of ZnO quantum dots (QDs). (d) TEM image of MXene nanosheet. **e** X-ray diffraction (XRD) patterns of Ti_3AlC_2 MAX and $Ti_3C_2T_x$ MXene. (f) Elemental analysis of the 0D/2D composite thin film performed with energy-dispersive X-ray spectroscopy (EDS).

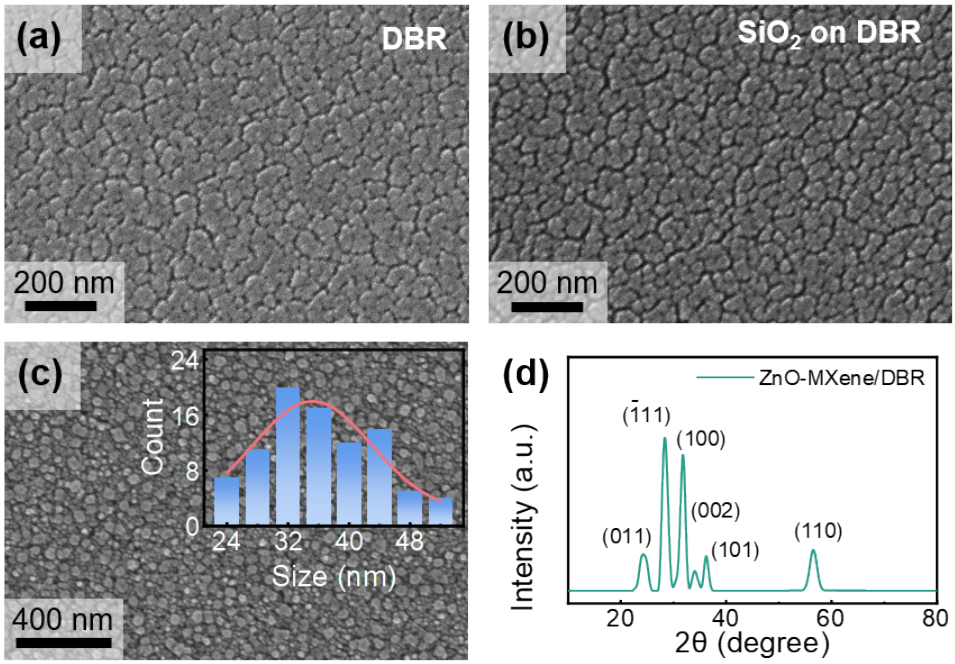

Fig. S2. Scanning electron microscopy (SEM) images of (a) DBR and (b) SiO_2 on DBR. (c) SEM image and (d) XRD patterns of the sample ZnO-MXene/DBR.

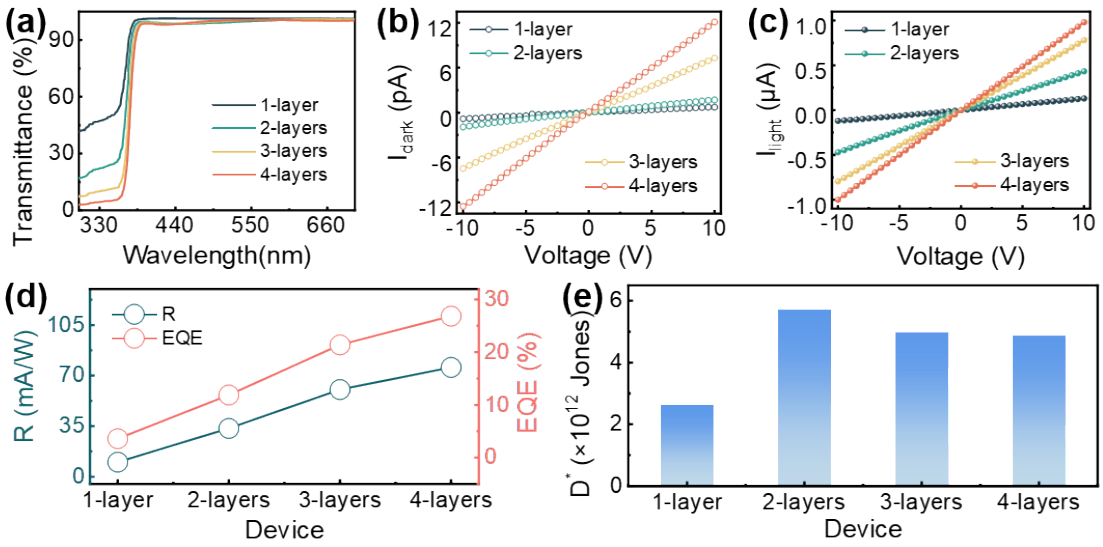

Fig. S3. (a) Transmittance spectra, (b) dark-current (I_{dark}), (c) photocurrent (I_{light}) of the devices with various layers of ZnO QDs. (d) Responsivity (R), external quantum efficiency (EQE), and **e** normalized detectivity (D^*) of the devices.

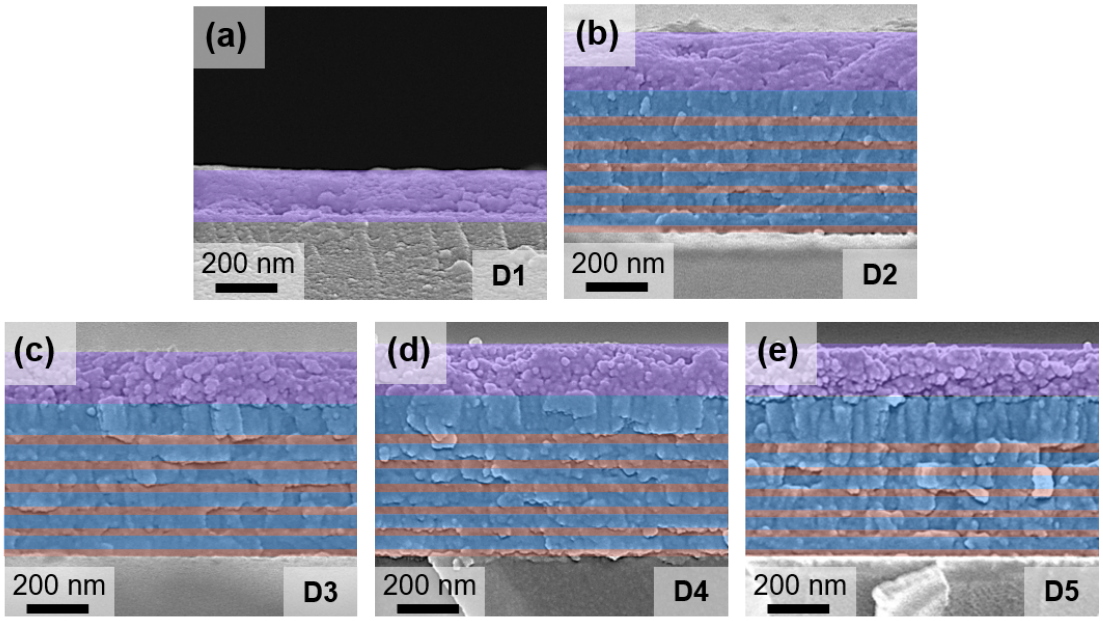

Fig. S4. Cross-sectional SEM images of the devices fabricated on (a) glass (D1) and on DBR with various thicknesses of SiO_2 isolating spacers: (b) 80 nm (D2), (c) 100 nm (D3), (d) 120 nm (D4), and (e) 140 nm (D5).

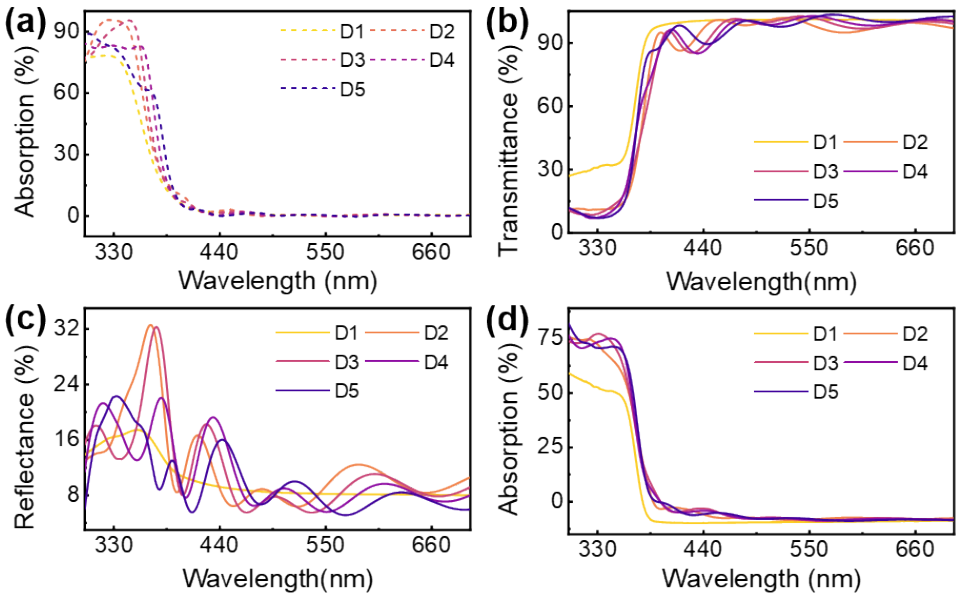

Fig. S5. (a) Simulated absorption spectra of the devices with various thicknesses of SiO_2 isolating spacers. (b) Transmittance, (c) reflectance, and (d) absorption spectra of the photodetectors.

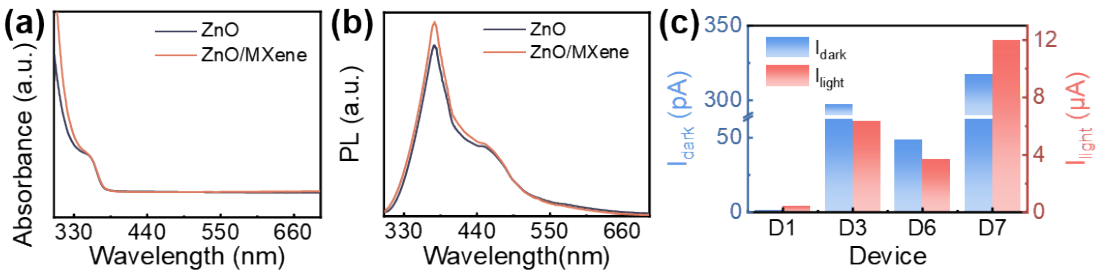

Fig. S6. (a) Absorbance and (b) photoluminescence (PL) spectra of ZnO QD and ZnO QD/MXene NS composite thin films. (c) I_{dark} and I_{light} of the devices at 10 V: ZnO/Glass (D1), ZnO/DBR (D3), ZnO-MXene/Glass (D6), and ZnO-MXene/DBR (D7).

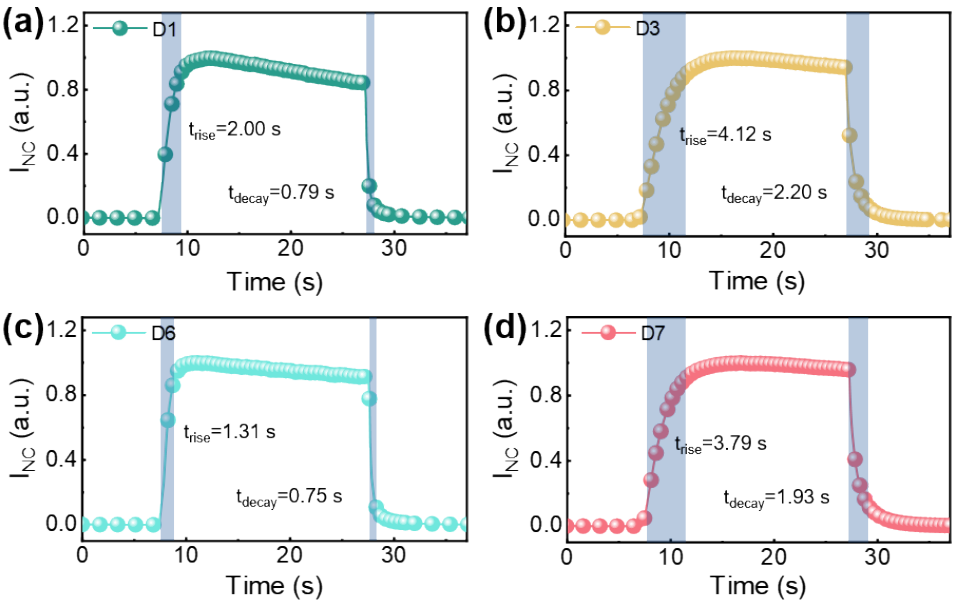

Fig. S7. Sigle period of the transient response of the photodetectors.

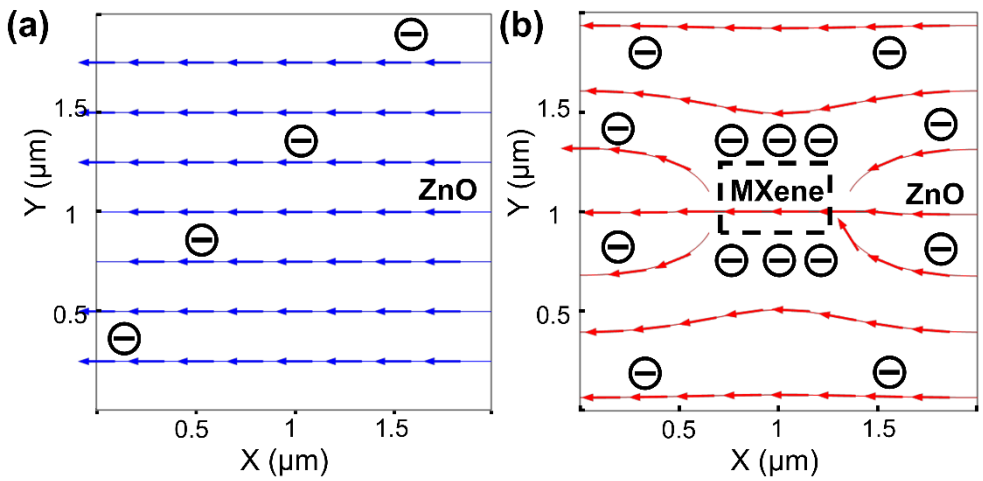

Fig. S8. Simulation of the current density distribution of (a) pristine ZnO and (b) ZnO QD/MXene NS nanocomposites.

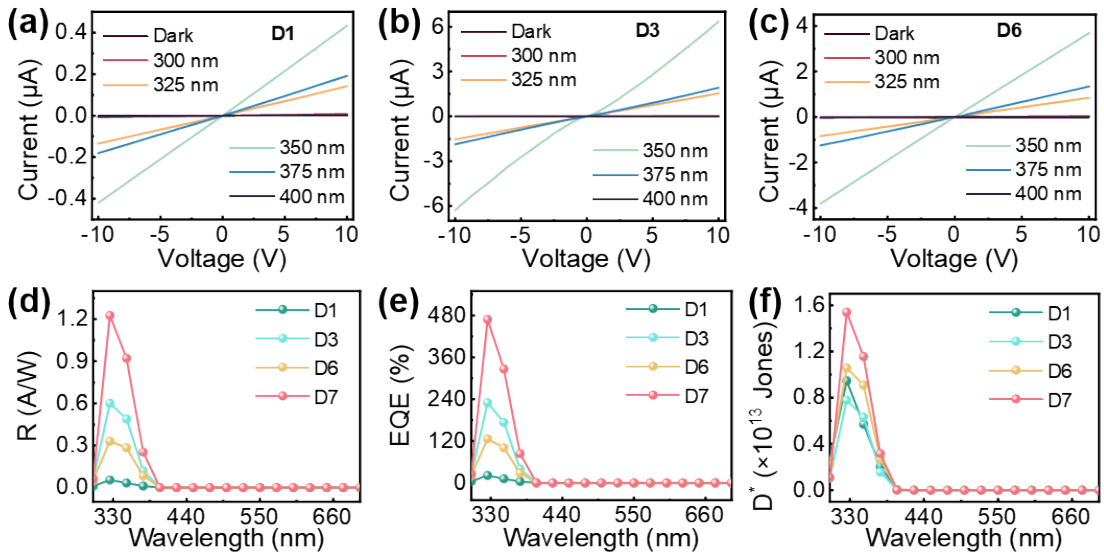

Fig. S9. (a) – (c) The I-V curves of the devices. The (d) R, (e) EQE, and (f) D^* of the photodetectors over a wavelength range between 300 and 700 nm.

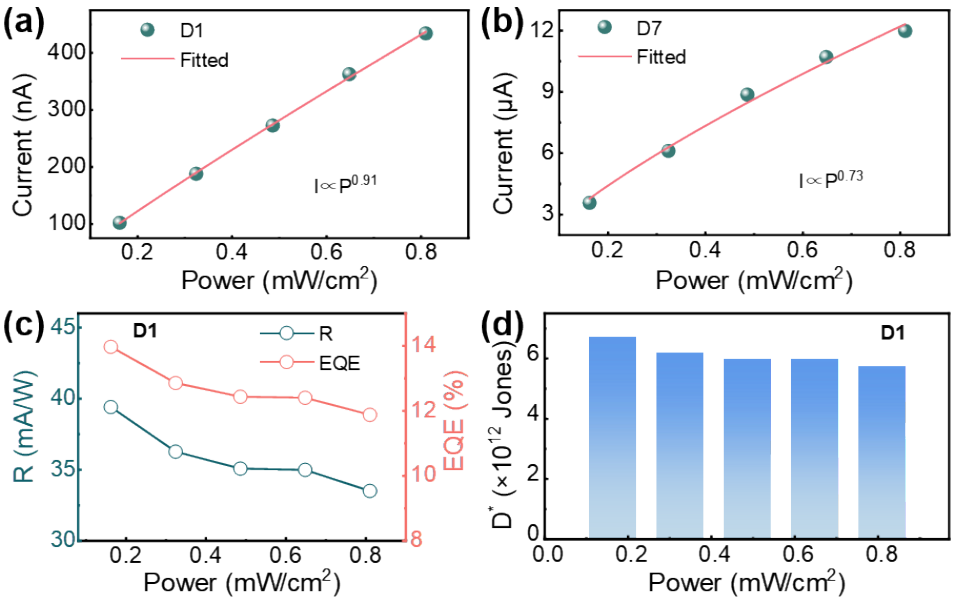

Fig. S10. Power law fitting curves of the device (a) D1 and (b) D7. The (c) R, EQE, and (d) D^* of the photodetector D1 with a variation of the light powers.

Table S1. Fitting coefficients and average lifetimes obtained from time-resolved photoluminescence (TRPL) spectra of the samples.

Sample	A_1	τ_1 (ns)	A_2	τ_2 (ns)	τ_{ave} (ns)
ZnO/Glass	0.40	0.42	0.61	0.99	0.87
ZnO-Mxene/Glass	0.83	0.34	0.17	1.78	1.09
ZnO/DBR	1.03	0.71	0.09	45.73	38.94

Table S2. R, EQE, and D^* switching ratio (SR) of the devices with various layers of ZnO QDs.

Layers of ZnO	1-layer	2-layers	3-layers	4-layers
Transmittance at 350 nm	50.1%	24.3%	10.9%	4.7%
R (mA W^{-1})	10.1	33.5	60.3	75.7
EQE	3.6%	11.9%	21.4%	26.8%
D^* ($\times 10^{12}$ Jones)	2.6	5.7	5.0	4.9
SR	1.8×10^5	2.5×10^5	1.1×10^5	8.1×10^4