Electronic Supplementary Material (ESI) for Nanoscale Advances.

Supplementary Information

Solution processed transparent anatase TiO_2 nanoparticles / MoO_3 nanostructures heterojunction:High performance self-powered UV detector for low-power and low-light applications

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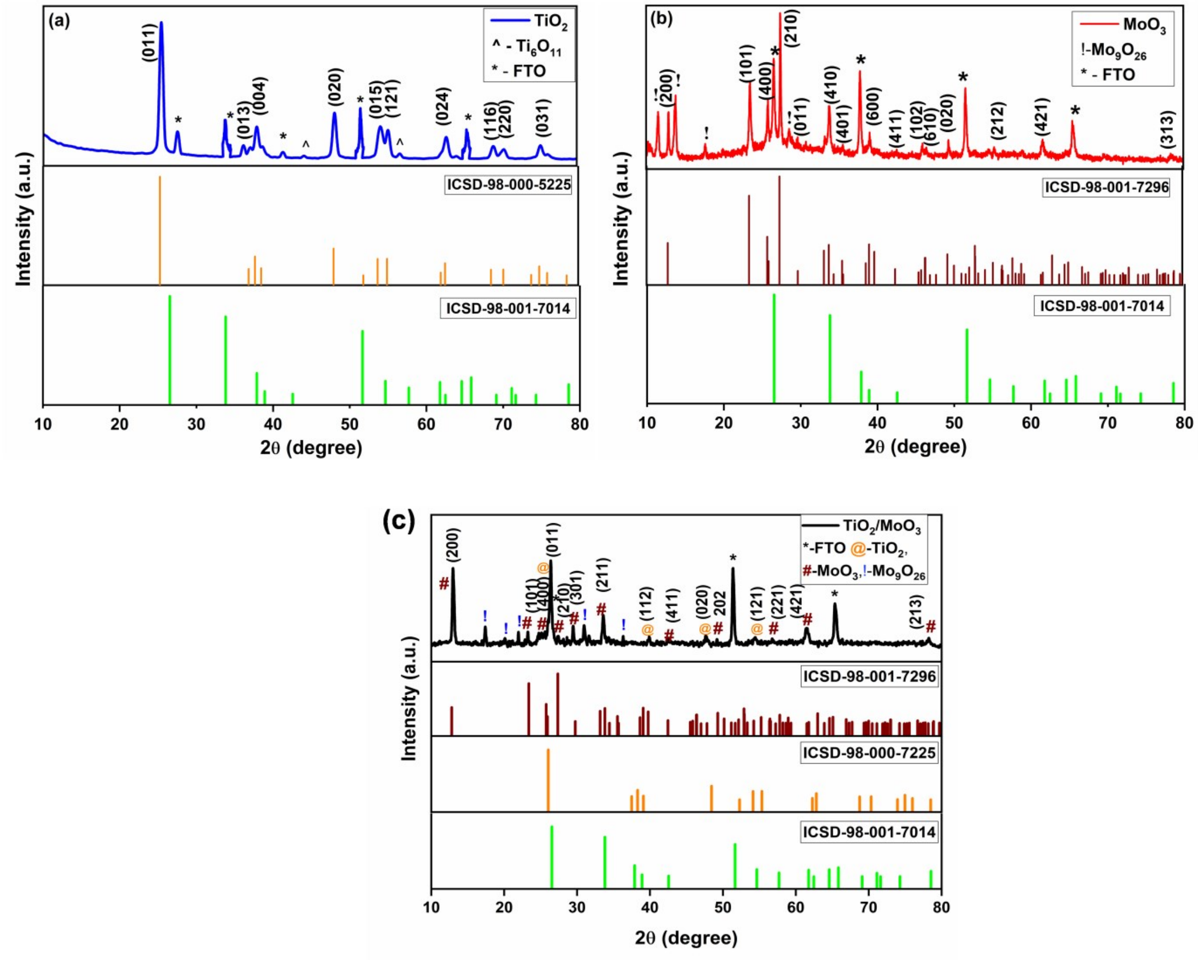

Figure S1. XRD patterns of (a)TiO_2,(b)MoO_3 and (c) TiO_2/MoO_3film

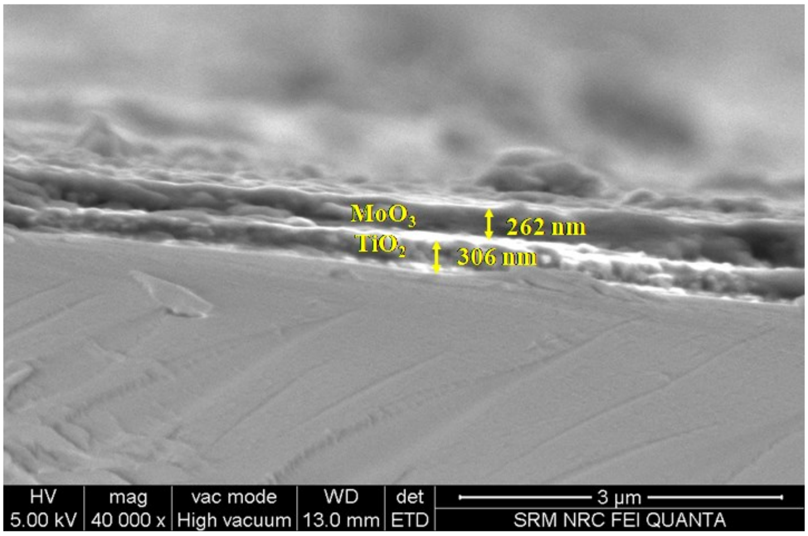

Figure S2. FE-SEM cross section image of the bilayer film

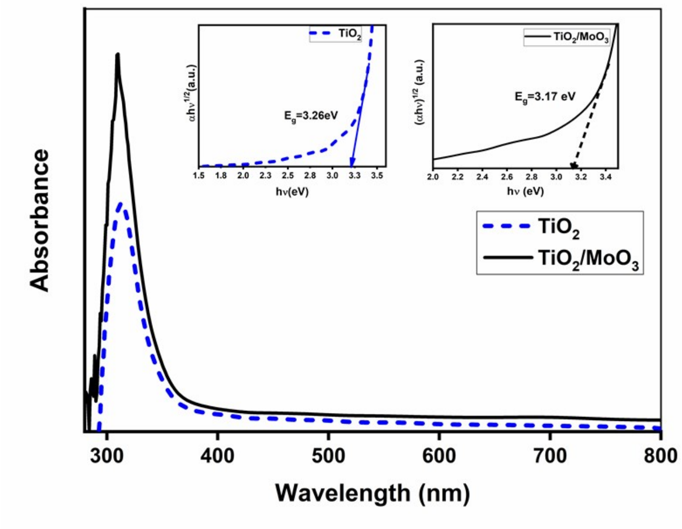

Figure S3. UV-visible absorption spectra of TiO_2, and TiO_2/MoO_3 film, Inset:Tauc plot of TiO_2 and TiO_2/MoO_3 film

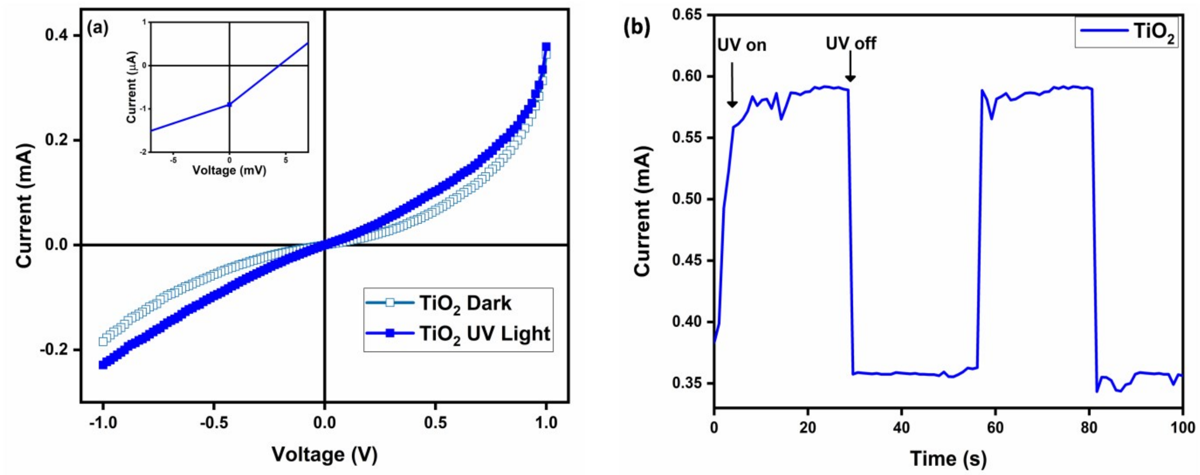

Figure S4.Device characteristics of TiO_2 based device (a) I-V characteristics under dark and UV illumination and (b) I-t characteristics under -1V.

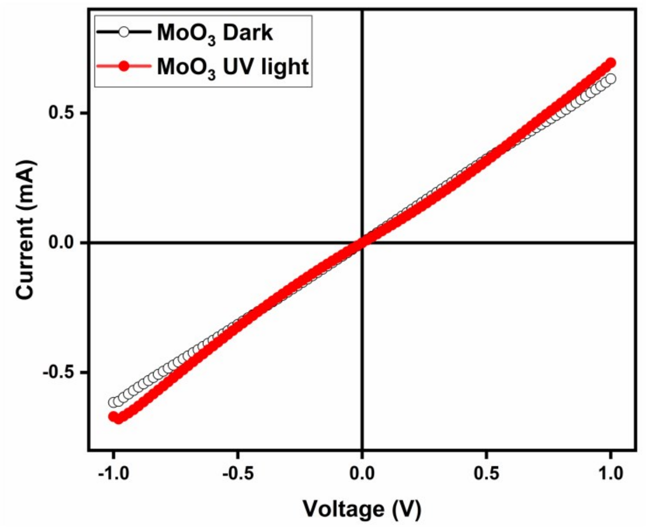

Figure S5. I-V characteristics of MoO_3 device under dark and UV illumination

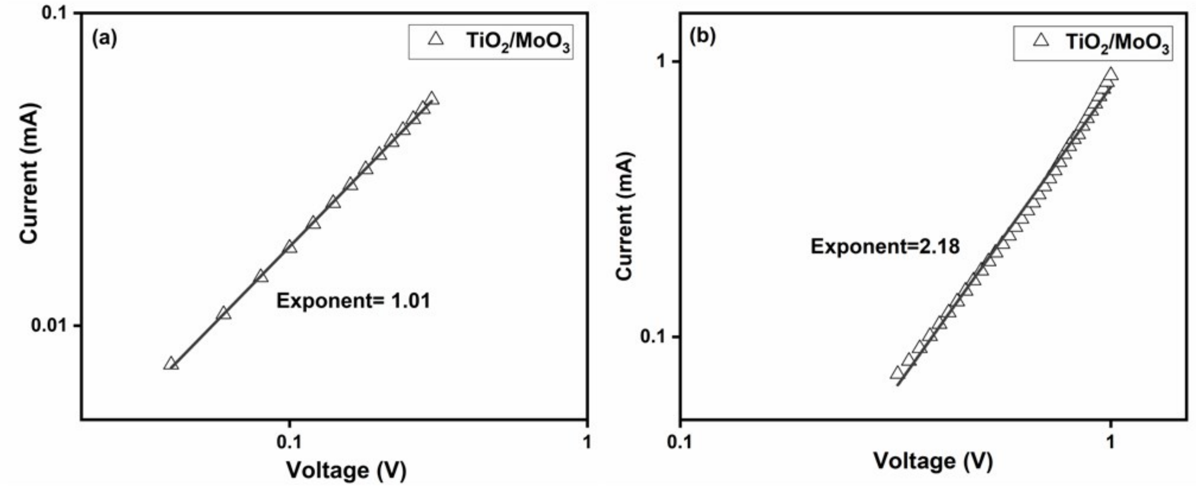

Figure S6.log-log plot of I-V characteristics of the bilayer device (a)at low voltage (b) at high voltage

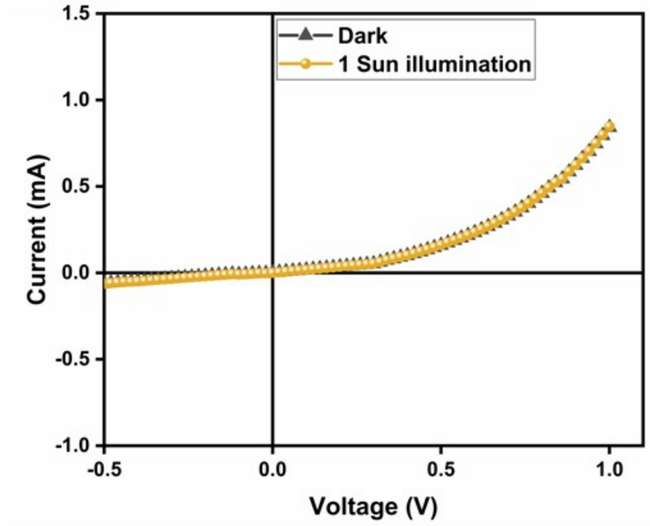

Figure S7. I-V characteristics of TiO_2/MoO_3 bilayer device under dark and 1 sun illumination

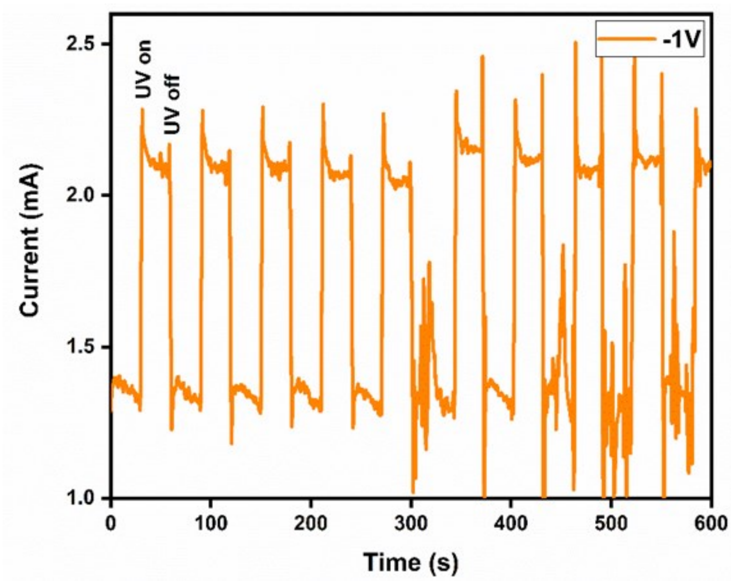

Figure S8. I-t characteristics of the bilayer device under -1V bias

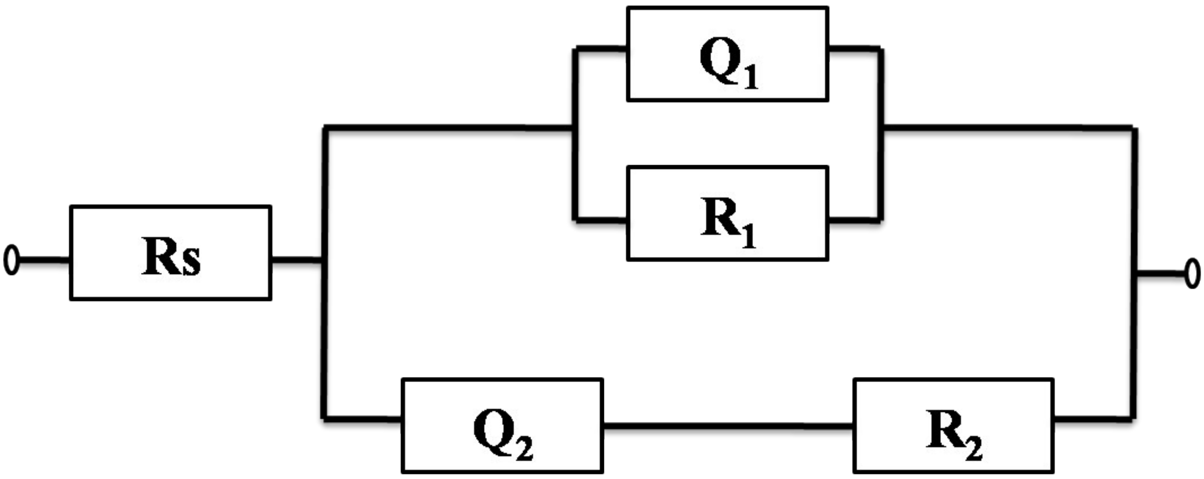

Figure S9. The equivalent circuit model of EIS spectra for TiO_2, MoO_3 and TiO_2/MoO_3 film

	TiO_2	MoO_3	TiO_2/MoO_3
Series resistance (Rs)	122 Ω	98 Ω	229 Ω
Charge transfer resistance (R_1)	3454Ω	5872 Ω	504 Ω
Diffusion resistance (R_2)	832 Ω	189 Ω	299 Ω

Table S1. Comparison of resistance values of TiO_2, MoO_3 and TiO_2/MoO_3 film as calculated using EIS equivalent circuit model

Sample	Ideality factor (n)	Reverse saturation current (I_s)	Barrier height (ϕ_b)
FTO/TiO_2/MoO_3/Au	2.98	1.56×10^{-6} A	0.77 eV

Table S2. Diode parameters of the bilayer film calculated from I-V characteristics

Device	**Wave-length (nm)**	**Intensity of the source (mW/cm^2)**	**Bias (V)**	**Photo responsivity (mA/W)**	**Detectivity (Jones)**	**Rise time (s)**	**Fall time (s)**	**Ref.**
TiO_2-NP	310	0.07	-5	$3.2x10^{-3}$	-	-	-	1
TiO_2-NT/BiOCl	355	2.04	-5	41.94	$1.41x\ 10^{14}$	-	0.81 s	2
TiO_2-NW/CuZnS	300	1.26	3	650	-	<0.2 s	<0.2 s	3
TiO_2/GO	280	30	6	826.8	$2.82x10^{13}$	810 ms	1.74 s	4
TiO_2-NP	352	0.076	-1	12.4	$3.3x\ 10^{11}$	-	-	This work
TiO_2-NP/MoO_3	352	0.076	-1	46.05	$2.84x10^{12}$	1.22	1.4	

Table S3. Performance of anatase TiO_2 based photodetectors

Device	**Wave-length (nm)**	**Intensity of the source ($\mu W/cm^2$)**	**Bias (V)**	**Photo responsivity (mA/W)**	**Detectivity (Jones)**	**Rise time (s)**	**Fall time (s)**	**Ref.**
Rutile TiO_2 NWs/ α-MoO_3	360	65	-2.2	$3.2x10^{-3}$	-	3.16	13.13	5
Anatase TiO_2 NPs/ α-MoO_3	352	76	-1	41.94	$2.84x10^{12}$	1.22	1.4	This work

Table S4. Performance of TiO_2/MoO_3 based UV detectors

Bias	I_d (µA)	I_L-I_d (mA)	R (A/W)	D (x10^{11} Jones)	EQE (%)
0	1.56 ± 0.04	0.194 ± 0.0018	0.1078 ± 0.023	0.153 ± 0.10	37.97 ± 0.075
-1	197 ± 12	0.833 ± 0.008	45.66 ± 0.47	28.18 ± 0.47	1.6 ± 0.015 x 10^4

Table S5. Statistical data on the performance of the bilayer device based on the 34 devices made

References:

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