Supplementary Information

Enhanced photoresponse of ZnO quantum dot-decorated MoS_2 thin films

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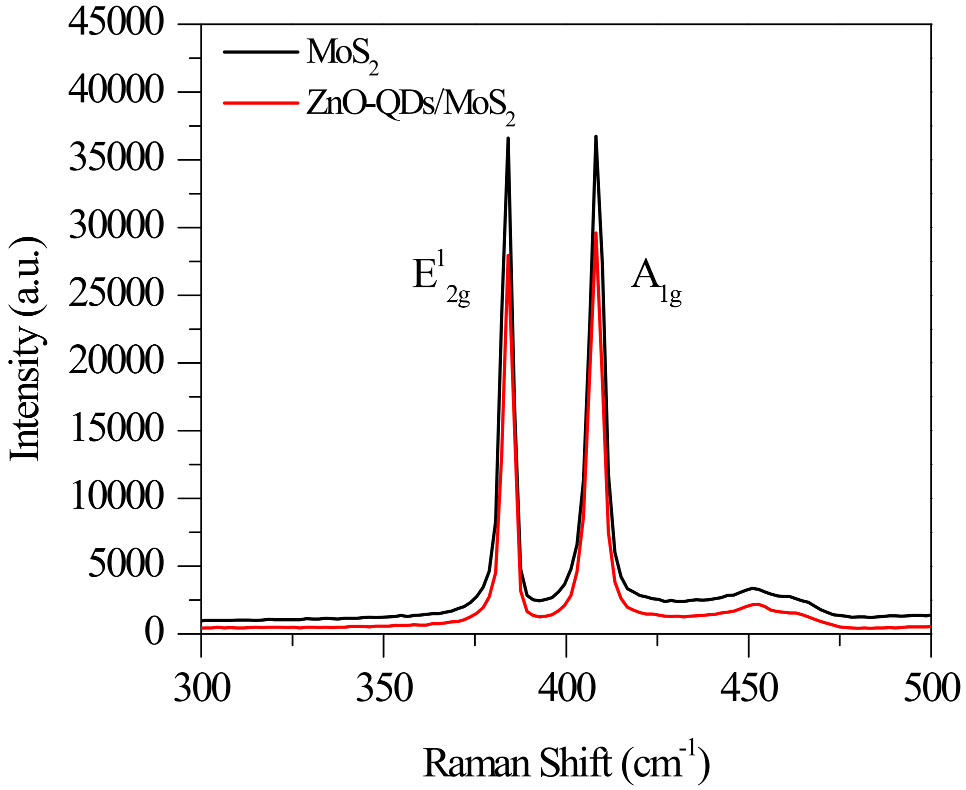

Figure S1. Raman Spectra of pristine MoS_2 flake (black curve) and ZnO-QDs/MoS_2 heterostructures (red curve). The difference between E^1_{2g} and A_{1g} is $\Delta = 24\ cm^{-1}$, confirming the multilayer nature of the MoS_2 flake.

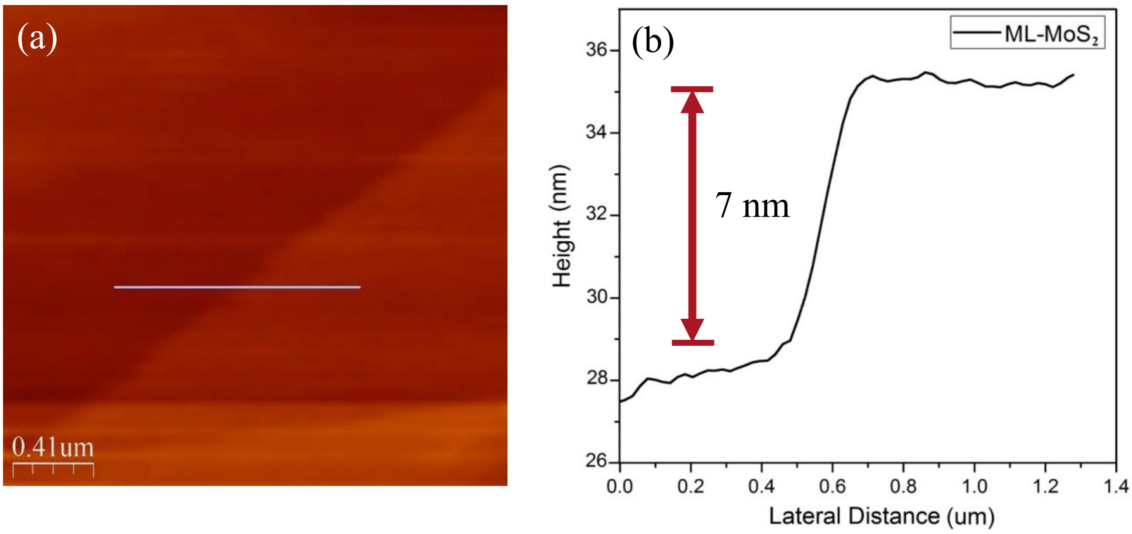

Figure S2. (a) AFM image of multilayer MoS_2 flake (scale bar: 0.41 μm). (b) Height profile along the purple line in AFM image confirms the multilayer nature of flake, which is 7 nm thick (~11 layers); a MoS_2 monolayer[1] is 0.65 nm thick.

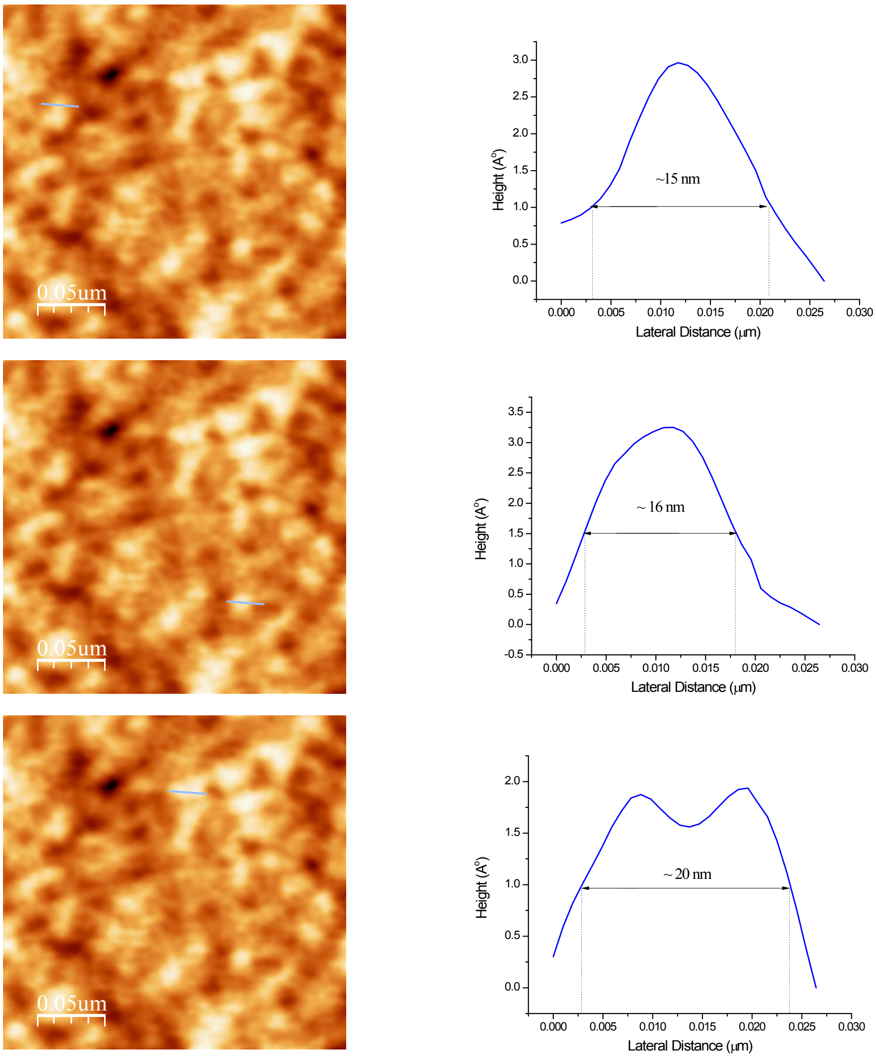

Figure S3. AFM images of ZnO-QDs (scale bar: 0.05 μm) at different areas of the MoS_2device. Height profiles along the lines in AFM images indicate the size of QDs; the average height of ZnO-QDs is 2 - 4Å and the average width is 10 - 20 nm.

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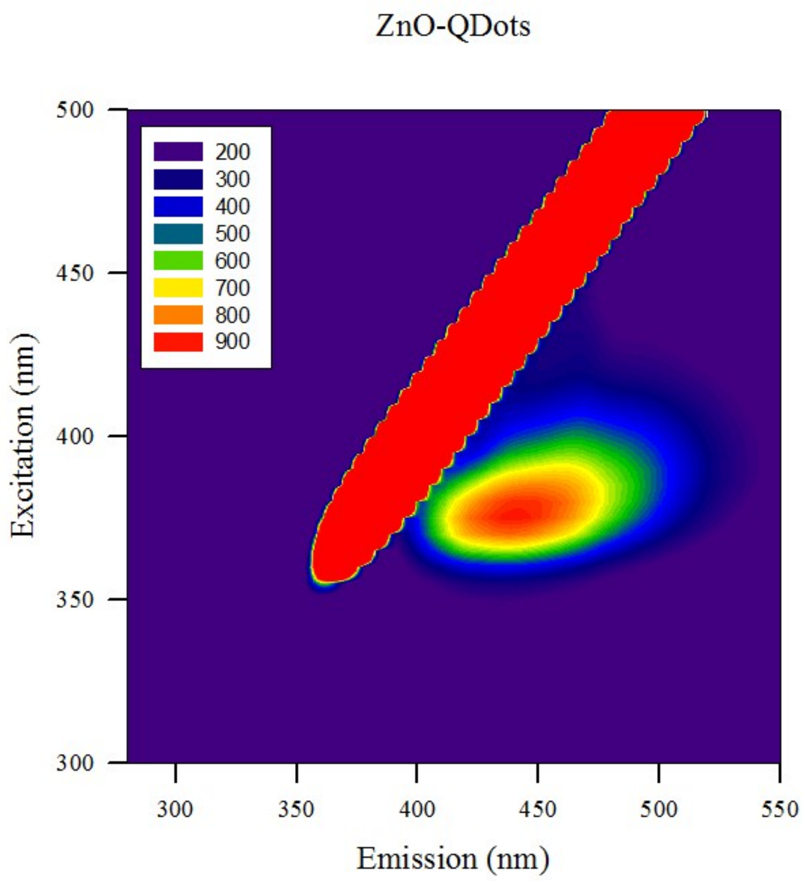

Figure S4. Fluorescence 3-D plot of ZnO-QDs. The x-axis shows the emission (nanometer) after incident light falls on the ZnO-QDs and the y-axis shows the excitation (nanometer) peaks at different energies of the photon of incident light (200–900 eV). The highest peak for ZnO-QDs is at 378 nm, providing a bandgap of 3.28 eV estimated by the formula $E_g = hc/\lambda$. The red thick line is caused by Raman scattering of methanol solution.

Table S1. Comparison of different photo-electrical characteristics for different materials.

Material (no.of layers)	V_{ds} (V)	V_{bg} (V)	Wavelength λ (nm)	Power of incident light ($mWcm^{-2}$)	Responsivity R (mAW^{-1})	Spectral range	Ref.
1L-MoS_2	8	-70	561	2.4×10^{-1}	8.8×10^5	Visible	[2]
1L-MoS_2	1.5	0	514.5	3.2×10^4	1.1		[3]
3L-MoS_2	10	0	532	2.0×10^3	5.7×10^2	λ < 700 nm	[4]
11L-MoS_2	1	30	220	11	1.913×10^6	UV-Visible	This work
11L-MoS_2 after drop-casting ZnO-QD	1	30	220	11	2.267×10^6	UV-Visible	This work
1L-MoS_2	1	50	532	8.0×10^4	7.5	Visible	[2]
GaSe	5	0	254	1	2.8×10^3	UV-Visible	[5]
GaS	2	0	254	2.6×10^{-2}	4.2×10^3	UV-Visible	

References

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