Supporting Information

Hot Carrier Dynamics in BA_2PbBr_4/MoS_2 Heterostructure

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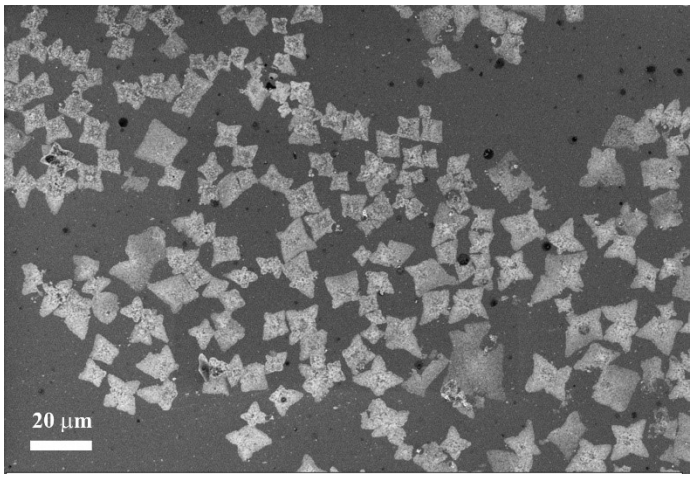

Fig. S1: FESEM image of 2D perovskite sheets.

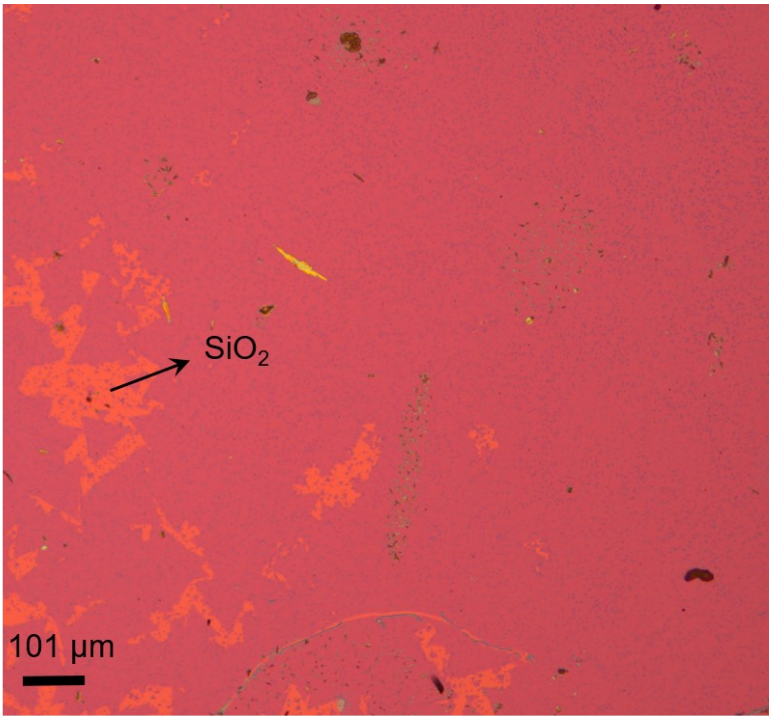

Fig. S2: Optical microscope image of MoS_2 monolayer.

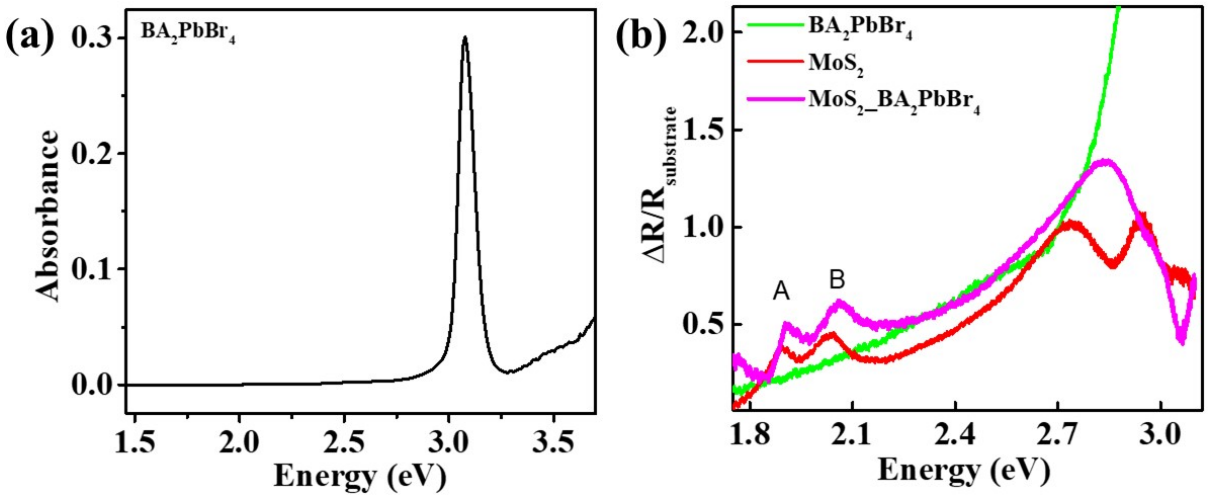

Fig. S3: (a) The absorption spectrum of BA_2PbBr_4 perovskite. (b) Comparative differential reflectance spectra of bare samples and the heterostructure.

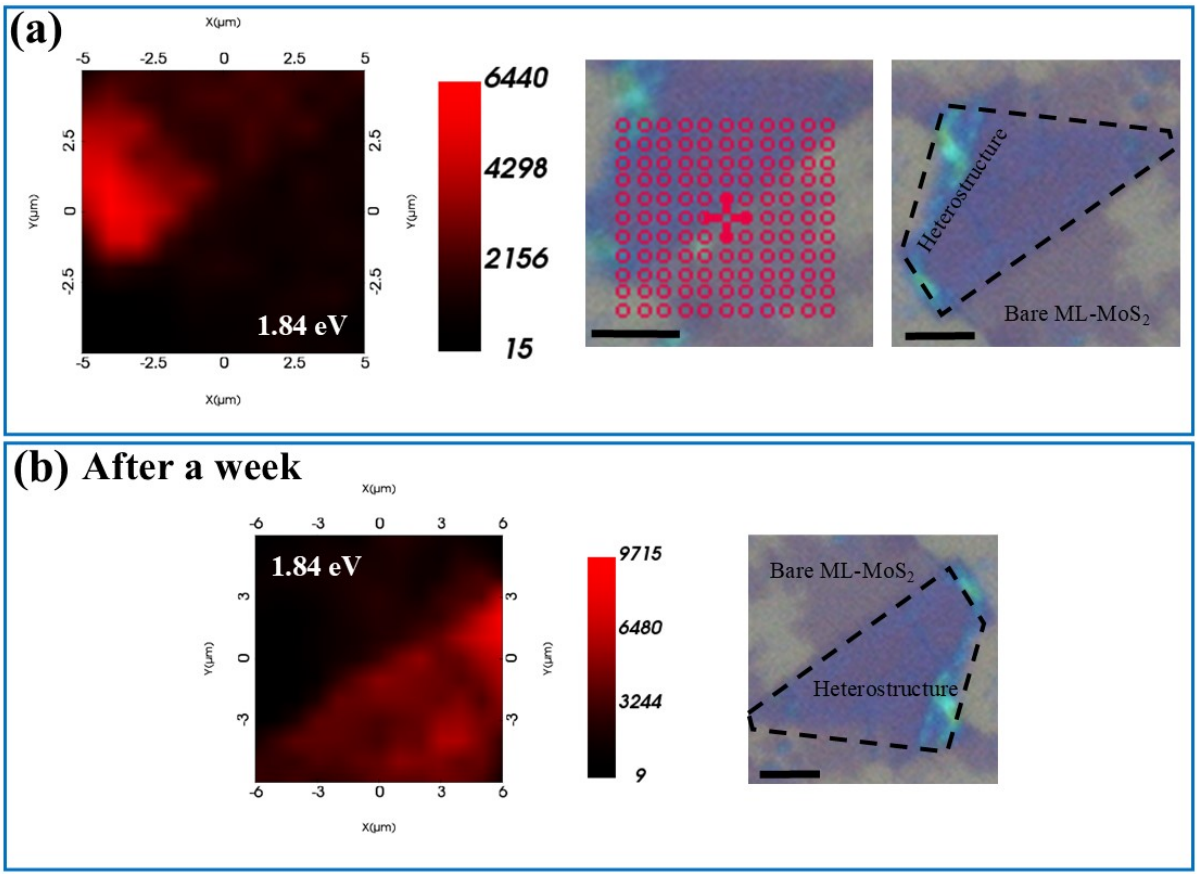

Fig. S4: (a) PL mapping of the heterostructure sample with excitation of 532 nm laser and the corresponding microscopic region. (b) PL mapping collected after one week on the heterostructure. The slight variation in intensity was due to different accumulation time.

Table S1: Parameters extracted from the fit of time-resolved reflectivity data with a bi-exponential decay function:

$$\frac{\Delta R}{R} = A_1 exp\left(-t/\tau_1\right) + A_2 exp\left(-t/\tau_2\right)$$

Here, A_1 and A_2 are the decay constants, and τ_1 and τ_2 are the fast and slow decay times, respectively.

Sample	τ_1 (ps)	A_1	τ_2 (ps)	A_2
BA_2PbBr_4	24.7	0.01279	195	0.00704
MoS_2	29.5	0.01144	202	0.00773
BA_2PbBr_4/MoS_2	31.4	0.01212	215	0.00686

Table S2: Parameters extracted from the fit of time-resolved electron temperature data with Eq. 6.

Sample	$\tau_{e\text{-}ph}$ (ps)	$A_{e\text{-}ph}$	τ_{ph} (ps)	A_{ph}	τ_{avg}	$k_{e\text{-}ph}/ k_{ph}$
BA_2PbBr_4	2.42	34499.12	105.9	2150.6	8.49	43.76
MoS_2	3.38	22093.82	180.9	2248.7	19.78	53.52
BA_2PbBr_4/MoS_2	3.01	23115.78	172.89	1871.6	15.73	57.43

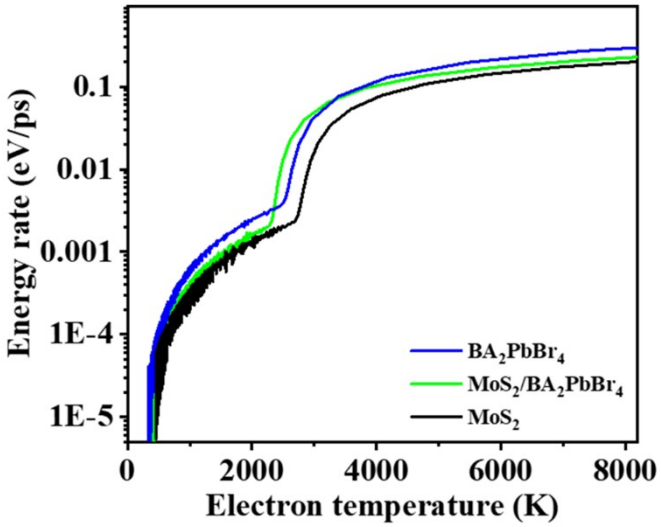

Fig. S5: Energy rate variation in pristine 2D perovskite BA_2PbBr_4, MoS_2 and MoS_2/BA_2PbBr_4 heterostructure.