

Supporting Information

Formation of oxygen protective layer on monolayer MoS₂ via low energy electron irradiation

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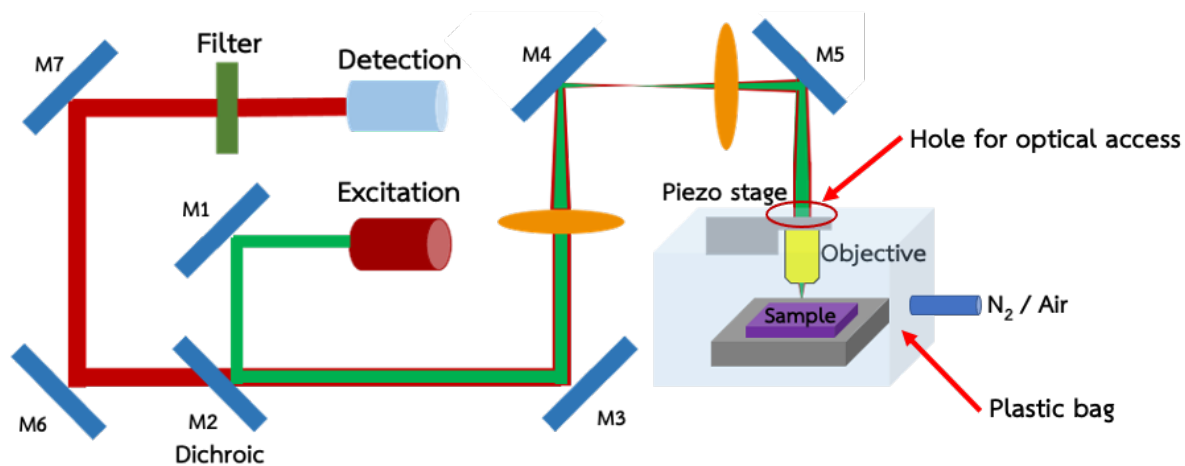


Figure S1. Diagram of a confocal microscope setup under N₂ and ambient atmosphere.

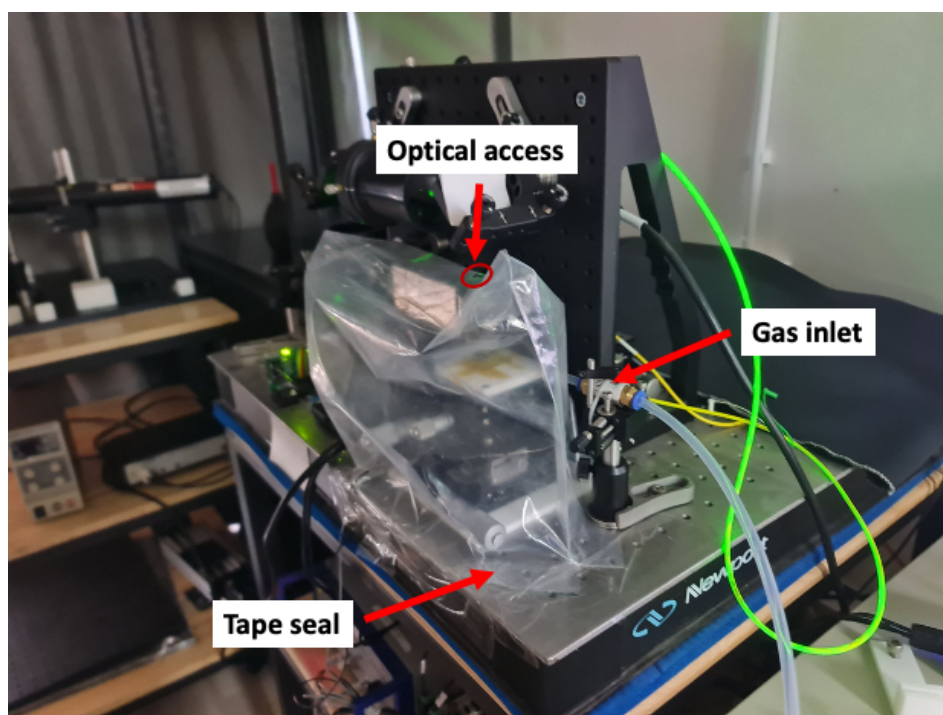


Figure S2. The experiment setup.

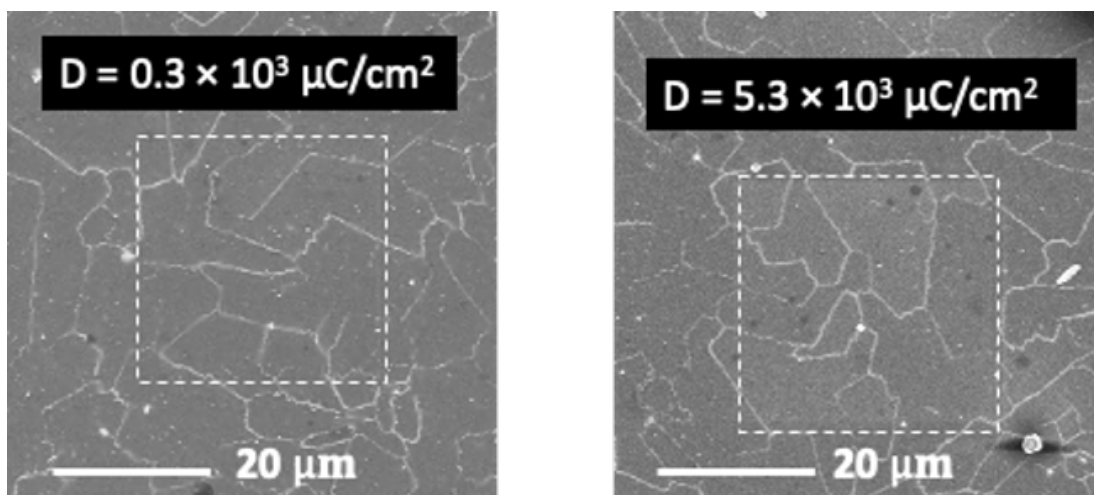


Figure S3. The SEM images with different electron irradiation doses in 2 regions.

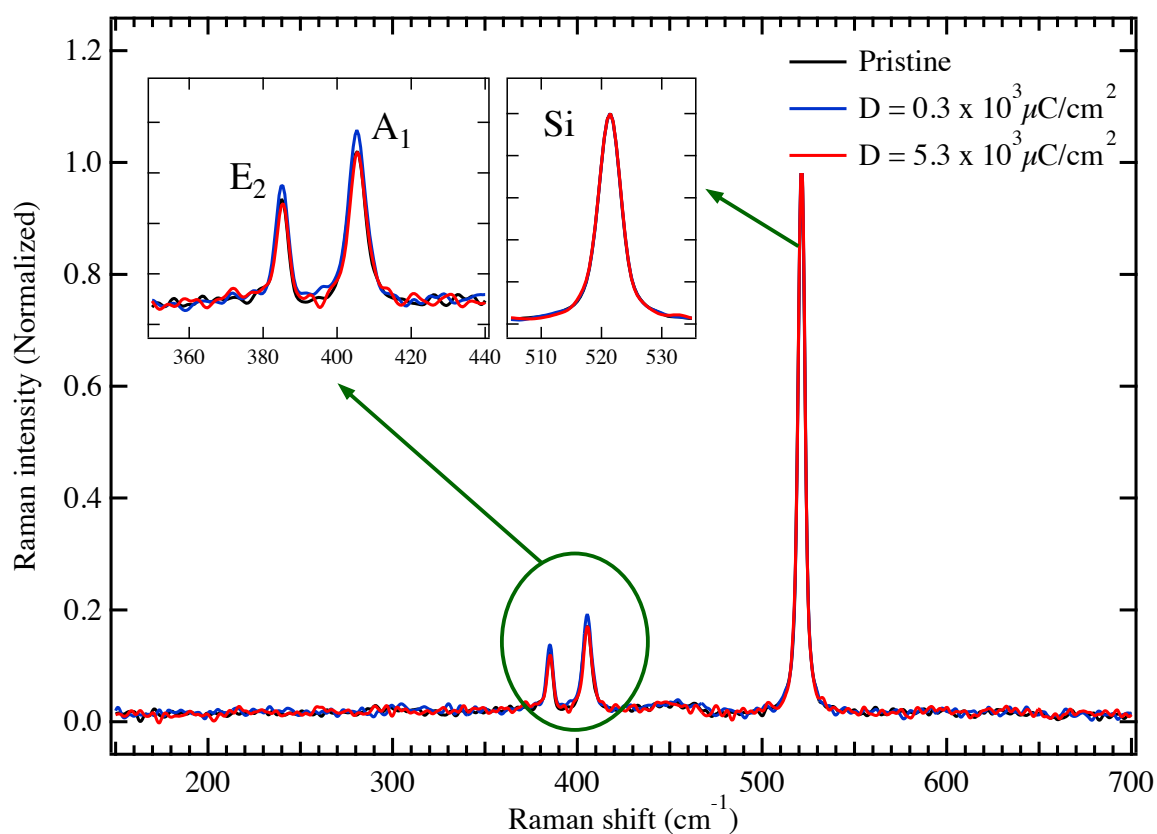


Figure S4. Raman spectra of monolayer MoS₂ with different electron irradiation doses.

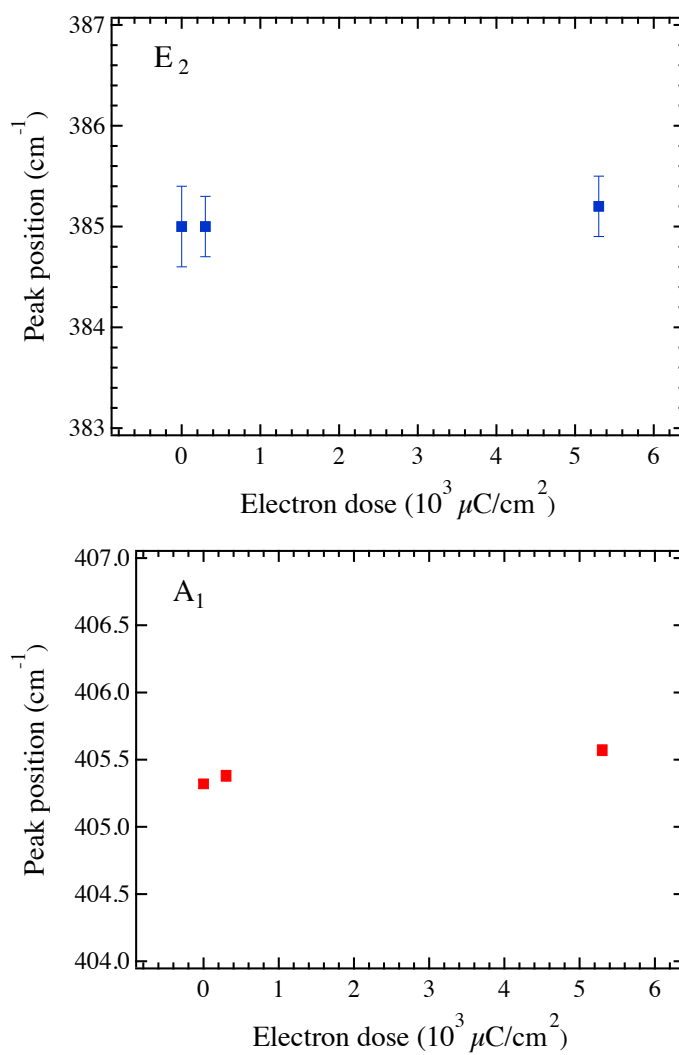


Figure S5. Raman peak positions of E_2 and A_1 modes as a function of electron dose.

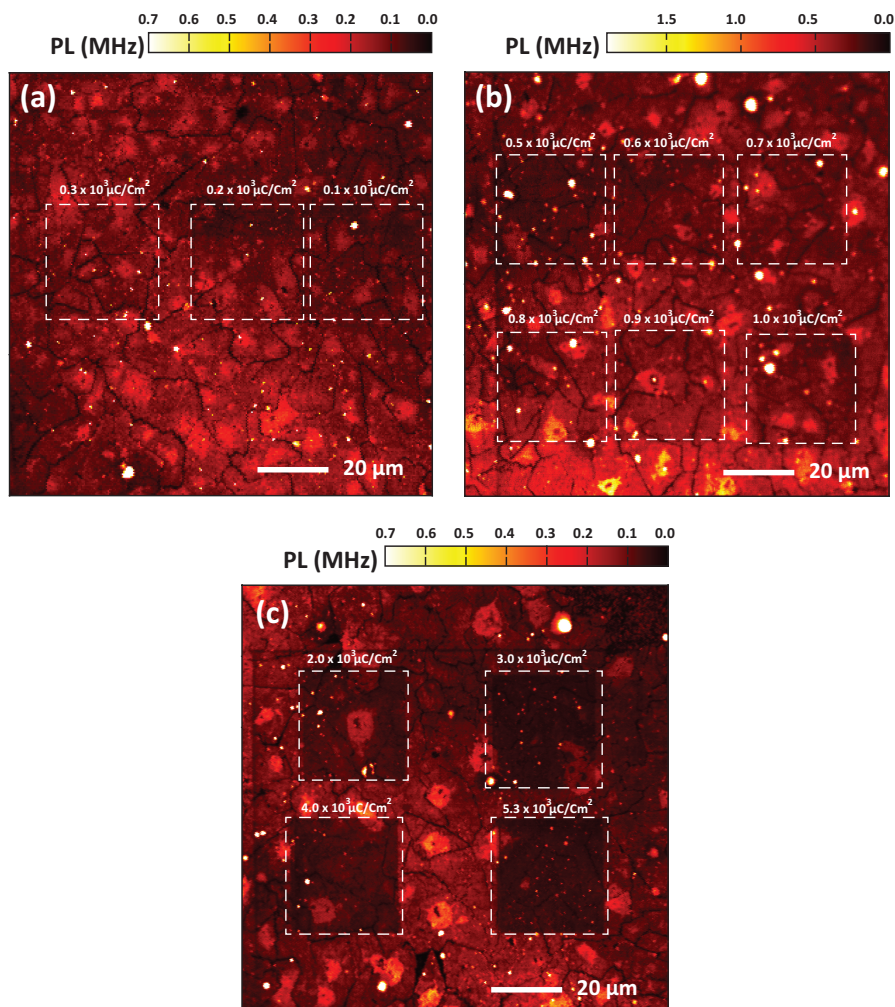


Figure S6. Confocal images of monolayer MoS₂ with electron irradiation dose variation, consisting of (a) $D = 0.1 \times 10^3 \mu\text{C}/\text{cm}^2$, $D = 0.2 \times 10^3 \mu\text{C}/\text{cm}^2$, and $D = 0.3 \times 10^3 \mu\text{C}/\text{cm}^2$, (b) $D = 0.5 \times 10^3 \mu\text{C}/\text{cm}^2$ up to $D = 1.0 \times 10^3 \mu\text{C}/\text{cm}^2$, and (c) $D = 2.0 \times 10^3 \mu\text{C}/\text{cm}^2$ to $D = 5.3 \times 10^3 \mu\text{C}/\text{cm}^2$.

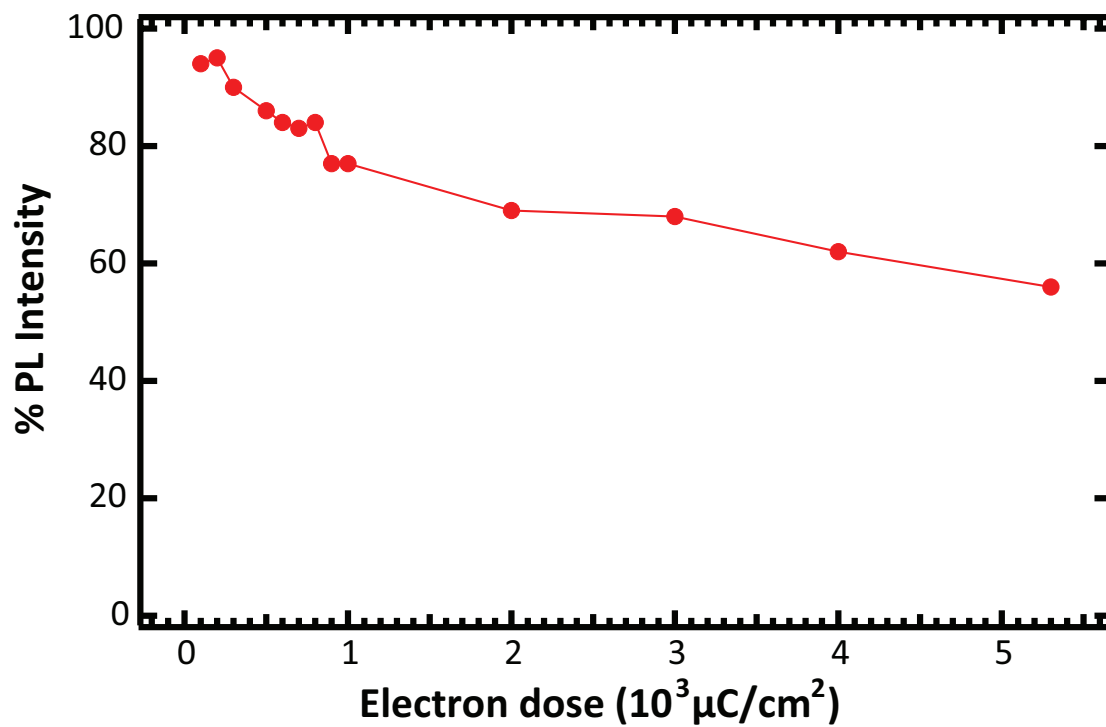


Figure S7. The relative PL intensity of the areas exposed by different electron irradiation dose.

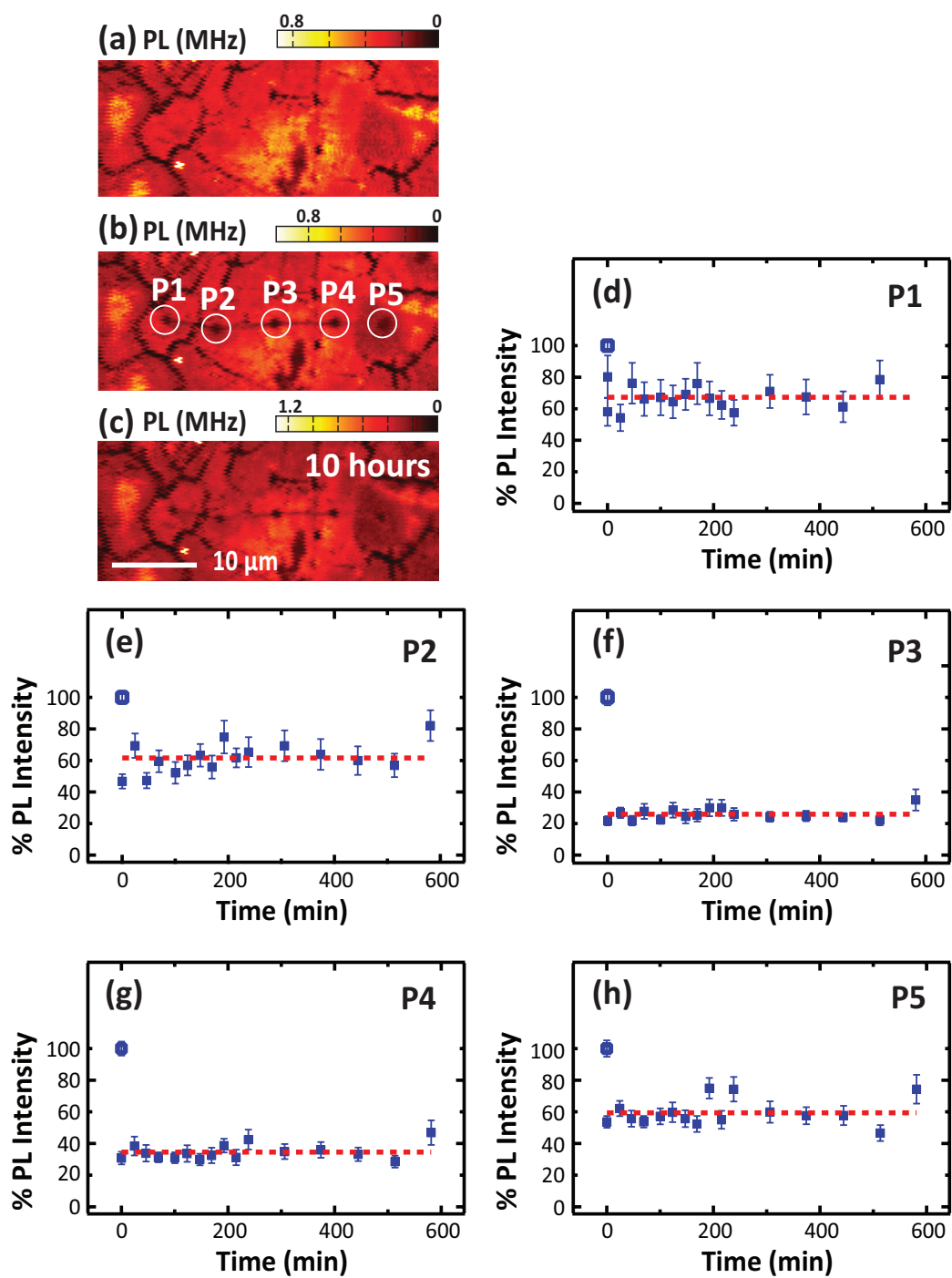


Figure S8. Relative PL intensity of pristine sample after high power laser exposure following by ambient atmosphere storage.

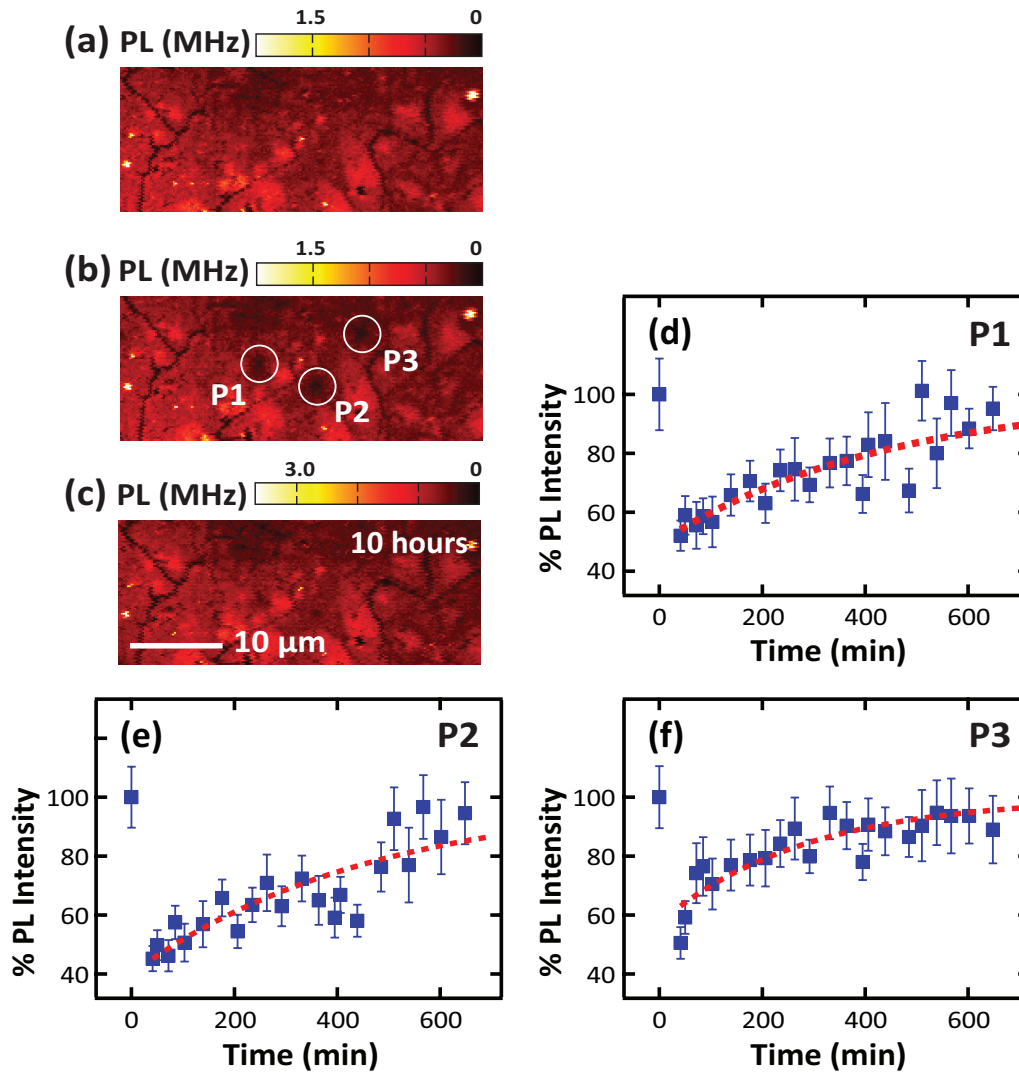


Figure S9. Relative PL intensity of electron dose irradiation $D = 0.2 \times 10^3 \mu\text{C}/\text{cm}^2$ areas after high power laser exposure following by ambient atmosphere storage.

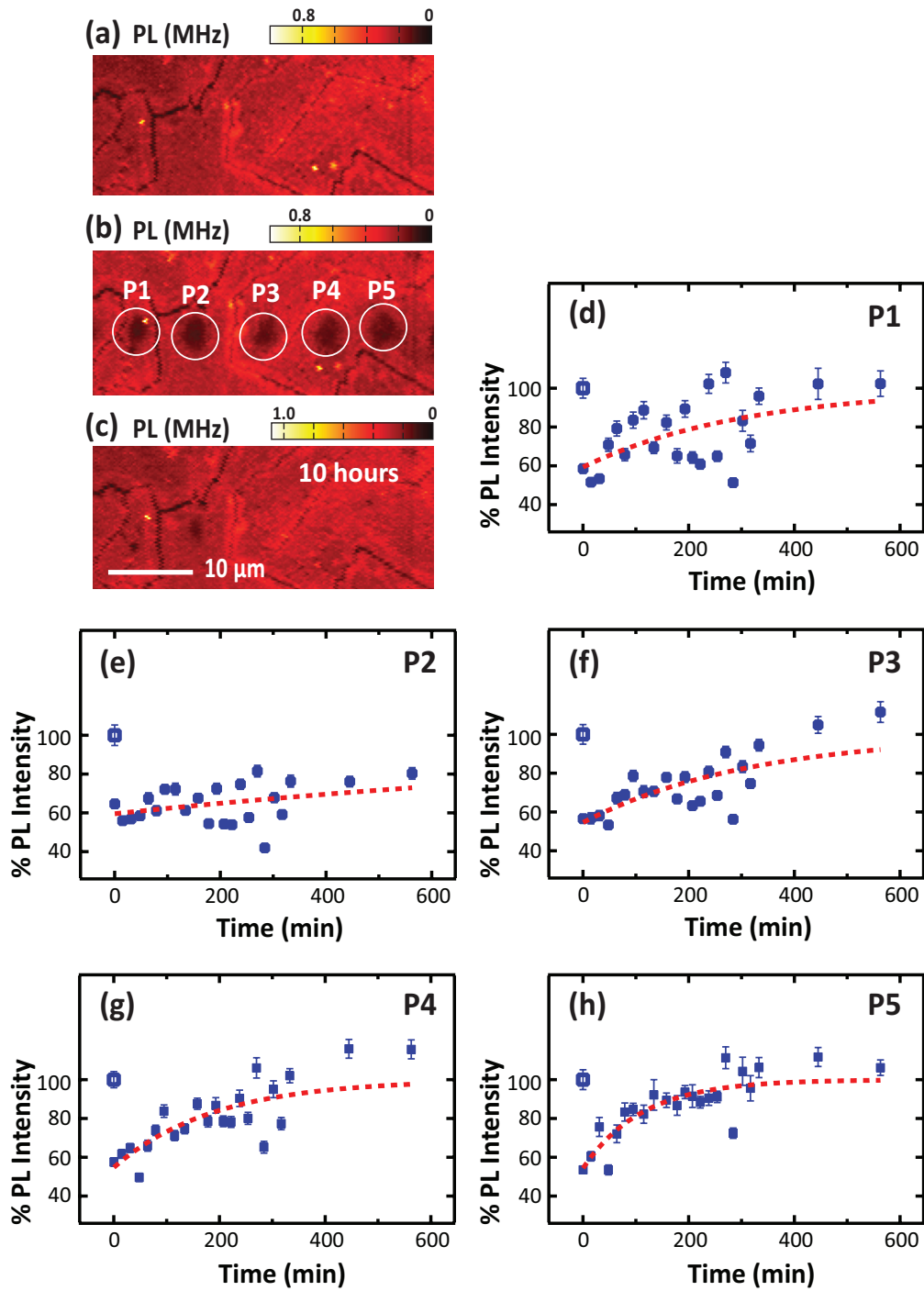


Figure S10. Relative PL intensity of electron dose irradiation $D = 0.3 \times 10^3 \mu\text{C}/\text{cm}^2$ areas after high power laser exposure following by ambient atmosphere storage.

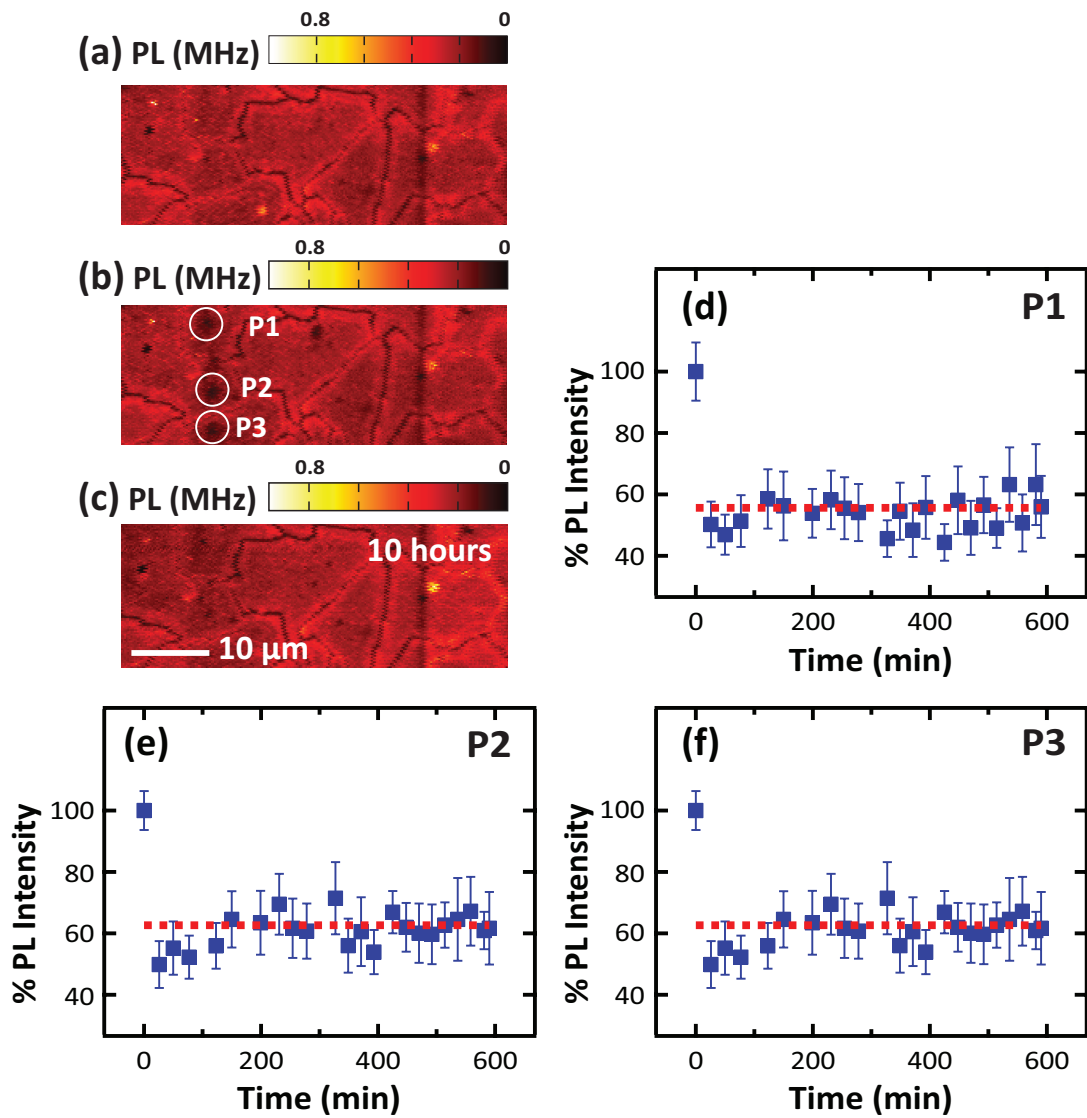


Figure S11. Relative PL intensity of electron dose irradiation $D = 2.0 \times 10^3 \mu\text{C}/\text{cm}^2$ areas after high power laser exposure following by ambient atmosphere storage.

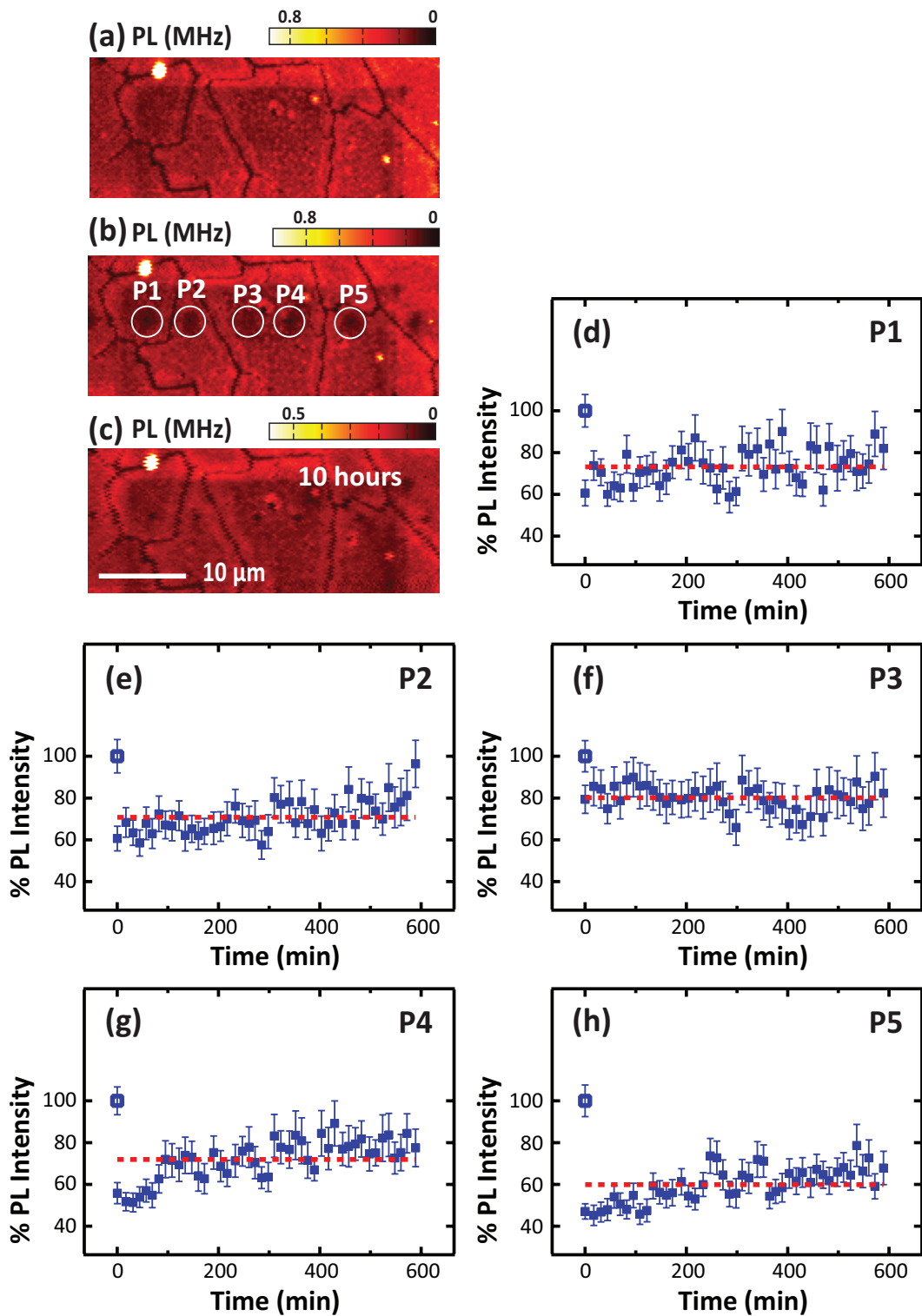


Figure S12. Relative PL intensity of electron dose irradiation $D = 5.3 \times 10^3 \mu\text{C}/\text{cm}^2$ areas after high power laser exposure following by ambient atmosphere storage.

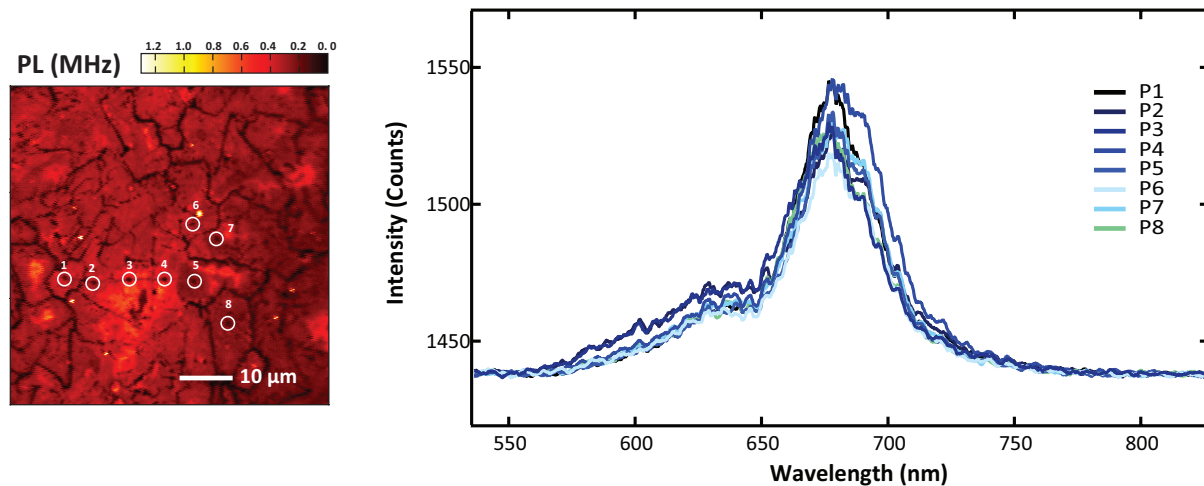


Figure S13. PL spectra of each point on the pristine monolayer MoS₂ film.

Condition	Peak Area (Count·nm)		
	B exciton	A exciton	Trion
Pristine	1,874 (18%)	7,541 (70%)	1,311 (12%)
Before the exposure of high power laser	1,180 (12%)	7,000 (72%)	1,612 (16%)
After the exposure of high power laser	398 (18%)	996 (46%)	790 (36%)
Kept in N ₂ for 10 hours	947 (16%)	2,938 (49%)	2,102 (35%)
Kept in ambient for 10 hours	1,774 (20%)	6,102 (67%)	1,203 (13%)

Table S1. The relative peak area of B exciton, A exciton, and trion from the pristine sample (Fig. 2), and the low dose $D = 0.3 \times 10^3 \mu\text{C}/\text{cm}^2$ sample that was exposed to the high-power laser (Fig. 6).