Supplementary Information for

Reversible Photoluminescence Modulation of Monolayer MoS_2 on Ferroelectric Substrate by Light Irradiation and Thermal Annealing

Peng Wang,[ac] Jian Wang,[a] Yun Zheng,[a] Hongyan Shi,[ab] Xiudong Sun,[ab] Wenjun Liu,[c] and Bo Gao*[ab]

[a]Institute of Modern Optics, School of Physics, Key Laboratory of Micro-Nano Optoelectronic Information System, Ministry of Industry and Information Technology, Key Laboratory of Micro-Optics and Photonic Technology of Heilongjiang Province, Harbin Institute of Technology, Harbin 150001, China

[b]Collaborative Innovation Center of Extreme Optics, Shanxi University, Taiyuan 030006, China

[c]Department of Physics, Harbin Institute of Technology at Weihai, Weihai 264209, China

*E-mail: gaobo@hit.edu.cn

1. Evaluation of the PDMS transfer process.

In order to evaluate the PDMS transfer process, we transferred CVD-grown monolayer MoS_2 onto hydrophilic SiO_2/Si substrate as a control, and performed a contrastive study by optical microscopy, micro-Raman and micro-PL spectroscopy. The optical images (Fig. S1a and S1b) show no obvious changes in morphology of monolayer MoS_2. The in-plane Raman mode E^1_{2g} (Fig. S1c) blue-shifted from 384.08 cm^{-1} to 384.65 cm^{-1} due to the release of growth-induced strain in MoS_2 after transfer. The out-plane mode A_{1g} unchanged, indicating no obvious doping in transferred MoS_2. Both samples displayed strong PL emission associated with the A and B exciton at 678 nm and 625 nm, respectively, suggesting that the band structure was not affected during the transfer process.

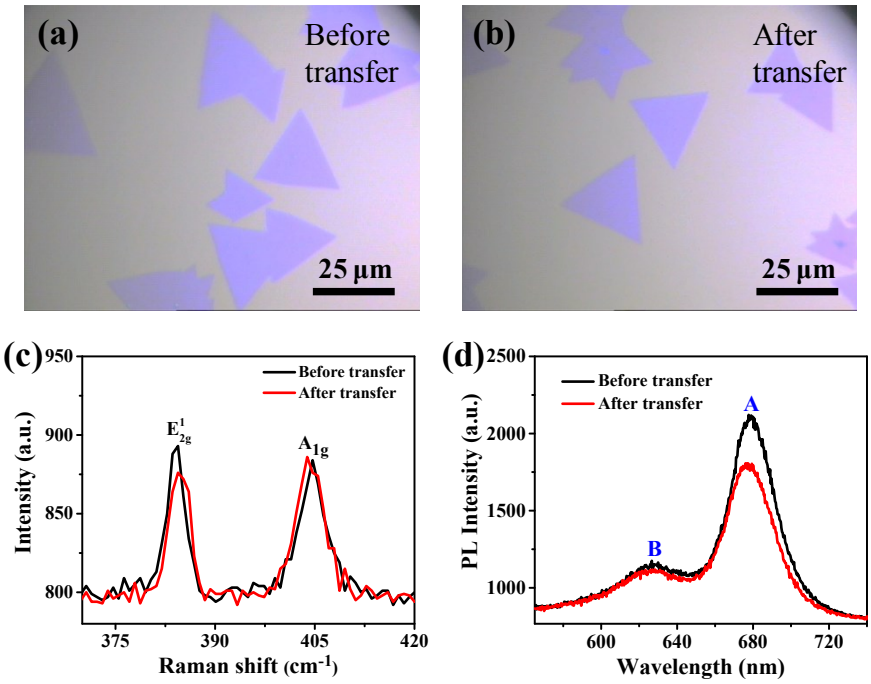

Fig. S1. Optical images of CVD-grown monolayer MoS_2 (a) before and (b) after transfer. (c) Raman spectra of MoS_2 before (black line) and after (red line) transfer. (d) PL spectra of MoS_2 before (black line) and after (red line) transfer.

2. PL spectra of as-grown MoS_2 before transfer.

Fig. S2 shows the PL spectra of as-grown MoS_2 before transfer. Both samples have uniform light emission, providing an excellent protype for this study.

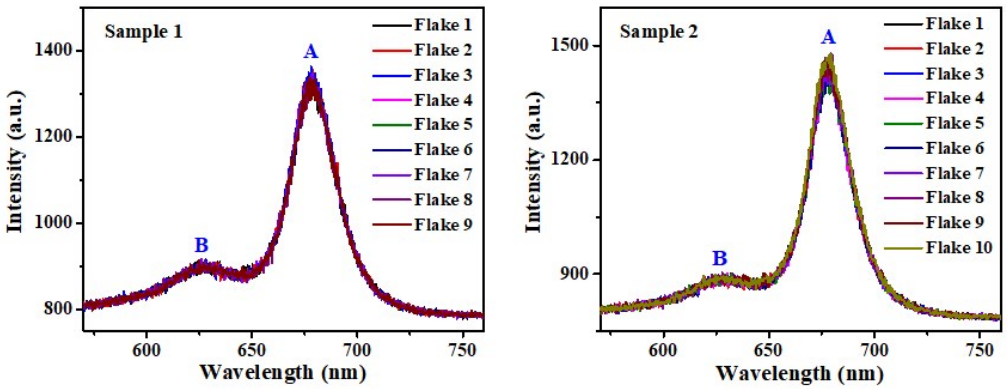

Fig. S2. PL spectra of two as-grown MoS_2 samples before transfer.

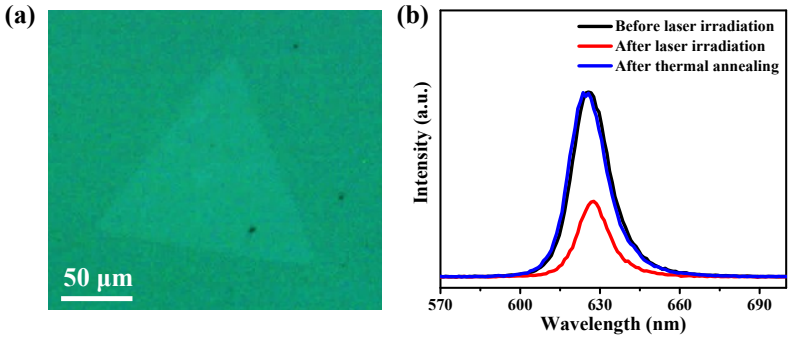

Fig. S3. (a) Optical image of CVD-grown monolayer WS_2 on P^+ Fe:$LiNbO_3$. (b) PL spectra of monolayer WS_2 on P^+ Fe:$LiNbO_3$ before laser irradiation, after laser irradiation and after thermal annealing. We also achieved reversible PL modulation of monolayer WS_2 on P^+ Fe:$LiNbO_3$ substrate by light irradiation and thermal annealing.