Supporting Information

Oxidation-Induced Modulation of Photoresponsivity in Monolayer MoS_2 with Sulfur Vacancies

Irfan H. Abidi,[1,*] *Ankit Bhoriya,*[1,2,3] *Pargam Vashishtha,*[1,2,3] *Sindhu Priya Giridhar,*[1] *Edwin LH Mayes,*[4] *Manoj* Sehrawat,[1,2,3] *Ajay Kumar Verma,*[1,2,3] *Vishnu Aggarwal,*[1,2,3] *Tanish Gupta,*[1] *H.K. Singh,*[2,3] *Taimur Ahmed,*[154] *Nita Dilawar Sharma,*[2,3] *Sumeet Walia*[1,*]

[1] School of Engineering, RMIT University, 124 La Trobe Street, Melbourne, Victoria 3001, Australia

[2] CSIR-National Physical Laboratory, Dr. K.S. Krishnan Marg, New Delhi 110012, India

[3] Academy of Scientific & Innovative Research (AcSIR), Ghaziabad, 201002, India

[4] RMIT Microscopy and Microanalysis Facility, RMIT University, Melbourne 3000, Australia

[5] School of Computing, Pak-Austria Fachhochschule, Institute of Applied Sciences and Technology, Haripur, 22620, Pakistan

[*] *Correspondence to: Irfan H. Abidi (*Irfan.haider.abidi@rmit.edu.au*) and*

*Sumeet Walia (*sumeet.walia@rmit.edu.au*)*

I.H. Abidi and A. Bhoriya are the equally contributing authors.

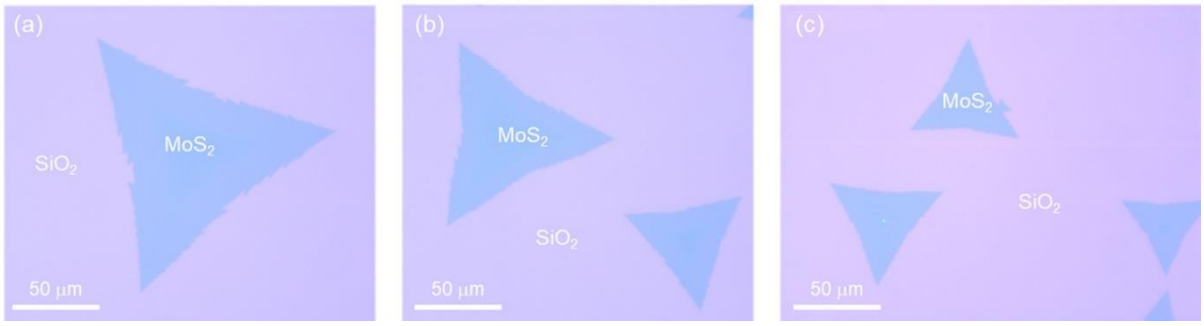

Figure S1. Optical images of LPCVD grown single-crystal MoS_2 flakes on 300 nm SiO_2/Si substrates.

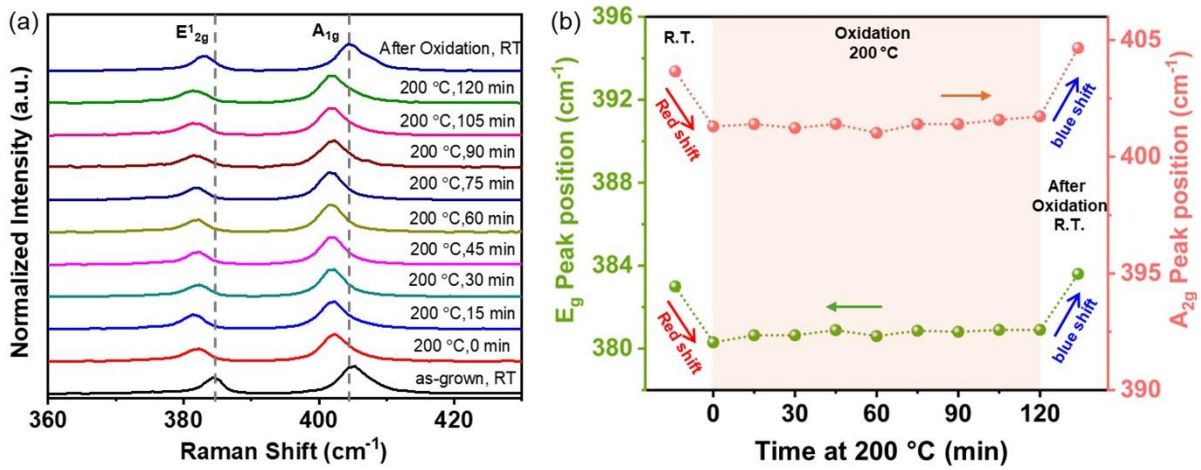

Figure S2. (a) Evolution of Raman spectra of as-grown MoS_2, acquired during in-situ Raman analysis while heating from RT to 200 °C and subsequent cooling down to RT. (b) Plot showing shift in the peak position of E^1_{2g} and A_{1g} Raman modes with heating to 200 °C and cooling to RT.

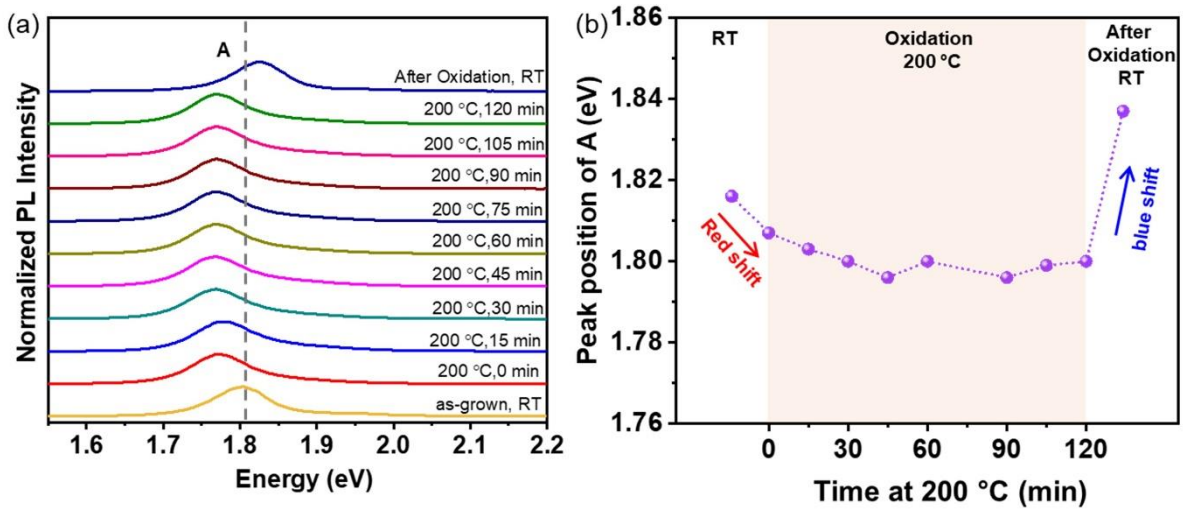

Figure S3. (a) Evolution of PL spectra of as-grown MoS_2, acquired during in-situ PL analysis while heating from RT to 200 °C and subsequent cooling down to RT. (b) Plot showing shift in the peak position of A exciton during heating to 200 °C and cooling to RT.

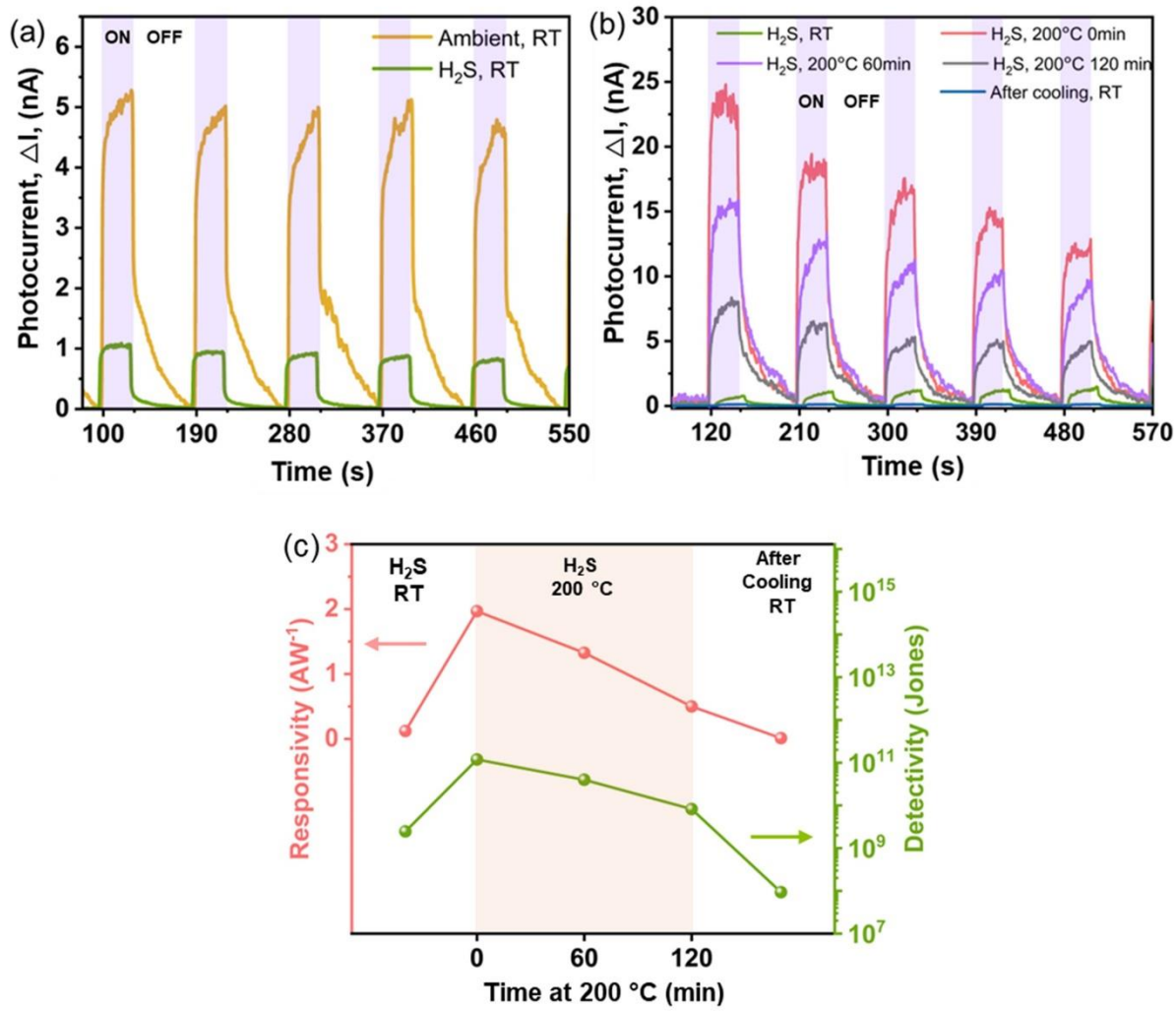

Figure S4. (a) Time-resolved photoresponse of as-grown MoS_2 based photodetector device tested under ambient conditions and H_2S environment. (b) Temperature-dependent transient photoresponse of the MoS_2 based device tested under H_2S environment. For this measurements, illumination wavelength of 660 nm, 3 mW/cm^2 of power density, and drain-source voltage (V_{DS}) of 1V are used. (c) Temperature correlated performance parameters (responsivity and detectivity) of the device tested in H_2S environment.