

Supplementary Information

Selective and local flash-annealing for improvement in contact characteristics of MoS₂ transistors

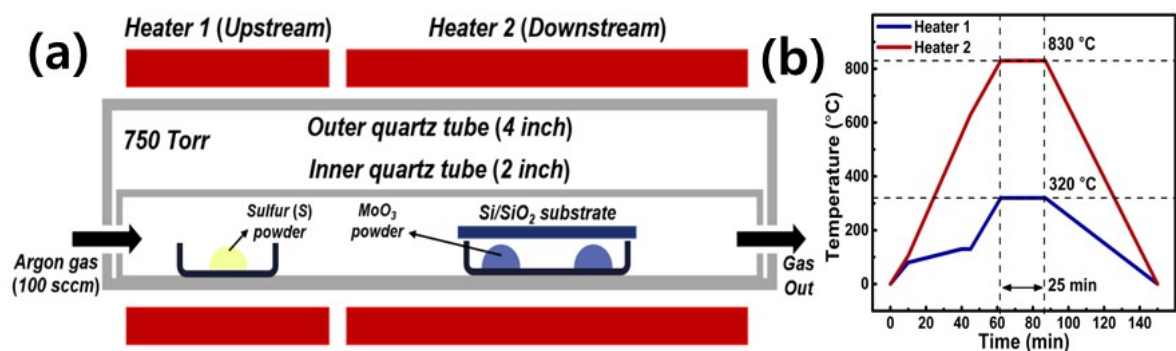
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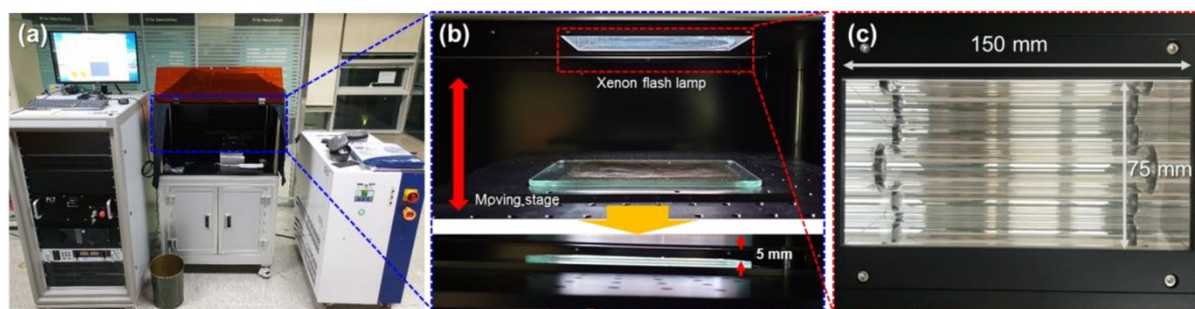
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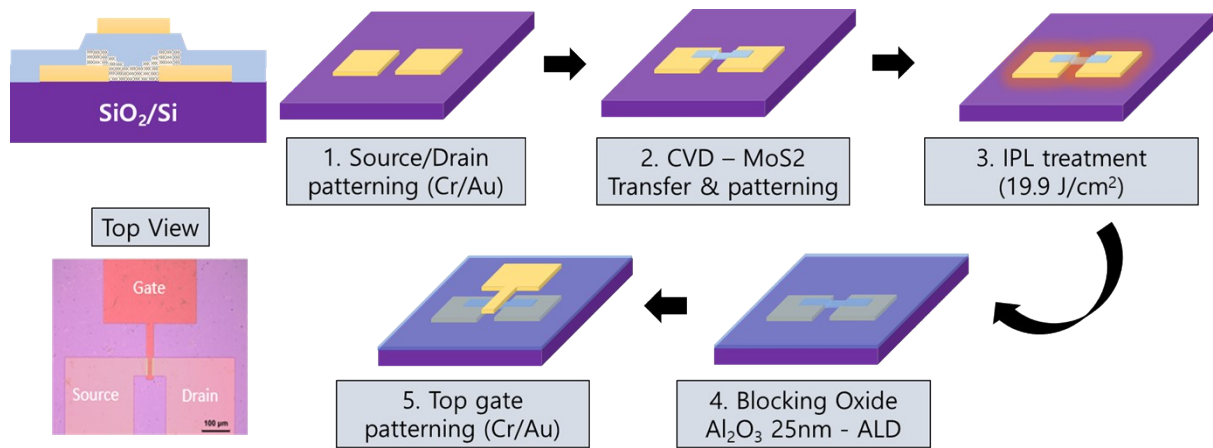
†These authors contributed equally to this work.



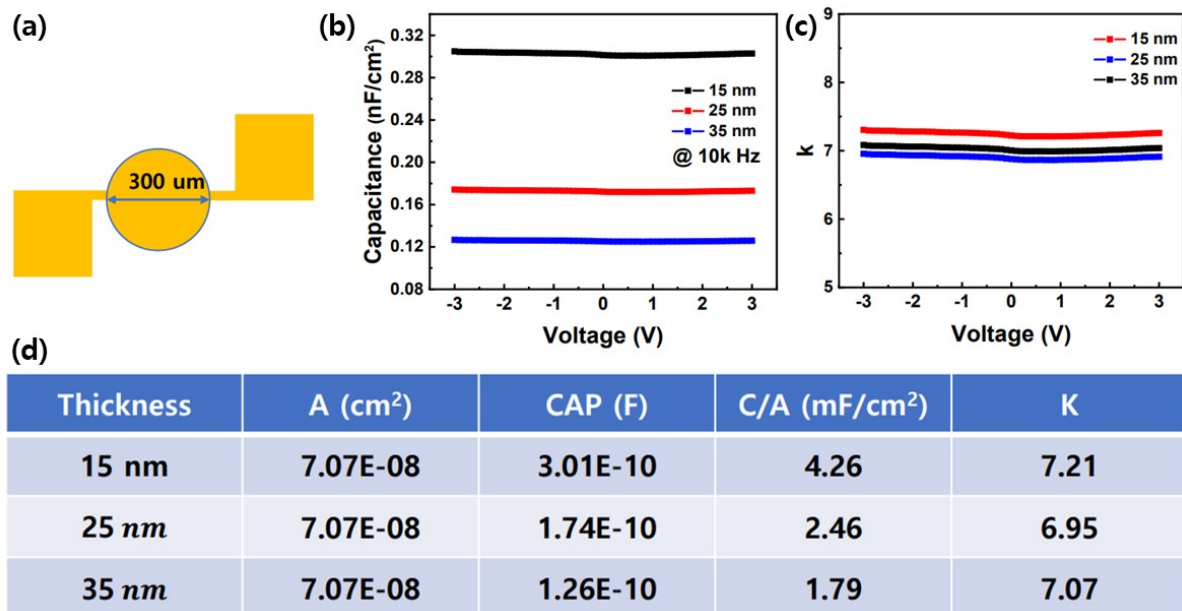
Supplementary Fig. 1. (a) Schematic of powder-based chemical vapor deposition (CVD) equipment for molybdenum disulfide. (b) Temperature-time profile of the CVD MoS₂.



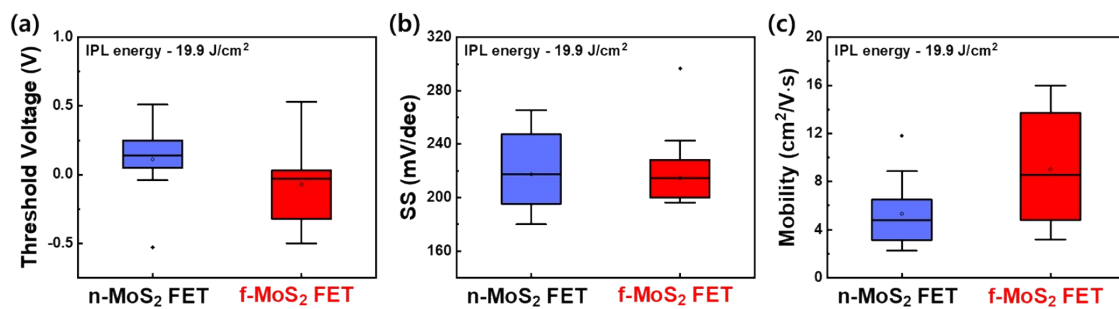
Supplementary Fig. 2. Optical images of (a) intensive pulsed light (IPL) system, (b) IPL moving stage, and (c) IPL xenon flash lamp.



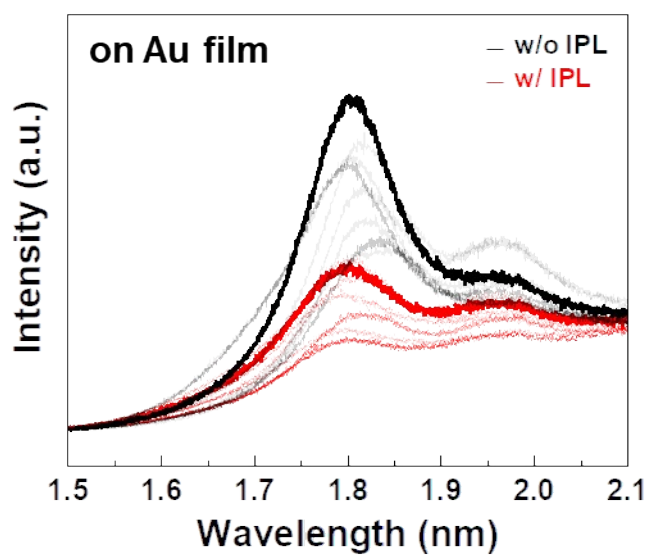
Supplementary Fig. 3. Schematic images of device fabrication processes.



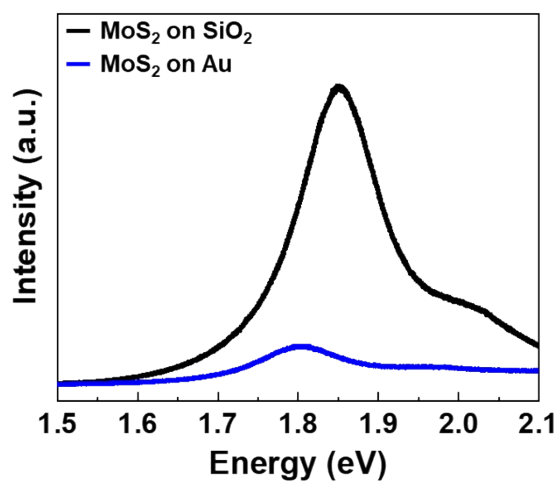
Supplementary Fig. 4. (a) Schematic image of the MIM pattern measured on various Al₂O₃ thickness (15–35 nm). (b) Capacitance-voltage characteristics of the Au/Al₂O₃/Au structure. (c) Extracted dielectric constant on Al₂O₃ thickness from the (b). (d) Dielectric properties of the Al₂O₃ gate insulator on thickness deposited by atomic layer deposition.



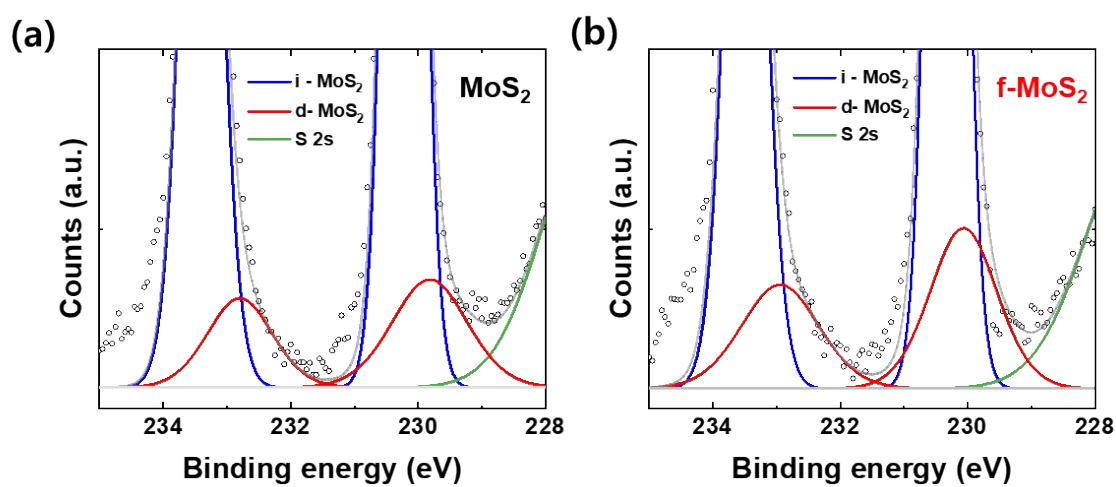
Supplementary Fig. 5. Distribution of (a) threshold voltage, (b) SS and (c) mobility in n-MoS₂ FET and f-MoS₂ FET.



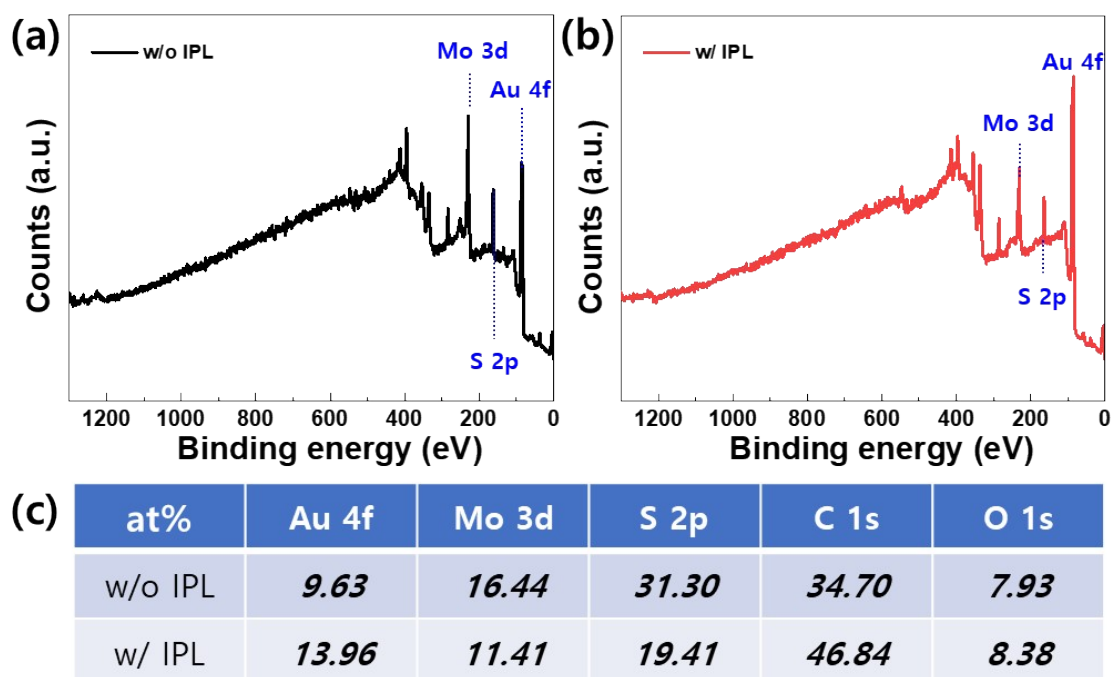
Supplementary Fig. 6. Photoluminescence (PL) spectra of MoS₂ and f-MoS₂ on Au. For the optical measurement on Au, 15 points from a couple of MoS₂ samples were obtained.



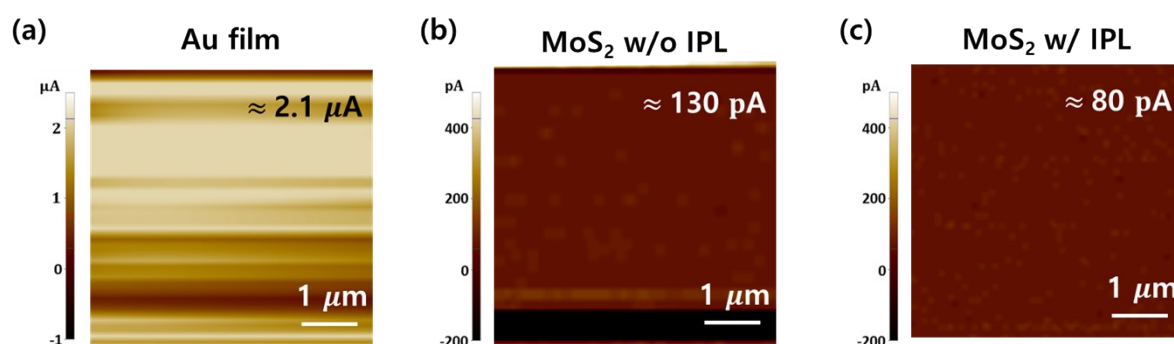
Supplementary Fig. 7. PL spectra of MoS₂ on SiO₂ (black) and Au (blue). Significant photoluminescence quenching was found owing to charge transfer from Au to MoS₂ after the MoS₂ was transferred on the Au thin film.



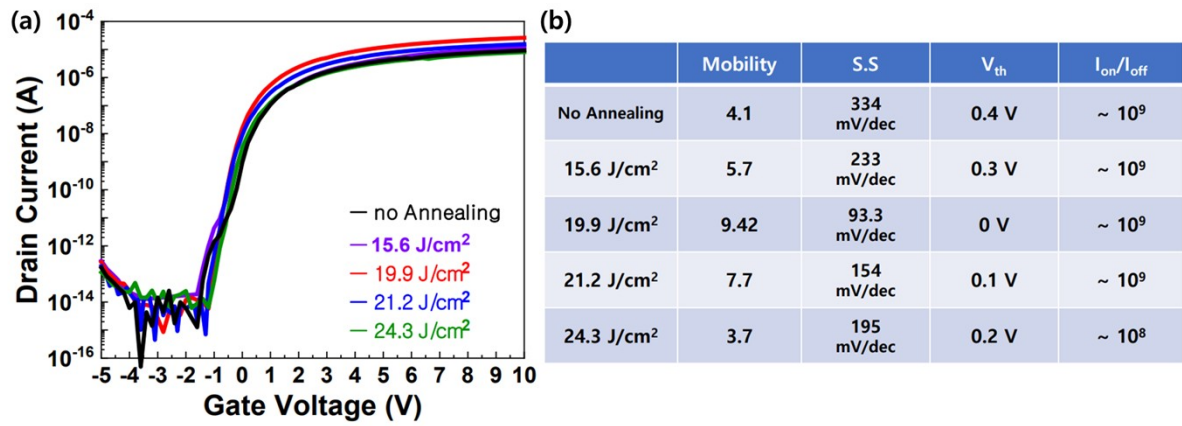
Supplementary Fig. 8. Zoomed-in XPS spectra of Mo 3d, showing a clear comparison of d-MoS₂ content in (a) MoS₂ and (b) f-MoS₂.



Supplementary Fig. 9. Survey XPS spectrum of (a) MoS₂ and (b) F-MoS₂ on Au film. Note that MoS₂ thin films treated with the flash exposure was denoted as F-MoS₂ in Manuscript. (c) Surface concentration (atomic percent) determined by XPS for MoS₂ (w/o IPL) and F-MoS₂ (w/ IPL) on Au film.



Supplementary Fig. 10. Conductive atomic force microscopy (C-AFM) mapping images of Au film, MoS₂ on Au film, and f-MoS₂ on Au film.



Supplementary Fig. 11. Transfer curves of the MoS₂ FETs on the flash annealing processes of various light energies from 15.6 to 24.3 Jcm⁻² (15.6, 19.9, 21.2, and 24.3 Jcm⁻²). It was found that the devices irradiated with the light energy density of 19.9 Jcm⁻² exhibits the best performance.

Supplemental References

1. Cho, Soo-Yeon, Hyeong-Jun Koh, Hae-Wook Yoo, Jong-Seon Kim, and Hee-Tae Jung. "Tunable volatile-organic-compound sensor by using Au nanoparticle incorporation on MoS₂." *ACS sensors* 2, no. 1 (2017): 183-189.