

Supporting Information

Hexagonal Boron Nitride for Surface Passivation of Two-dimensional van der Waals Heterojunction Solar Cells

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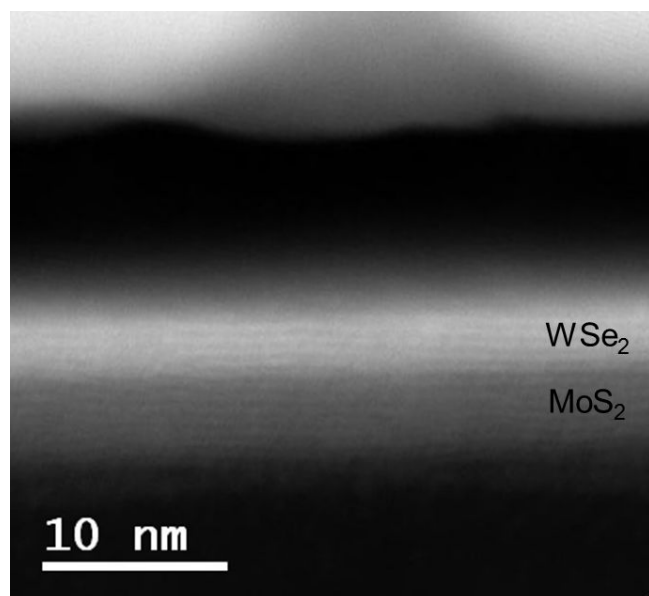


Figure S1. STEM image of the cross-section of a MoS₂/WSe₂/h-BN heterojunction solar cell. MoS₂ and WSe₂ layers are clearly distinguished by the contrast. H-BN, which is placed on top of WSe₂ layers, is not seen here due to its light-weighted atomic elements.

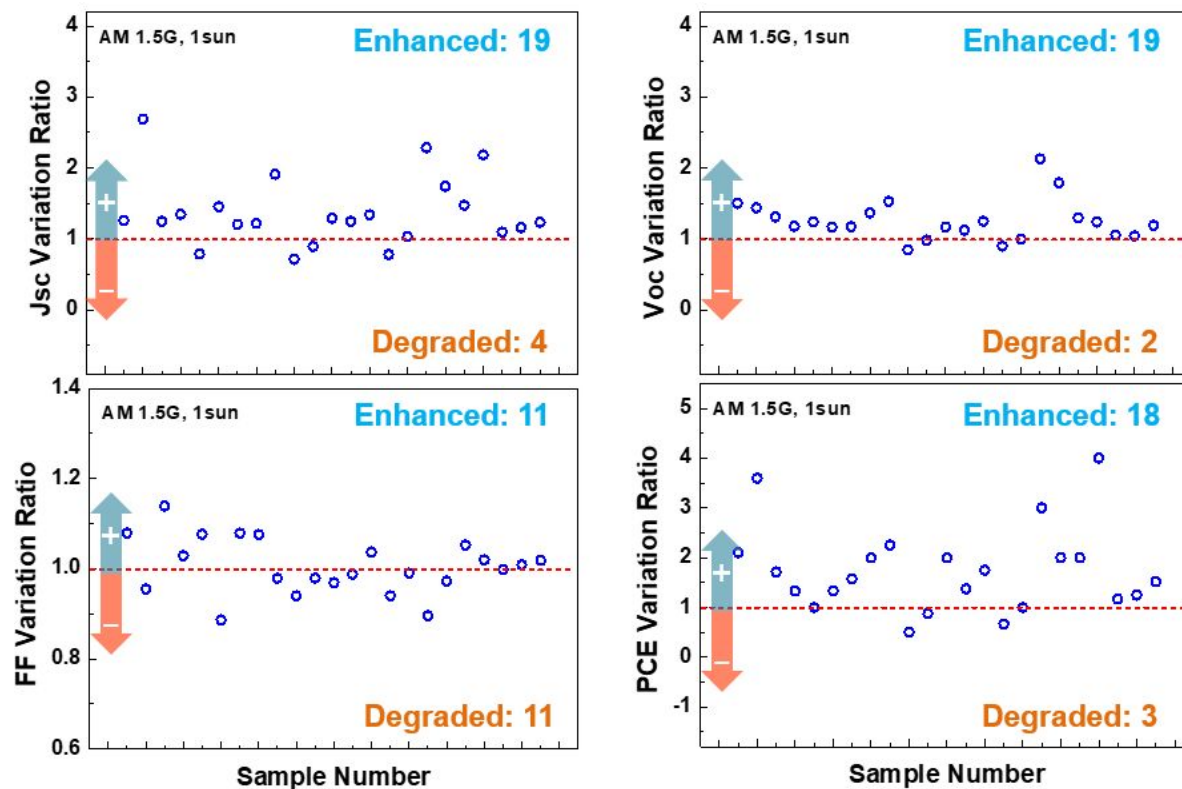


Figure S2. Plots of parameter variation ratio showing the data of all samples with indication on the number of samples which have shown enhancement or degradation after h-BN passivation.

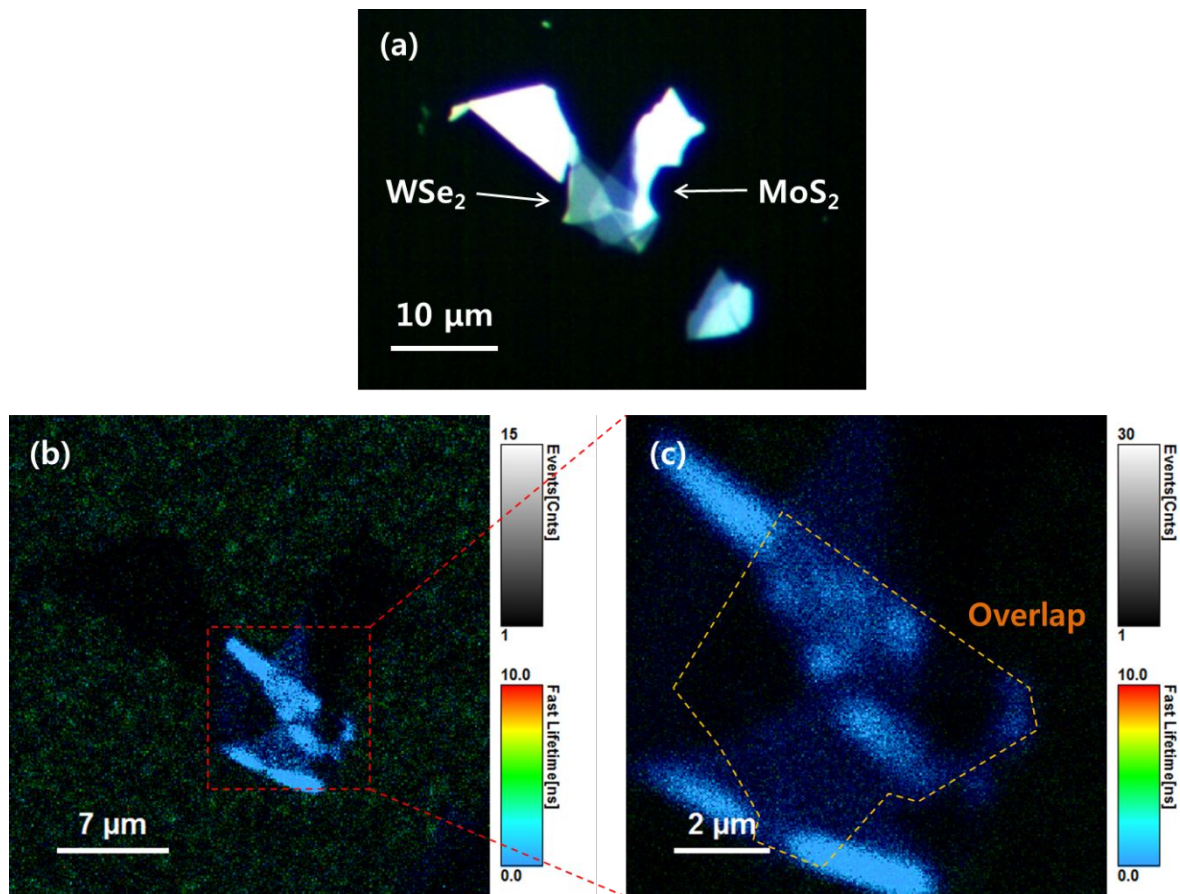


Figure S3. (a) Optical microscope image and (b), (c) TRPL mapping image of the measured $\text{MoS}_2/\text{WSe}_2$ heterostructure sample. For the TRPL images, each pixel exhibit information on both PL intensity and carrier recombination lifetime by brightness and color.

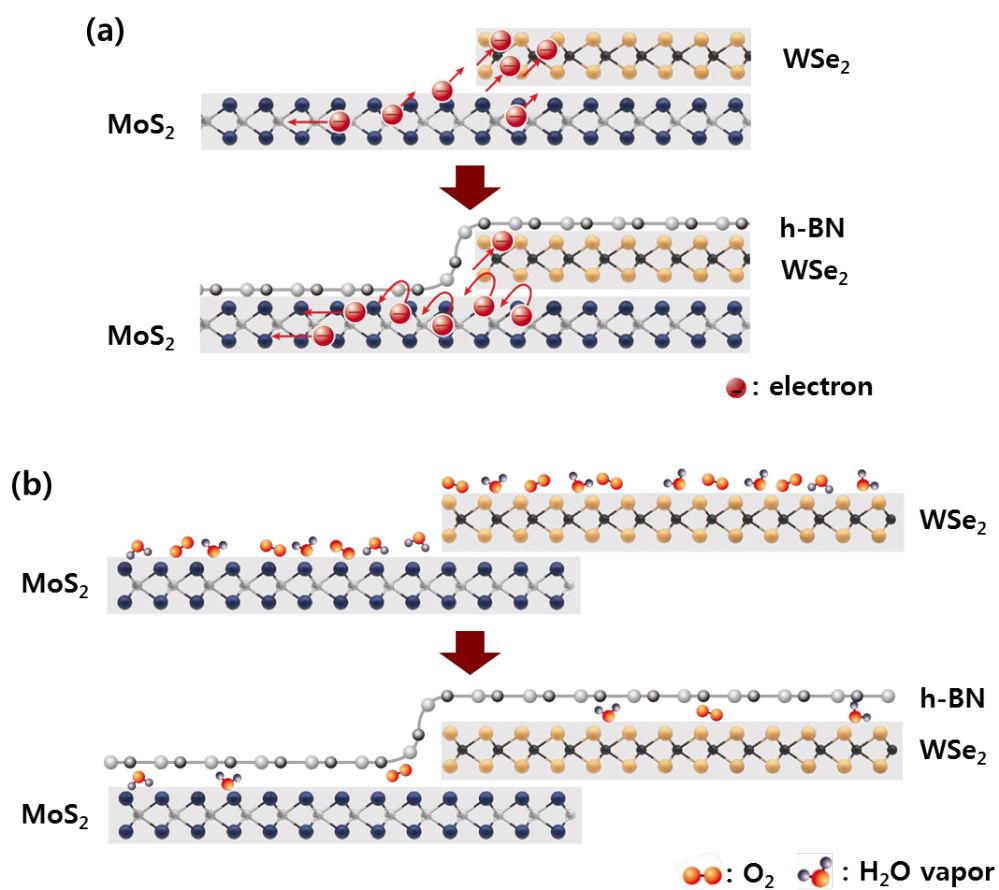


Figure S4. Schematic images describing the mechanism of carrier recombination suppression caused by the top h-BN passivation layer, at (a) the MoS₂/WSe₂ overlap and (b) the surface of non-overlapped MoS₂ and WSe₂ of the heterojunction device.

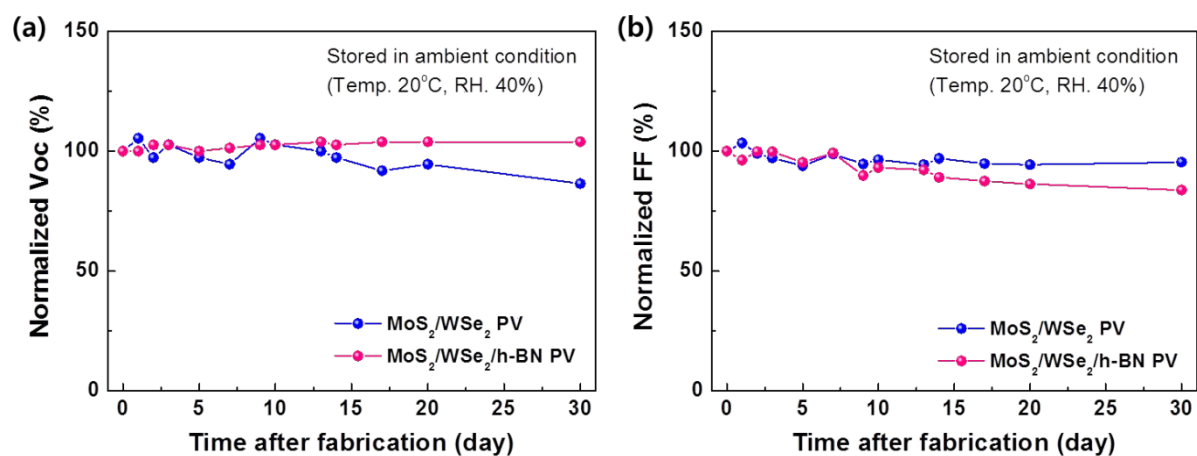


Figure S5. Evolution of (a) V_{OC} and (b) FF recorded from our MoS₂/WSe₂ solar cells without and with h-BN passivation layer for 30 days after fabrication, stored in ambient of room temperature and 40 % humidity condition.