

# **A Numerical Investigation on the Combined Effects of MoSe<sub>2</sub> Interface Layer and Graded Bandgap Absorber in CIGS Thin Film Solar Cells**

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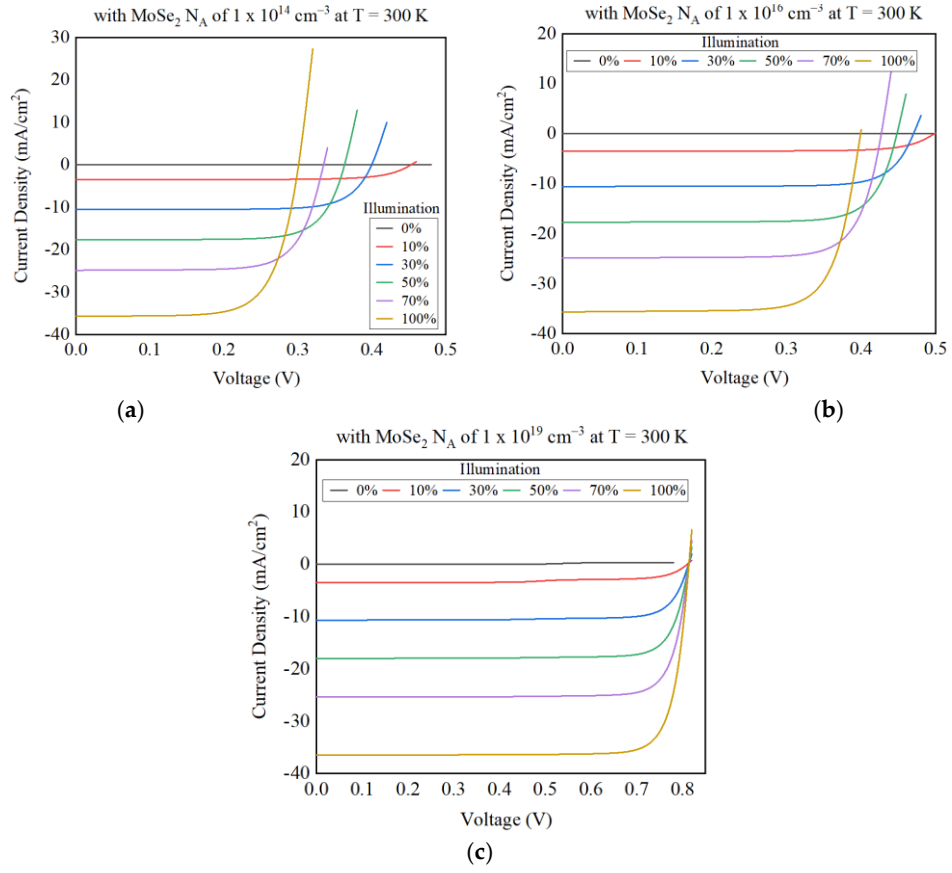
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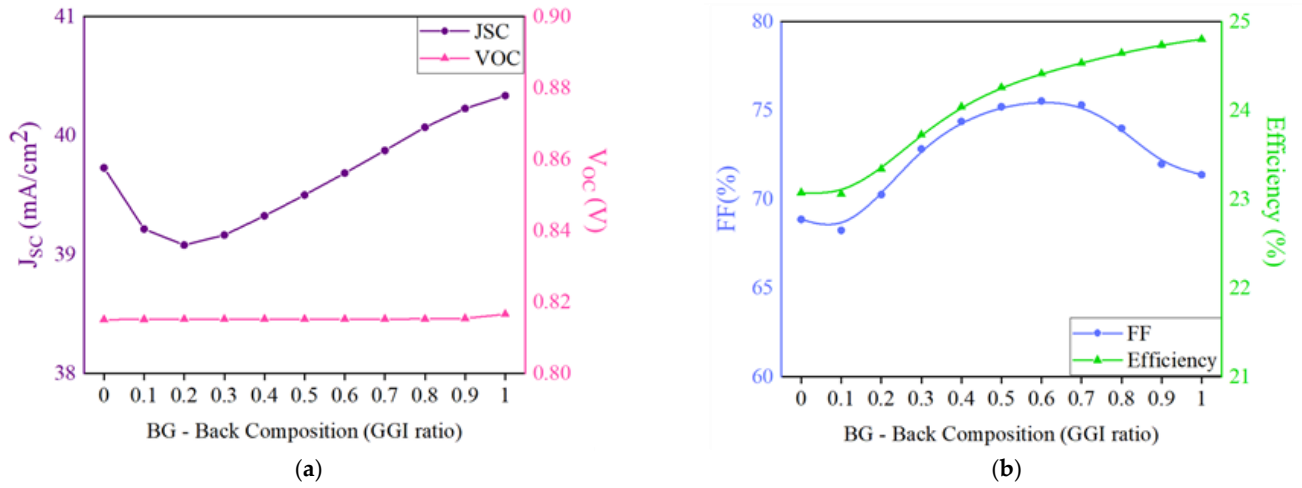
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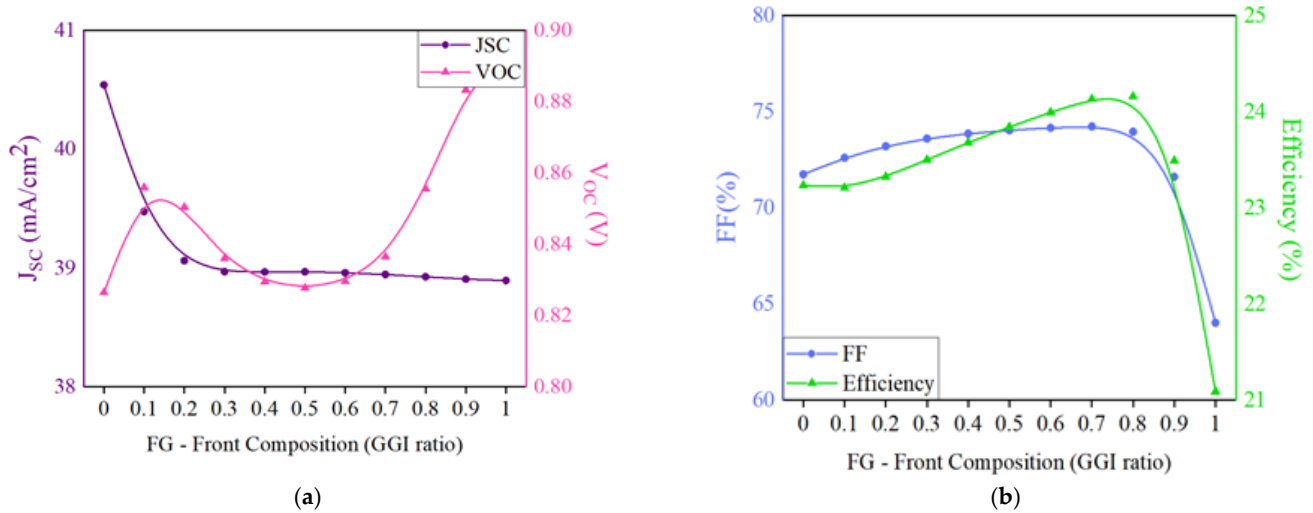
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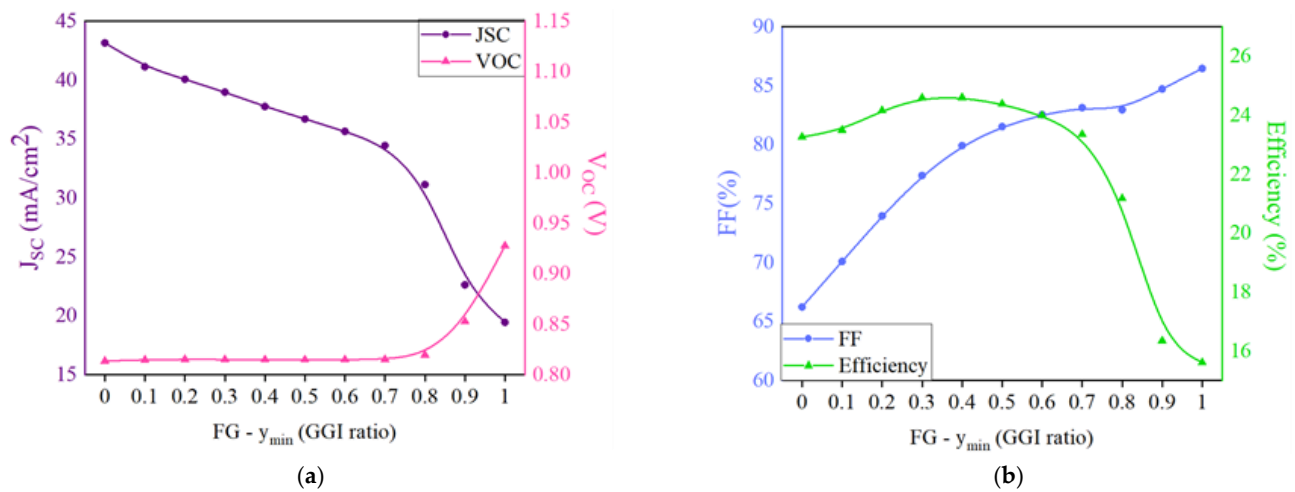
**Figure S1.** Measured J–V curves with different illumination values. Plots (a–c) correspond to the simulated CIGS device with carrier concentration of  $\text{MoSe}_2$  interfacial layer of  $1.0 \times 10^{14}$ ,  $1.0 \times 10^{16}$ , and  $1.0 \times 10^{19}$   $\text{cm}^{-3}$ , respectively, at  $T = 300$  K.



**Figure S2.** Electrical parameters as a function of back (CIGS/ $\text{MoSe}_2$  interface) composition ranging from 0 to 1 for BG structure (a)  $J_{sc}$  and  $V_{oc}$  (b) FF and conversion efficiency (PCE).



**Figure S3.** Electrical parameters as a function of front (CdS/CIGS interface) composition ranging from 0 to 1 for FG structure (a)  $J_{sc}$  and  $V_{oc}$  (b) FF and conversion efficiency (PCE).



**Figure S4.** Electrical parameters as a function of as a function of lowest composition value ( $y_{min}$ ) in the bulk region of CIGS absorber layer for FG bandgap profile (a)  $J_{sc}$  and  $V_{oc}$  (b) FF and conversion efficiency (PCE).