**Single-graded CIGS with narrow bandgap for tandem solar cells**

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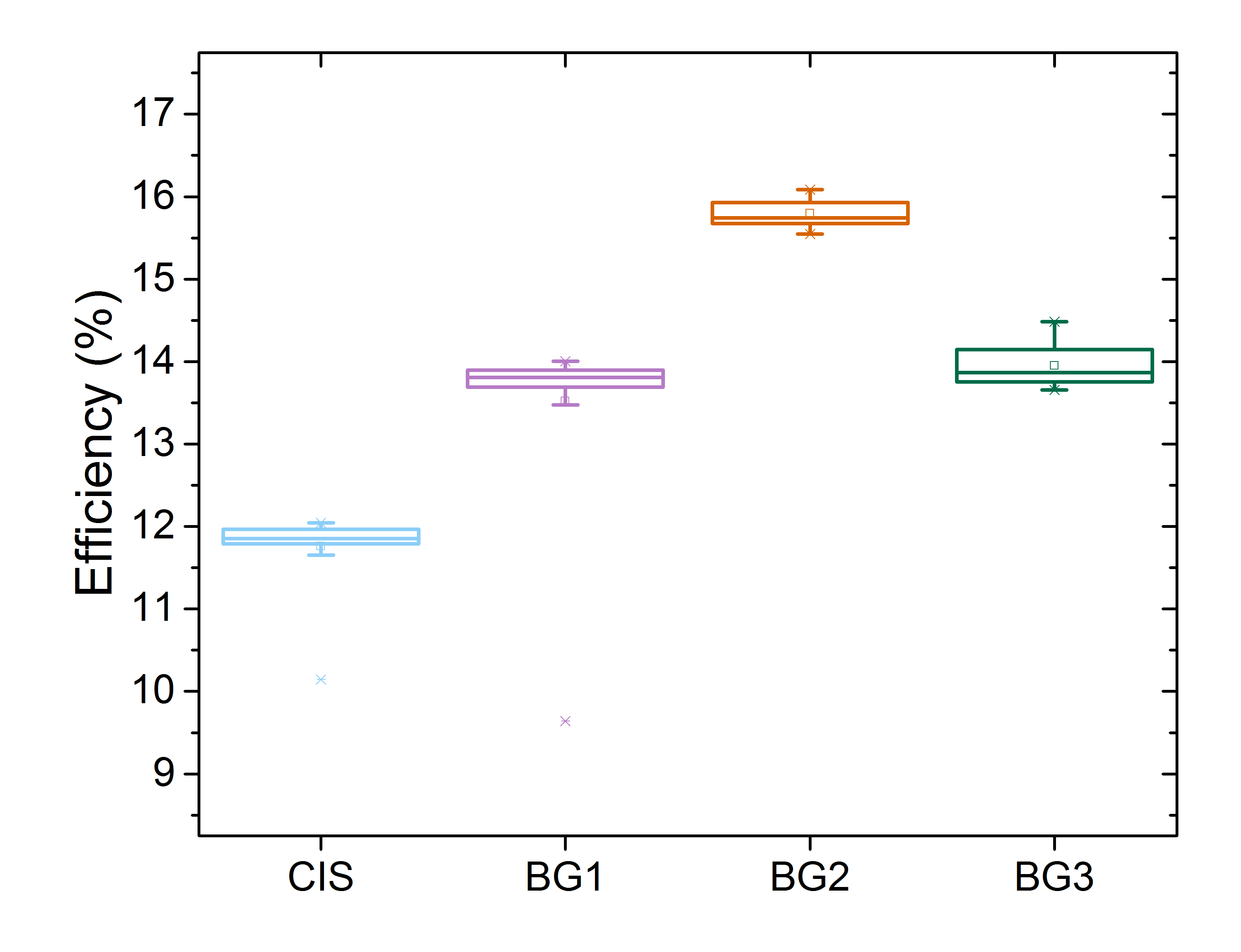
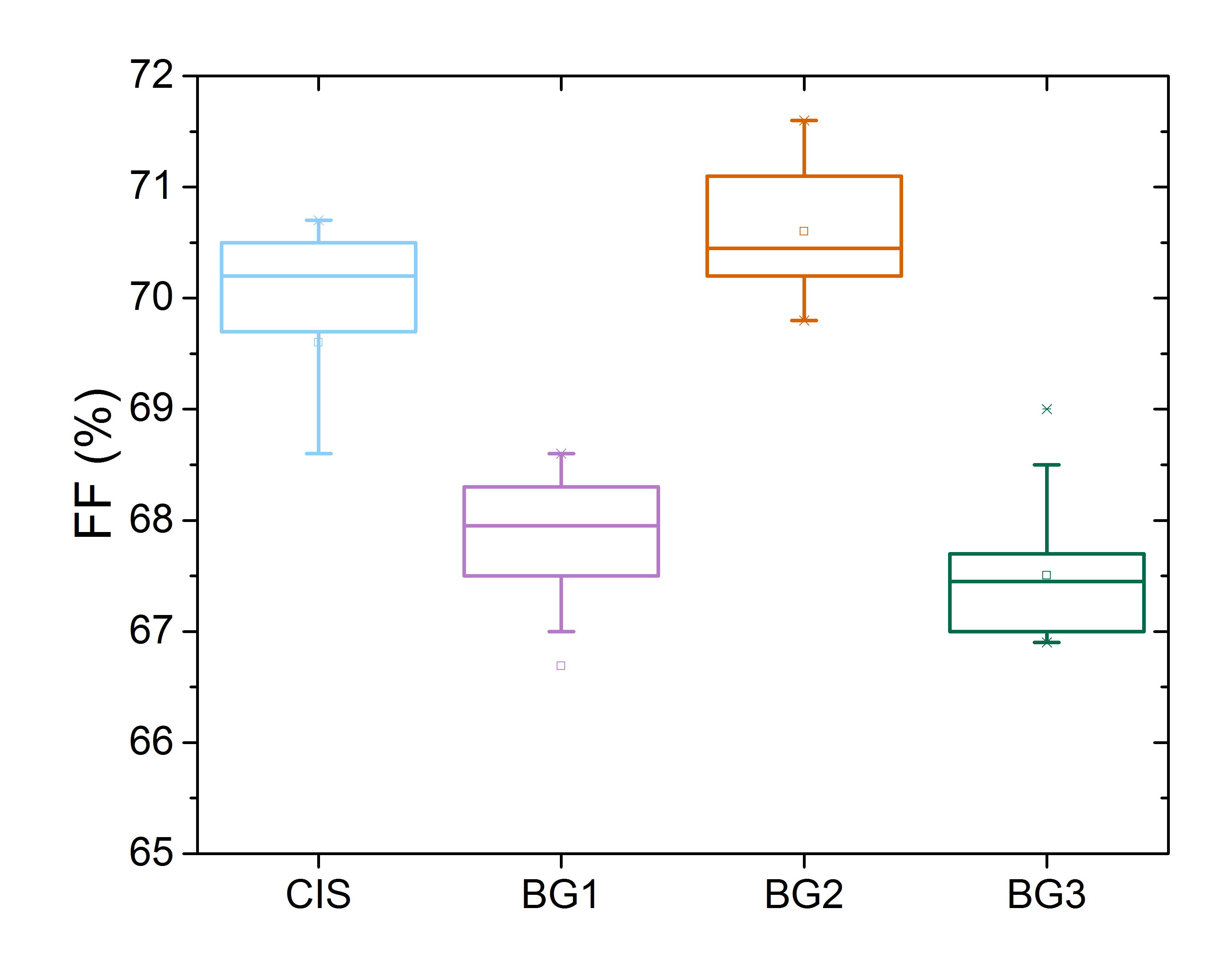
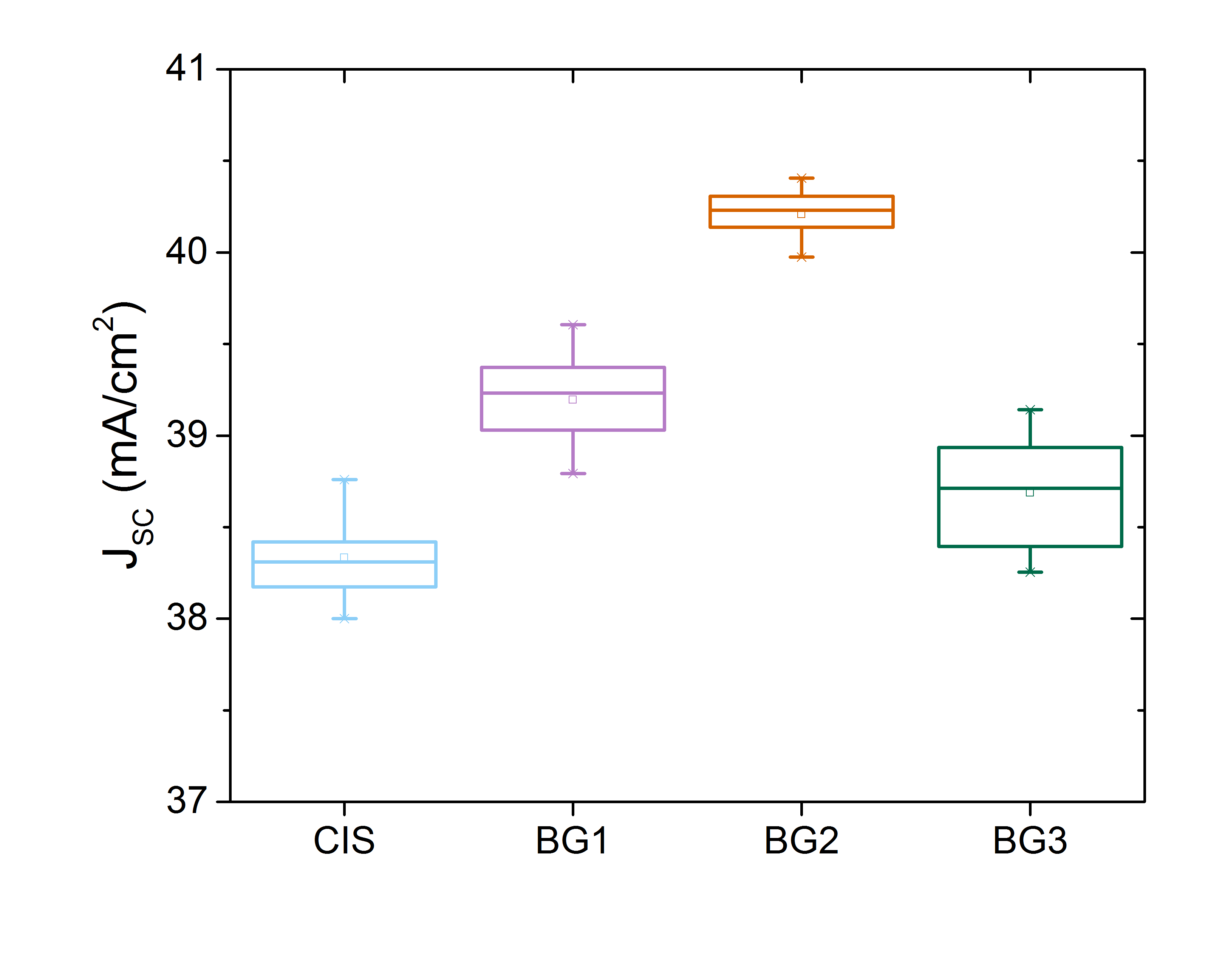
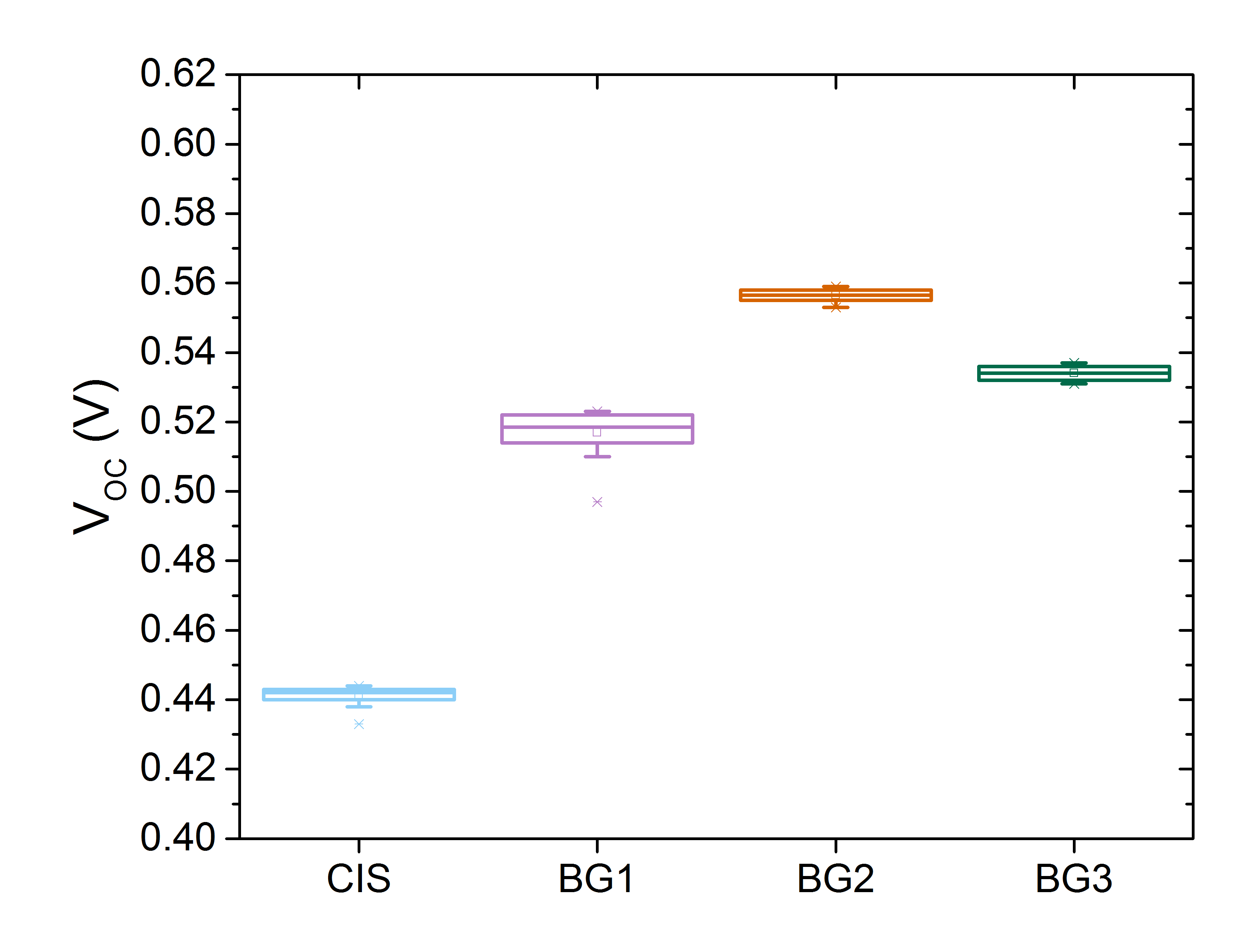
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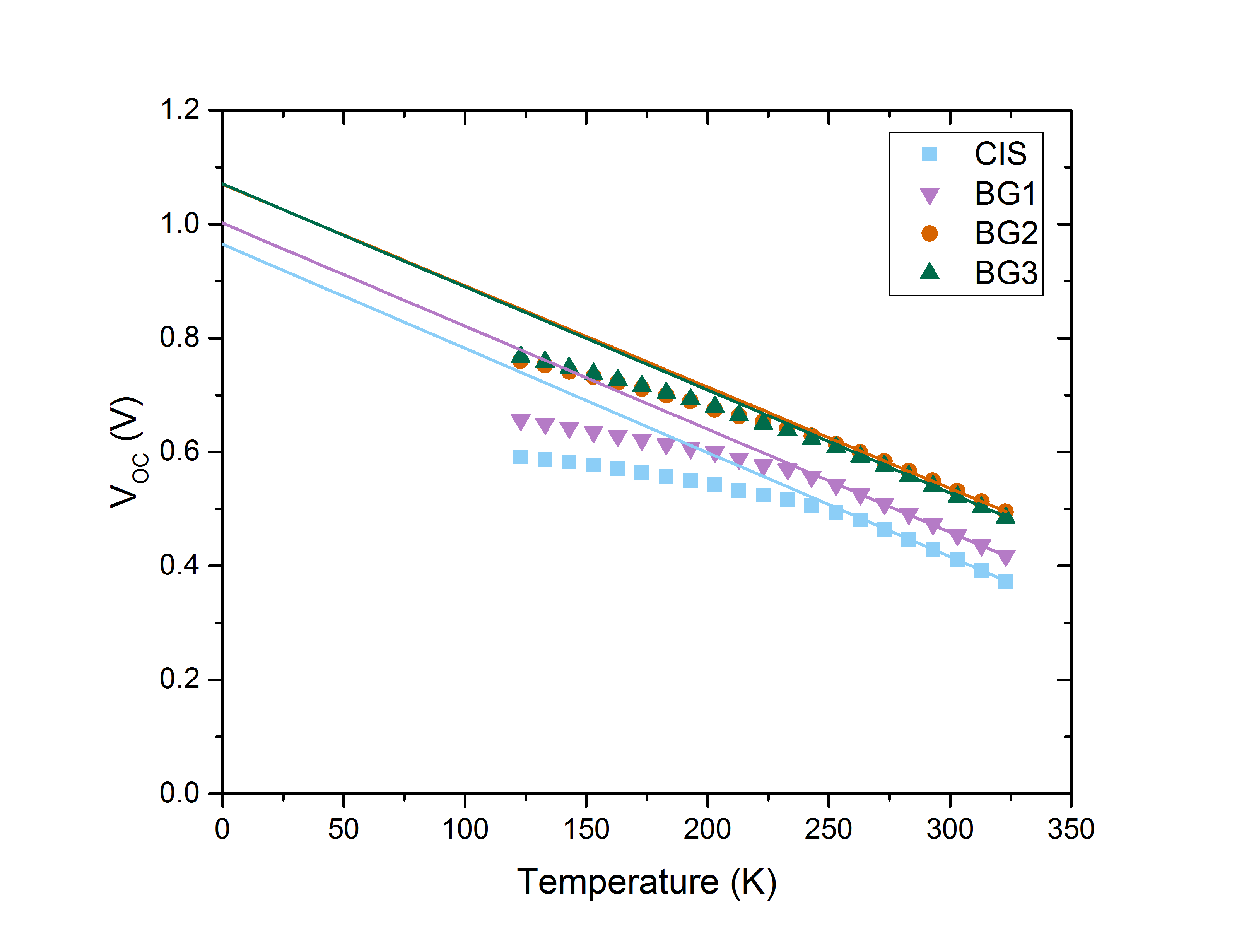
Single graded CIGS with low band gap for tandem solar cells

# Supplementary information



Supplementary Figure 1: JV- parameters of the samples with back grading in this work. Statistics over 18 cells each.

Supplementary Figure 2: Absorption of lifted of absorbers and representing bandgap extraction. The Absorption is extracted as 1-T/(1-R). The values do not reach 0 due to light-trapping inside the layer during the measurement.



Supplementary Figure 3: VOC-T plot for the cells investigated in this experiment. The extrapolation of the linear region gives activation energies below bandgap for the non- or only weakly graded cells

**Tables**

*Supplementary Table 1:* Fitting results of the IV curves presented in Fig. 1 using a one-diode model including series and parallel resistances. Rsillu and Rpillu is fitted on the illuminated curve and averaged over 16 or more cells while Rpdark, J0 and A are fitted on the dark *JV* curve.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | GGI | Rsillu  (Ω cm2) | Rpillu  (Ω cm2) | Rpdark  (Ω cm2) | J0  (mAcm-2) | A  (-) |
| CIS | 0.00 | 0.33 | 510 | 4600 | 2.05E-5 | 1.24 |
| BG1 | 0.04 | 0.23 | 460 | 1600 | 4.71E-5 | 1.54 |
| BG2 | 0.06 | 0.35 | 1240 | 2800 | 5.42E-5 | 1.66 |
| BG3 | 0.09 | 0.23 | 530 | 2500 | 1.19E-4 | 1.71 |