Supporting information S1

Is a passivated back contact always beneficial for Cu(In,Ga)Se_2 solar cells?

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SCAPS models: The CIGSe solar cell has a configuration of ZnO (300 nm, illumination side)/CdS (50 nm)/CIGSe 1 (50 nm)/CIGSe 2 (*d* nm)/back contact from top to bottom. To create a Ga grading towards the back contact, two absorbers are introduced without interface defects. The front absorber (CIGSe 1, close to CdS) has a bandgap of 1.2 eV and the rear absorber (CIGSe 2, close to the back contact) has a bandgap grading from 1.2 to 1.5 eV. The absorbers have a doping concentration of 1E16 cm-3. A back barrier potential of 0.4 eV (with respect to the valance band) is fixed for creating a Schottky contact. The absorber has a diffusion length of 720 nm for electrons. The definition file can be directly obtained from the authors. The band diagram for the thick cell is shown in Figure S1. Figure S2 plots the dependence of light *jV* curves on the back interface recombination velocity for thick (*d* = 2000 nm) and ultrathin (*d* = 450 nm) CIGSe solar cells.

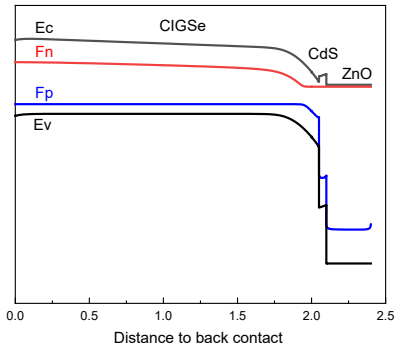

Figure S1 Band diagram of thick CIGSe solar cells.

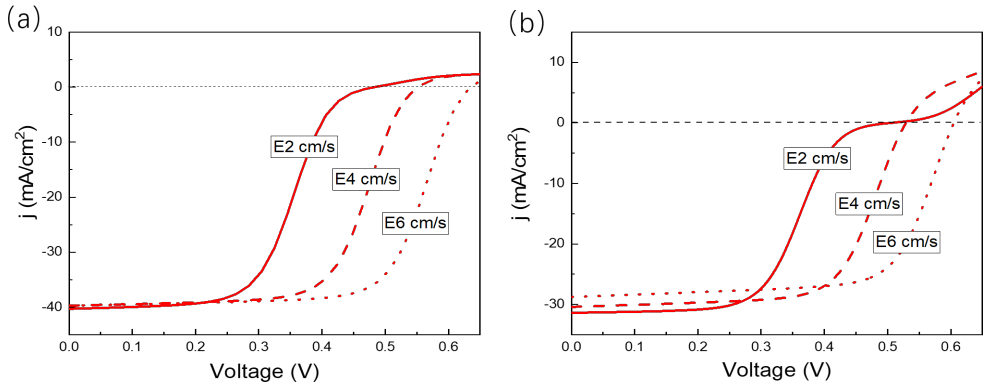

Figure S2 Dependence of light *jV* curves of (a) thick and (b) ultrathin CIGSe solar cells on back interface recombination velocity S_b.