Supporting Information for

Classification of solar cells according to mechanisms of charge separation and charge collection

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1. Equations used for Fig. 3

For the calculation of the average collection efficiency $\overline{f}_c$ for drift-dominated transport the equation

$$\overline{f}_c = 2\mu\tau\frac{V_{bi}-V}{d^2}\left(1-\exp\left(-\frac{d^2}{2\mu\tau(V_{bi}-V)}\right)\right). \quad \text{(S1)}$$

For a derivation, see ref. [1] for the case $\mu_n = \mu_p = \mu$.

The equation for the collection efficiency for diffusive transport just follows from using

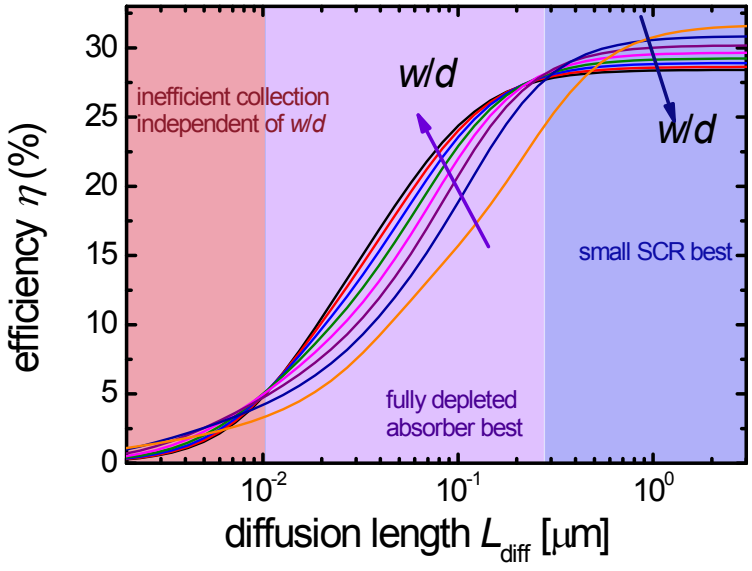
$$f_c(x) = \exp(-x/L_{diff}). \quad \text{(S2)}$$

for the position dependent collection efficiency for infinitely long slap of semiconductor (ignoring surface recombination). If the position dependent collection efficiency is averaged over position we obtain

$$\overline{f}_c = \frac{L_{diff}}{d}\left(1-\exp\left(-\frac{d}{L_{diff}}\right)\right) \quad \text{(S3)}$$

which was used for Fig. 3.

2. Alternative Fig. 4 with different thickness (d = 150 nm)



For the preparation of this graph, the parameters were the same as for Fig. 4 (see table below), except for the doping concentrations and the generation rate. For the doping concentrations the parameter were adjusted such that the ratios w/d stay the same as in Fig. 4 and the generation rate was adjusted such that the maximum J_{sc} stays the same. The latter has hardly any relevance for the qualitative trends because it just scales the efficiencies.

3. Table of parameters used for Fig. 4

Note: The values for the generation rate and the band gap are chosen to be similar to those of silicon to make sure that the efficiencies in the plot do not exceed the Shockley-Queisser limit.

name of physical quantity	symbol [unit]	value
Band mobility	$\mu_n = \mu_p$ [cm^2/Vs]	variable
Effective density of states	$N_C = N_V$ [cm^{-3}]	10^{19}
SRH lifetime	τ	1 µs
Band gap	E_g [eV]	1.1
thickness	d [nm]	1000
relative permittivity	ε_r	10
Doping concentration	N_A [cm^{-3}]	variable
Surface recombination velocity	S [cm/s]	10
Contact barrier heights	φ_b [meV]	0.05
(spatially constant) generation rate	G [cm^{-3}s^{-1}]	2.6×10^{21}

max. possible short circuit current	$J_{sc,max}$ [mA/cm^2]	42

Reference List

[1] R. S. Crandall, *J. Appl. Phys.* **1982**, *53*, 3350.