## Charge Carrier Mobility Dependent Open-Circuit Voltage in Organic and Hybrid Solar Cells

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**Abstract :** A better understanding of the open-circuit voltage (Voc) related losses in organic solar cells (OSCs) is desirable in order to assess the photovoltaic performance of these devices. We have derived Voc as a function of charge carrier mobilities ( $\mu e$  and  $\mu h$ ) for organic and hybrid solar cells by optimizing the drift-diffusion current density. The optimum Voc thus obtained depends on the energy difference between the highest occupied molecular orbital (HOMO) level and the quasi-Fermi level of holes of the donor material. We have found that the Voc depends on the ratio of the electron ( $\mu e$ ) and hole ( $\mu h$ ) mobilities and when  $\mu h > \mu e$  the Voc increases. The most important loss term in the Voc arises from the energetics of the donor and acceptor materials, which will be discussed in detail in this paper.

Keywords : charge carrier mobility, open-circuit voltage, organic solar cells, quasi-fermi levels

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