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Influence Of Light Absorption Profile On The Performance Of Organic Photovoltaics
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Abstract
ABSTRACT: We investigate how an enhanced light absorption at a specific position inside the active layer affects the performance of organic photovoltaic cells (OPVs), namely the short-circuit current density (Jsc), the open-circuit voltage (Voc), the fill factor(FF), and the power conversion efficiency (PCE). The performance is calculated using an updated version of a previously published analytical current-voltage model for OPVs, where the updated model allows the light absorption profile to be described by any functions provided that analytical solutions can be produced. We find that the light absorption profile affects the performance through the drift current. When the mobility imbalance is not very high (when the ratio of the mobility of the faster carrier type to the mobility of the slower carrier type is less than about 103), the PCE is maximized whenthe light absorption is concentrated at the center of the active layer. When the mobility imbalance is very high (when the ratio of the mobility of the faster carrier type to the mobility of the slower carrier type is more than approximately 104), the PCE ismaximized when the light absorption is concentrated near the electrode collecting the slower carrier type. Therefore, it is important to ensure that the light absorption profile is properly tuned so that the performance of OPVs is maximized. Moreover, any efforts that we make to improve the performance should not lead to a light absorption profile that would actually impair the overall performance.

Author Keywords
carrier mobility; fill factor; open-circuit voltage; power conversion efficiency; short-circuit current

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