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Influence of Active Layer Thickness on the Performance of Organic Photovoltaics with Light Trapping (Article)

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Abstract

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To maximize the performance of a photovoltaic device, light trapping is necessary. In this paper, we theoretically investigate the effect of active layer thickness on the performance of organic photovoltaic (OPV) cells with ideal light trapping . Although actual light trapping schemes are not ideal, this paper can still be useful in guiding us in maximizing the performance of actual OPVs with light trapping . The effect of active layer thickness on the power conversion efficiency (PCE), short-circuit current, open-circuit voltage, and fill factor (FF) of OPVs with ideal light trapping is described in this paper. For a low-recombination-loss OPV with ideal light trapping , the active layer thickness weakly affects the PCE. For a high-recombination-loss OPV with ideal light trapping , the active layer thickness strongly affects the PCE and must be very thin (around 10 nm) in order to maximize the PCE. Therefore, this paper shows that it is important for OPVs to have a low recombination loss so that the active layer thickness does not become a hindrance or an additional factor in creating highly efficient light trapping schemes that can maximize the PCE. This paper also shows that it is equally (if not more) important to develop light trapping schemes that are highly efficient at very thin active layers (around 10 nm) so that the PCE of any OPVs can be more or less maximized, whether the OPVs have low or high recombination losses.

SciVal Topic Prominence

Topic: Solar cells | Silicon solar cells | Light trapping

Prominence percentile: 98.307

Author keywords

Carrier recombination | diffusion current | light trapping | organic solar cell | power conversion efficiency (PCE)

Indexed keywords

Engineering controlled terms: Conversion efficiency | Efficiency | Open circuit voltage | Organic solar cells

Engineering uncontrolled terms: Carrier recombination | Diffusion currents | Light - trapping | Organic photovoltaic (OPV) | Organic photovoltaics | Photovoltaic devices | Power conversion efficiencies | Recombination loss

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