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Optical Modeling of Organic Photovoltaic Solar Cells MAITHILI GHAMANDE, JUTTA LUETTMER-STRATHMANN, University of Akron — Organic photovoltaic devices consist of several thin layers of material with different optical properties. Since the conversion of incident photons to charge carriers occurs only in the active layer, the intensity distribution of light within the device has an important effect on the efficiency of a solar cell. The intensity in turn depends upon properties of the layers, such as refractive index, absorption coefficient, and thickness, as well as on properties of the incident light, such as angle of incidence, spectral distribution, and polarization. In this work, we investigate the absorption of light in thin-film organic solar cells with computational methods. Since interference effects play an important role in thin films, we employ a transfer matrix method to calculate the complex amplitude of the electric field at the interfaces and propagate the electromagnetic wave within the layers. Intensity profiles are then calculated from the time averaged Poynting vector. We apply the method to conjugated polymer/fullerene bulk heterojunction solar cells and investigate devices with a range of geometrical parameters. We present results for plane geometries and explore how layer curvature may affect the efficiency of a solar cell.

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