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Spectral aspects of cavity tuned absorption in organic photovoltaics BRENT VALLE, Case Western Reserve University, STEPHEN LOSER, JONATHAN HENNEK, Northwestern University, KENNETH D. SINGER, Case Western Reserve University, JAMES ANDREWS, Youngstown State University, TOBIN MARKS, Northwestern University — In order to increase the power conversion efficiency of organic photovoltaic devices it is necessary to extend absorption to longer wavelengths and to concentrate and capture light in a thin bulk heterojunction (BHJ) layer. In this work, optical transfer matrix formalism is used to model absorption in organic photovoltaic devices as a function of BHJ thickness and incident wavelength in the optical cavity formed by the BHJ layer sandwiched between the aluminum cathode and indium tin oxide (ITO) anode. We have found that absorption can be finely tuned by adjusting the thicknesses of the BHJ and ITO layers within a relatively narrow range. We have also observed distinct spectral effects due to frequency pulling resulting in enhanced long- wavelength absorption. Because the absorption shifts arise purely from optical interference effects, tuning of the absorption spectrum can be achieved by careful cavity design without affecting the open circuit voltage. We have experimentally verified aspects of our modeling and suggest methods to improve device design. Additionally, we consider the effects of BHJ material gradients versus depth on absorption in these devices.

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