Abstract Submitted
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Relating Organic Solar Cell Fabrication Methods to Internal Electronic Properties Using Impedance Spectroscopy JAMES BASHAM, The Pennsylvania State University, National Institute of Standards and Technology, DAVID GUNDLACH, National Institute of Standards and Technology, THOMAS JACKSON, The Pennsylvania State University — We report on the use of impedance spectroscopy to quantify the effect of processing on an array of important OPV device metrics. Interestingly, extract modeled mobilities over the range of $2x10^{-3}$ to $1x10^{-2}$ cm^2/Vs by changing the spinning recipe. We find fast carrier relaxation times of $1x10^{-4}$ s for 3% efficiency cells vs $3x10^{-6}$ s for a 1.8% efficiency cell, possibly demonstrating reduced recombination in more efficient devices. Devices made via slowly dried films exhibit repressed recombination compared to quickly dried films. Measurements are taken across a bias range of -1 to 1 volt with illumination intensities spanning .001 to 3 suns, in order to test under conditions which are most relevant to real device operation. Impedance spectra are analyzed through the use of a 5 element compact model based upon the work of Bisquert et al [1,2]. We report an array of device metrics measured via impedance spectroscopy including shunt resistance, effective carrier lifetime, mobility, and capacitance for P3HT:PCBM devices with efficiencies of 3.5% to <1%, fabricated via several common recipes, in an effort to elucidate the varied and complex interplay between processing and device physics, and the overall effect on solar cell efficiency. [1] Fabregat-Santaigo, F., Garcia-Belmonte, G., Mora-Sero, I., and Bisquert, J. Phys. Chem. Chem. Phys., 2011, 13, 9083–9118 [2] Garcia-Belmonte, G.,Boix, P.P., Bisquert, J., Sessolo, M., and Bolink, H.J. Solar Energy Materials & Solar Cells 94(2010)366–375

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