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Device models for bilayer organic solar cells using interface rate equations NON THONGPRONG, PHILLIP DUXBURY, Michigan State Univ — Although the generalized Shockley diode equation is often used to fit the electrical response of organic photovoltaic devices, however developing device models to relate these parameters to atomistic processes is more difficult yet essential to fundamental understanding. A useful device model for organic heterojunctions was developed by Giebink et al. [1], where the heterointerface is treated using a rate equation approach and the electric field in the donor and acceptor regions is assumed to be constant. We have developed models and computational tools combining the bilayer interface model of Giebink et al. with methods to include non-uniform electric fields in the donor and acceptor regions of the material [2]. Injection barriers and trap effects in the donor and acceptor regions are also incorporated in our computational tools. Here the model and computational methods will be briefly outlined and results for the effects of low mobility in the donor or acceptor regions will be summarized. In these models, the series resistance in the generalized Shockley equation is interpreted as a sum of total bulk resistivity of materials and barriers at each layer's contact, while the parallel resistance mainly stems from dissociation efficiency of charge transfer states at the interface of doner and acceptor.

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[2] L. J. A. Koster, E. C. P. Smits, V. D. Mihailetchi, P. W. M. Blom, Phys. Rev. B (2005, APS).

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