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Device Model for Organic Semiconductor Light-Emitting Field-Effect Transistors DARRYL SMITH, Los Alamos National Laboratory, P. PAUL RUDEN, University of Minnesota — Recent experiments demonstrate ambipolar channel conduction and light generation in polymer field effect transistors (FETs).^{1,2} In the ambipolar mode of operation, the gate potential lies between those of the source and drain contacts, hence electrons are injected from one of these contacts and holes from the other. The carriers recombine in channel regions where both types of carriers are present, and the location of the resulting light emission is controlled by the voltages applied to the terminals. We describe a device model for ambipolar organic FETs based on the gradual channel approximation. Trapping of injected carriers in localized states within the polymer energy gap is shown to be important. A non-linear differential equation for the channel potential is derived and solved numerically. Carrier density and recombination profiles are determined. The calculations are in good agreement with experimental data^{1,2}.

- 1) J.S. Swensen, C. Soci, and A.J. Heeger, *Appl. Phys. Lett.* 87, 253511 (2005).
- 2) J. Zaumseil, R.H. Friend, and H. Sirringhaus, *Nature Materials* 5, 69 (2006).

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