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Numerical solution of the drift-diffusion equation for a p-i-p diode[1] ANGEL MANCEBO, SELMAN HERSHFIELD, Univ of Florida - Gainesville — In low carrier density semiconductors such as organic semiconductors the leads supply carriers to the sample. The extra charge flowing into the sample causes the phenomena of space charge buildup. In its simplest form this is characterized by the Mott-Gurney law, where the current is proportional to the voltage squared. The Mott-Gurney law as usually derived includes the drift term for the current but omits the diffusion term. The diffusion term cannot be neglected as the diffusion coefficient is proportional to the mobility by the Einstein relation. We numerically solve the drift diffusion equation and Poisson's equation for a p-i-p diode, where p refers to a p-type semiconductor and i to an intrinsic semiconductor with very few charge carriers. The model includes no charge traps. By including both the drift and the diffusion terms we find that the current is no longer proportional to the voltage squared but primarily linear with a slight upturn at higher voltages. Furthermore, by examining the carrier density vs. electric field in the sample, we are able to show that for fixed length, there is a maximum current for which there is a physical steady state solution. We will discuss the implications of our results for using the Mott-Gurney law to fit for carrier mobility.

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