

Merck is a leading provider of high-performance materials and solutions for the display industry. One prominent technology that has grown steadily in importance over the last years are displays based on organic light emitting diodes (OLEDs). Such devices consist of multiple thin layers and the performance is highly influenced by the interaction and properties of these layers. Together with the high number of different physical processes going in the OLED, this makes the prediction of the device performance very difficult. In some cases, even the impact of the physical parameters on the performance is not sufficiently understood. To deliver the best materials possible to our customers, we however must adapt materials very precisely, which requires understanding the significance of all parameters on device performance.

One parameter that we want to understand better is the density of states (DOS) of the layers. Its shape arises from the fact that the organic layers in OLEDs are amorphous and disordered. There exist modelling techniques like kinetic Monte Carlo simulations that take the density of states into account, but these are rather slow and not applicable to obtain all performance parameters. An alternative approach are drift-diffusion simulations which are quite established for OLED device simulations, but the existing approaches usually do not (or only partially) take the DOS shape into account.

We present a drift-diffusion model that takes into account arbitrary shapes of the DOS and preliminary simulation results for simple device stacks. The goal is to further extend the theory to the simulation of complex OLEDs and more performance parameters.



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