Guest excitation pathways in the phosphorescent organic light emitting diodes using the exciplex forming cohost

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Cohosts which consist of hole transporting materials (HTMs) and electron transporting materials (ETMs) have been widely developed as the host materials for efficient phosphorescent organic light emitting diodes (PhOLEDs). While it was experimentally reported that the direct charge transfer is the dominant mechanism in exciplex free cohost OLEDs, the exciton transfer is dominant in exciplex forming cohost OLEDs. However, there has been little theoretical research on how guest molecules are excited in exciplex forming cohost OLEDs. Here, we construct diabatic states of cohost systems with the localized diabatization, and then obtain the diabatic Hamiltonian such that the diagonal elements and the off-diagonal elements are the energies of the diabatic states and the diabatic couplings between them. Using the Förster theory, the transfer rates between those diabatic states are calculated to determine the diabatic populations as a function of time for the cohost systems. We compare the population dynamics for the exciplex forming and free cohost systems, and then we find that guest excitation pathways differ depending on the formation of the exciplex and the arrangement of molecules in the system. In the exciplex free cohost system, most of the guest molecules are excited through the charge transfer pathway, but the exciplex forming cohost system shows that the guest is excited through both energy and charge transfer pathways. In addition, by comparing the results in the guest/HTM/ETM arrangement with those in the guest/ETM/HTM arrangement, we find that the guest excitation occurs when the molecules are arranged in the guest/HTM/ETM.

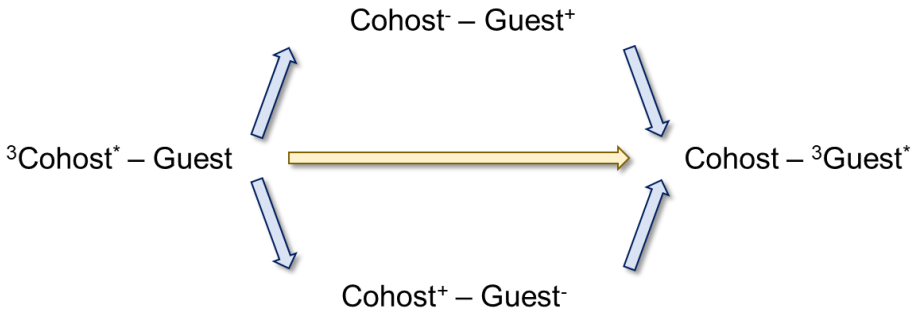

Figure 1 Guest excitation pathways of cohost PhOLEDs.

Acknowledgments

References

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