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High Performance Organic Light-Emitting Diodes Based on Intramolecular Charge Transfer Emission from Donor-Acceptor Molecules
ABHISHEK KULKARNI, XIANGXING KONG, SAMSON JENEKHE, Departments of Chemical Engineering and of Chemistry, University of Washington, Seattle WA, 98195 — A clear understanding of the key factors governing the electroluminescence (EL) efficiency of emissive donor-acceptor (D-A) molecules in OLEDs is currently lacking, but is essential to a rational molecular design of future emissive materials. In this study, OLEDs based on intramolecular charge transfer emission from 3,7-[bis(4-phenyl-2-quinolyl)]-10-methylphenothiazine (BPQ-MPT) and 3,6-[bis(4-phenyl-2-quinolyl)]-9-methylcarbazole (BPQ-MCZ) had device performances that differ by orders of magnitude. High performance (44360 cd/m^2 , 21.9 cd/A , 5.78% external quantum efficiency (EQE) at 1140 cd/m^2) green OLEDs were achieved from BPQ-MPT which has a HOMO level at 5.09 eV and a non-planar geometry. In contrast, diodes with far lower performance (2290 cd/m^2 , 1.4 cd/A , 1.7% EQE) were obtained from BPQ-MCZ which has a HOMO level of 5.75 eV and a planar geometry. These results highlight the pronounced influence of the electron donor strength and molecular geometry on the EL efficiency of D-A molecules.

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