Effect of arylamine hole-transport units on the performance of blue polyspirobifulorene light-emitting diodes

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Abstract

The operation of blue light-emitting diodes based on polyspirobifluorene with a varying number of N,N,N', N' tetraaryldiamino biphenyl (TAD) hole-transport units (HTUs) is investigated. Assuming that the electron transport is not affected by the incorporation of TAD units, model calculations predict that a concentration of 5% HTU leads to an optimal efficiency for this blue-emitting polymer. However, experimentally an optimum performance is achieved for 10% TAD HTUs. Analysis of the transport and recombination shows that polymer light-emitting diodes with 5%, 7.5%, and 12.5% TAD units follow the predicted behavior. The enhanced performance of the polymer with 10% TAD originates from a decrease in the number of electron traps, which is typically a factor of three lower than the universal value found in many polymers. This reduced number of traps leads to a reduction of nonradiative recombination and exciton quenching at the cathode.

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