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Appending triphenyltriazine to 1,10-phenanthroline: a robust electron-transport material for stable organic light-emitting diodes

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ABSTRACT

There has been an increasing demand for high-performance and cost-effective organic electron-transport materials for organic light-emitting diodes (OLEDs). In this contribution, we present a simple compound 3-(3-(4,6-diphenyl-1,3,5-triazin-2-yl)phenyl)-1,10-phenanthroline through the facile Pd-catalyzed coupling of a triphenyltriazine boronic ester with 3-bromo-1,10-phenanthroline. It shows a high T_g of 112 °C. The ultraviolet photoelectron spectroscopy measurements reveal a deep HOMO level of –6.5 eV. The LUMO level is derived as –3.0 eV, based on the optical bandgap. The low-temperature solid-state phosphorescent spectrum gives a triplet energy of ~2.36 eV. n-Doping with 8-hydroxyquinolatolithium (Liq, 1:1) leads to considerably improved electron mobility of 5.2×10^{-6}–5.8×10^{-5} cm^2 V^{-1} s^{-1} at $E = (2–5) \times 10^5$ V cm^{-1}, in contrast with the triarylphosphine oxide–phenantroline molecular conjugate we reported previously. It has been shown that through optimizing the device structure and hence suppressing polaron-exciton annihilation, introducing this single Liq-doped electron-transport layer could offer