Organic Light-Emitting Materials based on [5] Helicene Derivatives

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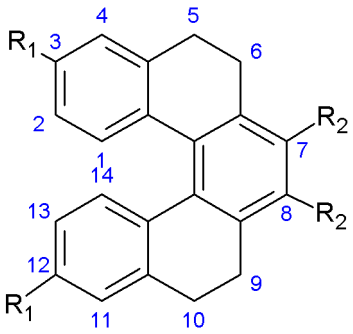
A series of new emitters based on a [5]helicene core structure were synthesized and characterized. They were engineered to allow effective internal charge transfer in order to facilitate them to reach high fluorescence quantum yield, Φ_f. Two electron donating groups are attached at position 3 and 12 of a helicene while one or two withdrawing groups are located at position 7 and 8 of a helicene forming a π-shape electron push-pull system. The donor and acceptor groups were varied in order to obtain a variety of compounds. Physical and optical properties of helicenes are affected by their pendant groups. As a result, helicenes that were synthesized possess melting temperature which varies from 265 to 345 ^{o}C. Their band gaps (E_g) are varying from 2.08 to 2.91 eV. Lowest unoccupied molecular orbital (LUMO) energy levels of the compounds are ranging from -2.9 to -3.7 eV and highest occupied molecular orbital (HOMO) energy levels of the compound are ranging from -5.8 to -6.0 eV. The quantum yield as high as 0.96 can be obtained from one of the new compounds. Organic light-emitting diodes using these new compounds as emitting materials were successfully fabricated and characterized.



R1 = Donor group; e.g. –OMe, -N(Ph)Me, -N(Ph)$_2$
R2 = Acceptor group; e.g. –CN, -C(=O)-O-C(=O)-,
-C(=O)-NR-C(=O)-