



Technology Offer

Blue Light Emitting Polytriphenylene Dendrimers, Methods of Preparation and Uses thereof

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Background

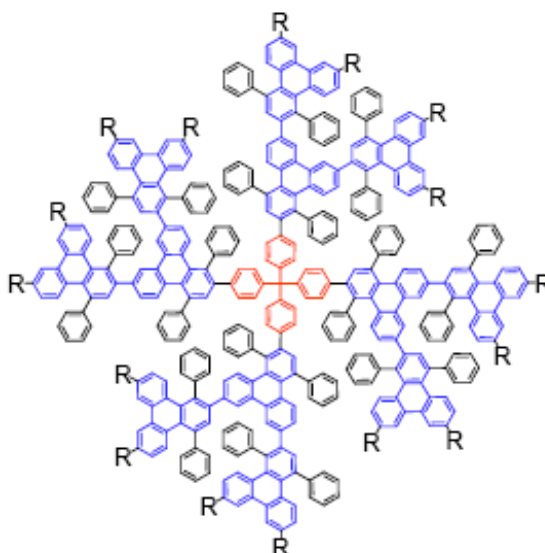
In the past decade, light-emitting dendritic materials have attracted much interest due to their applicability as emissive layers in organic light-emitting diodes. This class of material allows to combine the advantages of small molecules, such as anthracene, phenanthrene or pyrene² with those of conjugated polymers, such as polyfluorenes or poly(para-phenylene vinylene)s. Up to now the most promising approach for dendrimer light emitting diode (DLED) materials was to use an either fluorescent or phosphorescent light emitting core and attach conjugated, but non-emissive dendrons in order to keep the emissive units separated, thus avoiding excimer formation and quenching effects. The utilization of conjugated dendrons, on the other hand, facilitates sufficient charge transport, which is a necessary premise for efficient devices. One of the biggest advantages of using such dendritic molecules is the variety of possible combinations of cores, dendrons and surface groups.

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The attractive properties of multi-chromophores dendrimers suggested a new approach towards blue light-emitting materials with the following characters:

- (i) blue light emission is brought about by the presence of electronically decoupled polycyclic aromatic hydrocarbon (PAH) units;
- (ii) the units are incorporated into a rigid polyphenylene dendritic structure and thus adopt sterically defined positions and disallow intra-dendrimer chromophore-chromophore interactions;
- (iii) amorphous films are obtained due to the lack of intermolecular interactions;
- (iv) the amount of “useless” substituent and coupling units is kept at a minimum

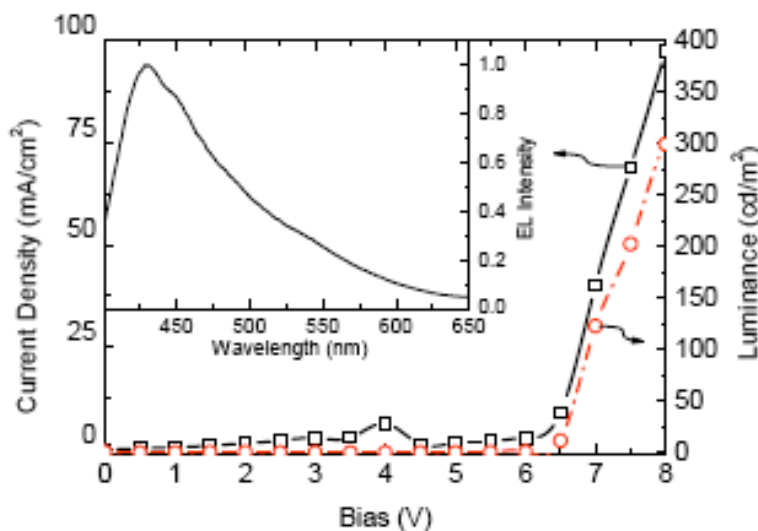
Figure 1:
Blue emitting dendrimer G2 (R=H)



Blatt 2

To test electroluminescent properties of dendrimer G2, DLEDs were fabricated in a standard sandwich geometry using the following configuration: indium tin oxide (ITO)/poly(3,4-ethylenedioxythiophene) doped with poly(styrene sulfonate) (PEDOT:PSS)/Dendrimers/1,3,5-tris(1-phenyl-1H-2-benzimidazolyl)benzene (TPBi)/CsF/Al. To avoid recombination at the chemically unstable cathode interface, TPBi was applied as an additional electron transport and hole blocking layer.

Figure 2: I-V-L characteristics of an ITO/PEDOT:PSS/G2/TPBi(10nm)/CsF/Al device. Inset: normalized electroluminescence spectrum at 9V bias



Overall the performance of the presented devices can compete with the best reported fluorescence based blue emitting DLEDs with respect to device efficiency and brightness which also holds true for a comparison with fluorescent blue light emitting polymeric devices based on poly(para-phenylene) type polymers.

These dendrimers exhibit stable and pure-blue emission in both PL and EL spectra and they could provide an avenue for dendritic emitters with the optimized EL efficiency/color purity trade-offs needed for pure blue light.

Patent Information

Patent application EP filed.

Literature

T. Qin, G. Zhou, H. Scheiber, R.E. Bauer, M. Baumgarten, C.E. Anson, E.J.W. List, K. Müllen: "Polytriphenylene Dendrimers: A Unique Design for Blue-Light-Emitting Materials", *Angew. Chem.* 2008, 120, 1 – 6

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