(BI)PHENYL SUBSTITUTED 9-(2,2-DIPHENYLVINYL)CARBAZOLES AS LOW COST HOLE TRANSPORTING MATERIALS FOR EFFICIENT RED PHOLEDS

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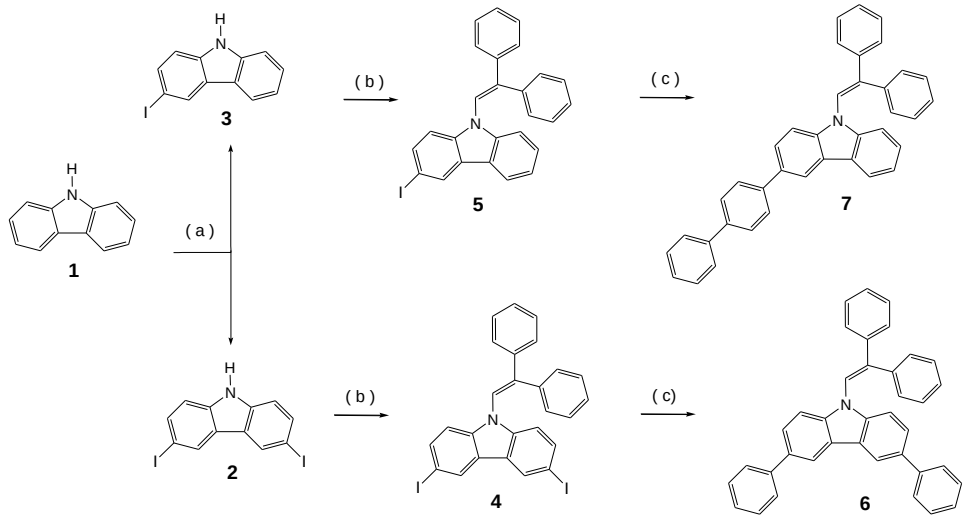
Phosphorescent organic light emitting diodes (PhOLEDs) have attracted much attention because they use both singlet and triplet excitons for generation of light, making 100% internal quantum efficiency possible. Achieving the high level internal quantum efficiency depends on several factors, including high quantum yield emitters, exothermic energy transfer from host to emitter, effective exciton confinement as well as balanced carrier transport [1, 2]. It is well known that carrier transporting materials are crucial to enable a balance carrier transport from cathode and anode [3]. Considerable exertion is needed for the development of efficient red PhOLED devices, because the lower gap of red phosphors usually induces serious carrier trapping, leading to higher operation voltages and carrier imbalance [4]. Accordingly, it is desirable to exploit new hole transport materials to create red PhOLEDs with reduced power consumption and improved efficiency.

In this study, the new low cost 9-(2,2-diphenylvinyl)carbazole-based derivatives with aryl substitutions were synthesized and investigated. Our previous study found that introducing the diphenylvinyl fragment in carbazole ring could increase spatial hindrance of the moiety and the derivatives could be used for the preparation of thin and stable amorphous layers on substrates [5]. The synthesis of phenyl or 4-biphenyl substituted 9-(2,2-diphenylvinyl)carbazole based derivatives (6 and 7) was carried out by synthetic route, which is shown in Scheme 1.



Scheme 1. a) KI, KIO_3, acetic acid; b) 2,2-diphenylacetaldehyde, (±)-camphor-10-sulfonic acid, toluene; c) $Pd(PPh_3)_2Cl_2$, KOH, THF, phenyl boronic acid for compound 6 or 4-biphenyl boronic acid for compound 7.

We have examined the novel hole transporting materials in the fabrication of red PhOLEDs. The respective peak efficiencies were recorded at 8.7 % (5.6 cd/A and 3.9 lm/W) and at 8.7 % (5.4 cd/A and 3.8 lm/W), correspondingly, for the devices using 3,6-diphenyl-9-(2,2-diphenylvinyl)carbazole (6) and 3-(4-biphenyl)-9-(2,2-diphenylvinyl)carbazole (7) as hole transporting materials. The high efficiencies of the red PhOLEDs suggest great potential of the new (2,2-diphenylvinyl)carbazole based electroactive materials for applications in OLED devices.

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