3-(N,N-DIPHENYLAMINO)CARBAZOLE DONOR CONTAINING BIPOLAR DERIVATIVES WITH VERY HIGH GLASS TRANSITION TEMPERATURES AS POTENTIAL TADF EMITTERS FOR OLEDs

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Blue light emitting derivatives, particularly the pure organic materials with suitable light colour and high morphological stability are very relevant in the OLEDs industry [1]. Achieving of a suitable light colour and suitable morphological stability in pure organic emitters is a hot investigations field in last years. At this time very actively studied TADF (thermally activated delayed fluorescent) emitters have also solved a disadvantage that only singlet excitons are used for traditiona OLEDs [2].

We present well defined electroactive bipolar derivatives containing 3-(N,N-diphenylamino)-9H-carbazole as donor and (bis)phenylsulfone or benzophenone as acceptor fragments. Such structures are interesting as potential TADF emitting materials and we tested the derivatives in this field. 3-(N,N-Diphenylamino)carbazole fragment is useful for emitting properties of the materials and the bipolar nature is responsible for suitable transfer of charges in the emitting layer. Variation of the rigid aromatic structures also enabled us to synthesize the group of amorphous materials having very high values of glass transition temperature and also emitting derivatives for OLEDs. Novel electro-active bipolar derivatives have been prepared using 3-(N,N-diphenylamino)carbazole as electron donor fragment connected with various electron acceptors. The derivatives can form homogeneous solid amorphous layers with very high glass transition temperatures of 111–173 ^{o}C. The materials, which were well soluble in common organic solvents, were tested as emitting materials dispersed in 4,4′-bis(N-carbazolyl)-1,1′-biphenyl (CBP) host. The OLED with the emitter bis[4-3-(N,N-diphenylamino)carbazol-9-ylphenyl] sulfone exhibited the best overall performance. The OLED using the emitter demonstrated low turn-on voltage of 3.0 V, maximum brightness exceeding 2630 cd/m2, current efficiency of 3.2 cd/A, power efficiency of 2.2 lm/W and EQE exceeding 1.7 %at 100 cd/m2. For the technically important brightness of 1000 cd/m2 ehfficiencies above 2.5 cd/A were obtained. The results demonstrate that some of the materials could be further investigated as potential TADF emitters.

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