Horizontal molecular orientation in solution-processed organic light-emitting diodes based on an oligofluorene derivative

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Researchers have made significant progress on organic light-emitting diodes (OLEDs) in the last decades. Phosphorescent1 and thermally-activated delayed fluorescent (TADF) OLEDs2 which harvest both singlet and triplet excitons have achieved internal quantum efficiencies of nearly 100%. To further improve light outcoupling efficiency and the overall performance of OLEDs, a few works have been carried out on the horizontal orientation of the transition dipole moments of the light-emitting molecules.3 While the potential of horizontally oriented emitters in vapor-deposited glassy organic doped films is now well-established, it should be emphasized that there has been no report so far on such a preferential molecular orientation in OLEDs based on spin-coated glassy doped films. Considering the importance to develop high performance OLEDs via solution-processing for low cost and large area applications, control of the orientation of the light-emitting molecules in spin-coated organic films would be extremely relevant to the field.

Here, we demonstrate that horizontal orientation of light-emitting molecules can be achieved in spin-coated glassy thin films based on a blend of a heptafluorene derivative4 in a 4,4'-bis(N-carbazolyl)-1,1'-biphenyl (CBP) host. The molecular orientation was investigated both in heptafluorene neat films and in CBP:heptafluorene (90:10 wt.%) blend films by variable angle spectroscopic ellipsometry and angle dependent photoluminescence measurements. Solution-processed fluorescent OLEDs with horizontally oriented heptafluorene emitters were then fabricated and showed deep blue electroluminescence with an external quantum efficiency as high as 5.3 %.

Reference