Orientation Control of Disk-like Hole Transport Molecules and their Application in OLEDs Aimed for Low Driving Voltage

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Organic amorphous films are important components in organic devices such as organic light-emitting diodes (OLEDs). Recently, horizontally oriented amorphous thin films have been used in OLEDs, making use of their high-performance electrical characteristics. In this study, we further synthesized novel disk-like molecular structures of B-DDP, T-DDP and BT-DDP, aimed for the enhancement of horizontal orientation by introduction of two-dimensional planar structures having rather intense π-π interaction, leading to further low driving voltage in OLEDs. In the DDP derivatives, the order of orientation parameter of S is BT-DDP(−0.23) < T-DDP (−0.18) < B-DDP (−0.11) < α-NPD (−0.01), indicating that BT-DDP shows superior horizontal orientation. In the OLED characteristics, compared with α-NPD, the use of DDP derivatives resulted in lower driving voltage. We clarified that the ITO/BT-DDP interface provides small energy barrier for hole injection probably due to the planar orientation of BT-DDP on an ITO surface.