Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.


# Supplementary Information

## Highly efficient inverted organic light-emitting diodes using composited organic heterojunction as electrode-independent injectors

**Supporting Information (Figure S1)** To elaborate the role of intrinsic TAPC and m-MTDATA in the p/bulkjunction/n structure, we also fabricated two heterojunction devices without intrinsic TAPC and m-MTDATA layer, as shown **Figure S1**, We find that the current density without intrinsic TAPC and m-MTDATA is larger than the devices with intrinsic TAPC and m-MTDATA. This futher indicates intrinsic TAPC and m-MTDATA layer in the heterojunction plays the role of reducing leak current of IOLEDs and preventing electrons injection from ITO cathode due to their high LUMO level.

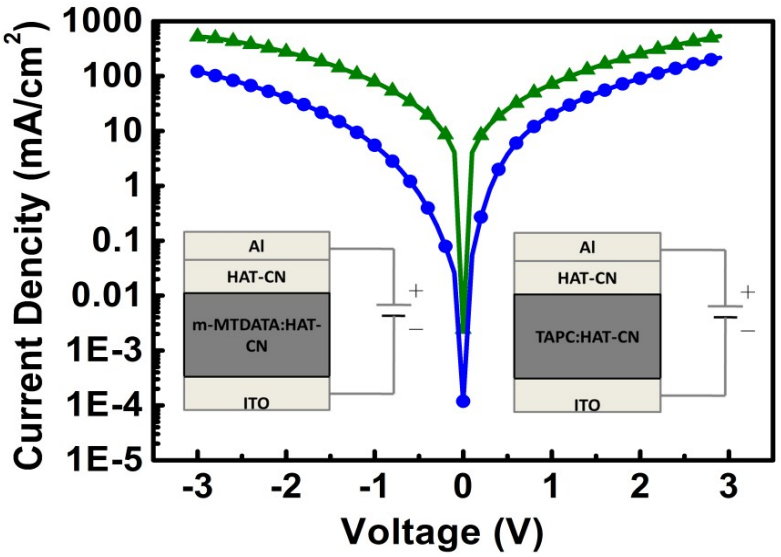


**Figure S1:** Current dencity versus voltage characteristics (I-V) of ITO/ m-MTDATA:HAT-CN (2:1, 60 nm)/HAT-CN (10 nm)/Al (green triangles) and ITO/ TAPC:HAT-CN(2:1, 60 nm)/HAT-CN (10 nm)/Al (blue circles). The inset shows the schematic illustration of two devices. The forward bias refers to ITO as cathode and Al as anode, and reverse bais refers to ITO as anode and Al as cathode.

**Supporting Information (Figure S2)** The surface morphologies of intrinsic m-MTDATA films in p/bulkjunction/n

were measured by tapping-mode atomic force microscopy(AFM), as shown in Figure **S2**. The roughness mean square (RMS) values were 2.79 nm, 3.10 nm and 2.85 nm for the m-MTDATA films. The roughness is small than the total thickness of 10nm m-MTDATA, values were 2.79 nm, 3.10 nm and 2.85 nm for the m-MTDATA films. The roughness is small than the total thickness of 10nm m-MTDATA, we believe a 10 nm of m-MTDATA can fully cover the cathodes. This indicates 10nm of m-MTDATA film in p/bulkjunction/n can prevent the direct contact of m-MTDATA:HAT-CN and ITO cathodes, so the electrons can't be injected from the three different ITO cathodes due to the high LUMO of intrinsic m-MTDATA.

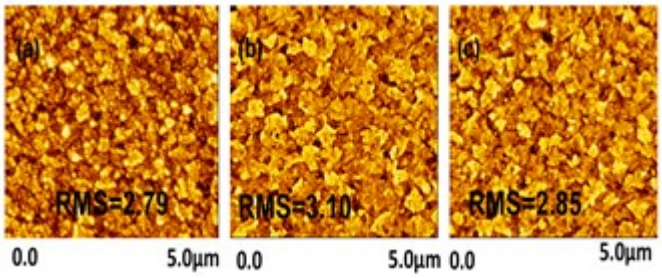


Figure **S2** Surface morphologies of m-MTDATA film on the three different ITO cathode, and three different ITO cathode refers to (a) without UV-O3 treatment, (b) with UV-O3 treatment, (c) Introduction of a thin Al layer.

**Supporting Information (Table 2)** Summaries of the electroluminescence performance of red and blue IOLEDs for different cases

| Device | Von (V) | PE[a,b] (lm/W) | CE[a,b] (cd/A) | EQE[a,b] (%) |
|---|---|---|---|---|
| R1 | 2.4 | 27.2,23.0 | 25.0,24.8 | 14.1,14.0 |
| R2 | 2.4 | 26.1,22.0 | 24.0,23.9 | 13.9,13.8 |
| R3 | 2.4 | 26.9,23.0 | 24.7,24.0 | 14.0,13.9 |
| F1 | 2.8 | 37.5,23.0 | 34.8,27.0 | 14.3,11.0 |
| F2 | 2.8 | 38.5,21.0 | 36.4,,26.0 | 14.7,10.5 |
| F3 | 2.8 | 40.8,24.0 | 36.4,27.0 | 14.0,10.4 |

a refers to The maximum PE, CE, and EQE; b refers to PE, CE, EQE at the luminance of 1000