Supporting information

Negative polaron resistant p-type host for extended lifetime in deep blue phosphorescent organic light-emitting diodes

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Experimental

General information

All chemicals and reagents were purchased from commercial suppliers. 9H-3,9'-bicarbazole was purchased from Sunfine global Co. Ltd. and sublimed before use. Bromo benzene and 2-fluorobenzonitile were purchased from TCI Co. Cesium carbonate used as a base was purchased from Samchun Chem. Toluene, tetrahydrofuran, *n*-hexane, and methylene chloride were products of Samchun pure chemical Co. Ltd.. *N*,*N*-dimethylformamide (DMF) was purchased from Daejung Chemical & Metal Co.. All reactions and manipulations were performed in the oil bath. All column chromatography (methylene chloride (MC)/*n*-hexane (HEX) mixed solvent) was carried out on a stationary phase of the column on silica gel. All materials were purified by vacuum sublimation in order to get purity higher than 99.9 % before the device test.

The HOMO and LUMO were estimated and calculated using cyclic voltammetry (Ivium Tech., Iviumstat). The UV-vis spectra were observed using UV-vis spectrophotometer (JASCO, V-730) and the PL spectra were obtained using a fluorescence spectrophotometer (PerkinElmer, LS-55). UV-vis analysis was performed using a tetrahydrofuran solution of the sample and PL measurements at room temperature was performed using a toluene solution of the sample. The triplet energy of the material was measured after 2 ms delay time at 77 K using a frozen tetrahydrofuran solution in liquid nitrogen. The tetrahydrofuran and toluene were distilled over sodium and calcium hydride.

The ^{1}H and ^{13}C nuclear magnetic resonance (NMR) spectra were recorded with a Unity Inova (Varian, 500 MHz) spectrometer. Solvent for the NMR analysis was chloroform ($CDCL_3$) and dimethyl sulfoxide(DMSO-d_6). The equipment to measure mass spectra was Advion, Expresion^{L} CMS spectrometer in APCI mode. Purity of the material was analyzed using high performance liquid chromatography (Younglin Instrument Co.) using a mobile phase of acrylonitrile: methylalcohol(9:1).

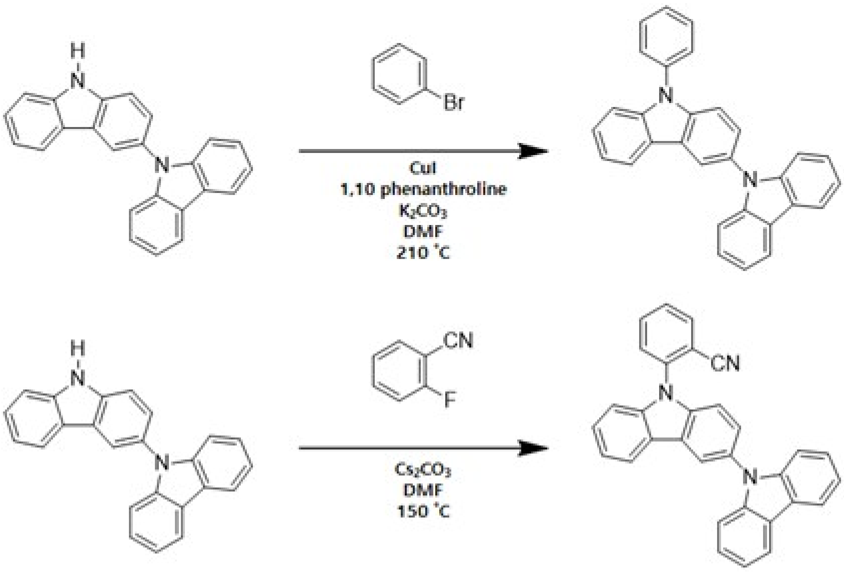
Synthesis

9-Phenyl-9H-3,9'-bicarbazole(CzPh)

CzPh was synthesized in the same way as the reference[1].

References

1. Yoshizaki, Kei; Ogiwara, Toshinari; Kawamura, Yuichiro; Yasukawa, Keiichi; Yoshida, Kei 'Organic electroluminescent element and electronic device', Idemitsu Kosan Co.,Ltd., Japan, 2019.



Scheme S1. Synthetic route to CzBN and oCzBN

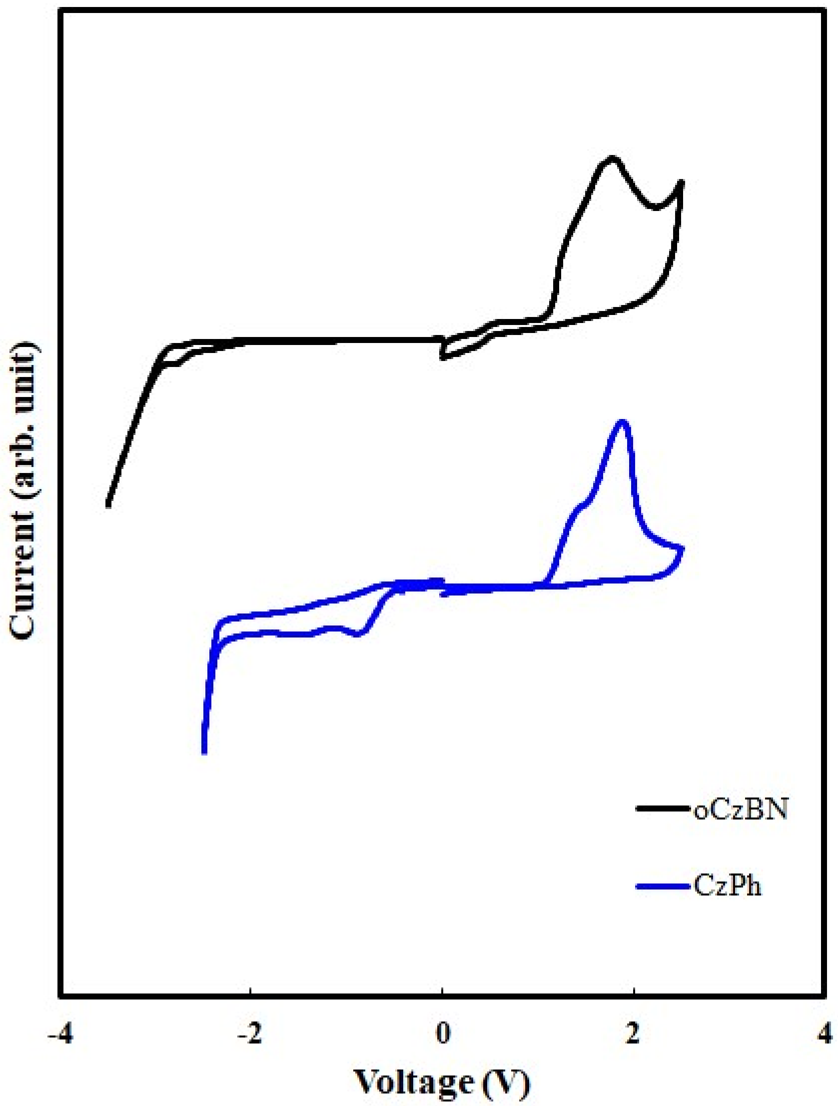


Figure S1. Cyclic voltammetry (CV) data of the hosts.

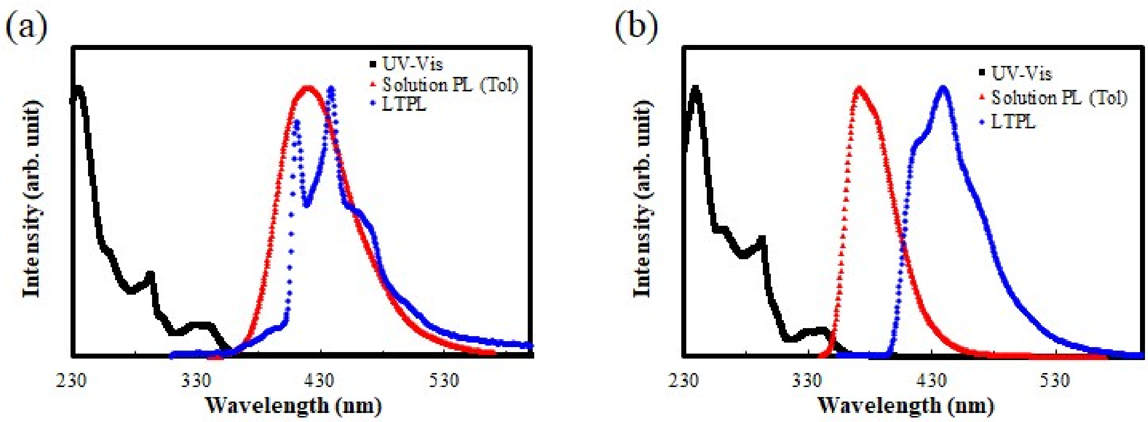


Figure S2. (a) Photophysical properties of oCzBN (b) Photophysical properties of CzPh

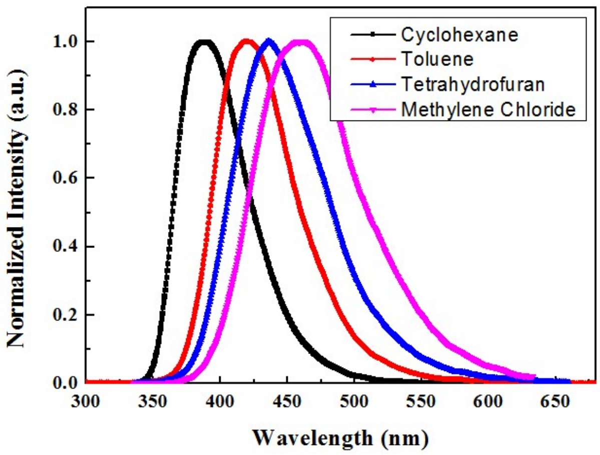


Figure S3. PL spectra of the oCzBN host at different solvents.

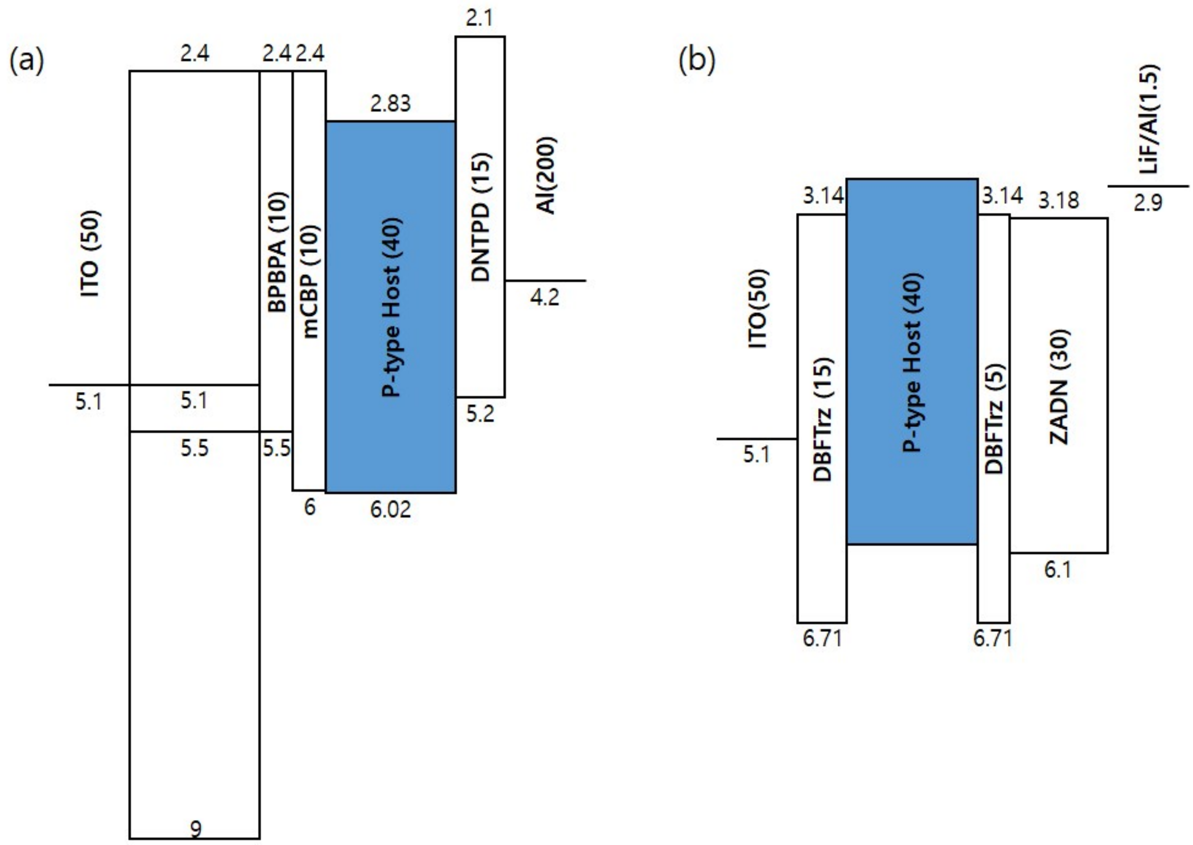


Figure S4. (a) HOD and (b) EOD device structures

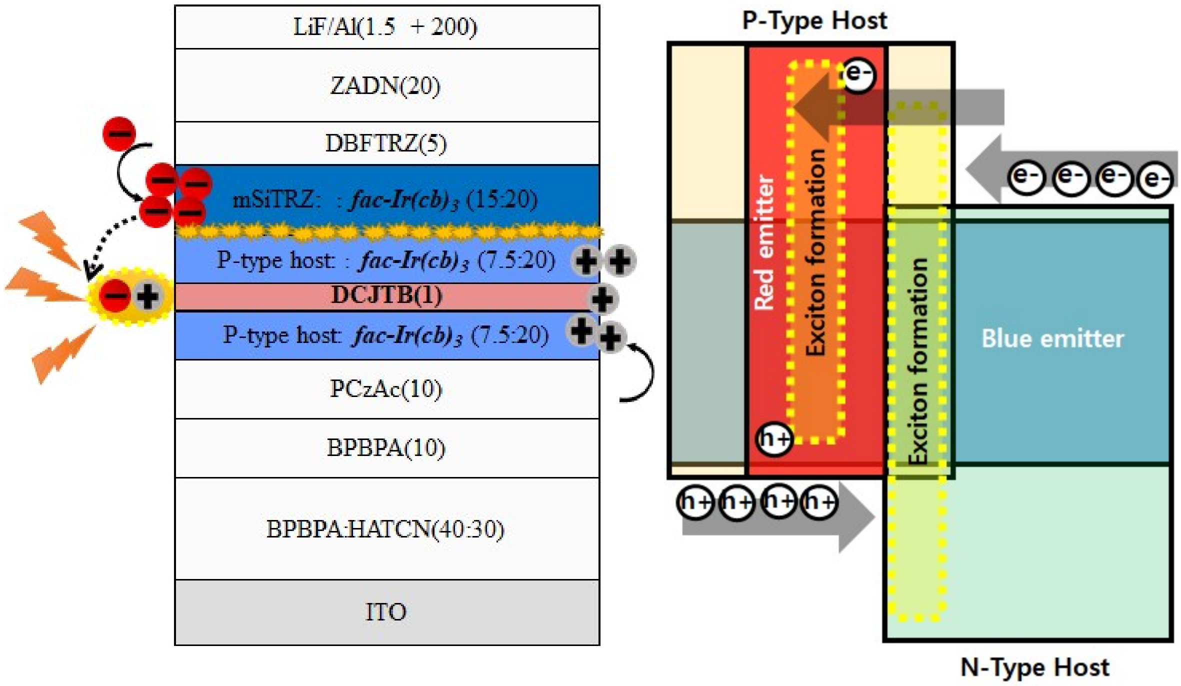


Figure S5. The device structure for the electron leakage test