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Supporting Information

Manipulating Förster and Dexter interactions between thermally activated delayed fluorescence host and phosphorescent dopant for highly efficient solution-processed red and white OLEDs

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Experimental Section

General information: The TADF host DMAC-DPS, 4CzDMAC-DPS and iridium dendrimer R-D2 were synthesized by our group, which were previously reported. The hole-injection material PEDOT:PSS, the electron transporting materials including DPEPO, TmPyPB, and the electron injecting material Liq were purchased from Xi'an Polymer Light Technology Corporation. The absorption and PL spectra were obtained by a Shimadzu UV-2700 UV-VIS spectrophotometer and a Hitachi F-4600 fluorescence spectrophotometer, respectively. The transient PL spectra were measured by single photon counting spectrometer from Edinburgh Instruments (FLS920) with a Picosecond Pulsed UVLASTER (LASTER377) as the excitation source.

OLED fabrication: Acetone and ethanol were used to clean the ITO glass substrates with ultrasonic bath. The ITO substrates were further dried with N_2 followed by a 20-min ultraviolet ozone treatment. A 45-nm-thick modified PEDOT:PSS was spin-coated onto the ITO substrate, and then baked at 120°C for 10 min. A 50-nm-thick doped or neat EML was also prepared by spin-coating directly on the modified PEDOT:PSS, followed by a baking process at 50°C for 10 min. The other organic materials and Al cathode were vacuum deposited in a high vacuum chamber. All the devices were encapsulated by UV-curable resin and measured in ambient air. The current-voltage-luminescence characteristics and EL spectra were concurrently recorded with a PR735

SpectraScan Spectroradiometer and a Keithley 2400 source meter.

The theoretical exciton utilization efficiency (η_{eue}) was calculated as follows:

$$EQE = \gamma \eta_{eue} \phi_{PL} \eta_{out} \quad \text{(S1)}$$

where γ represents the charge balance factor, regarded as 1 for the balanced charge flux, Φ_{PL} refers to the intrinsic PLQY for the emission layer, and η_{out} is the light out-coupling efficiency, estimated as 0.3 for ITO glass substrate.

Table S1. Prompt and delayed fluorescence lifetime constants of the TADF hosts in the doped films.

τ_p/τ_d [ns/μs]	0 wt.%	1 wt.%	5 wt.%	10 wt.%	50 wt.%
DMAC-DPS	25.4/3.26	14.9/3.14	10.9/3.07	5.3/1.85	4.8/1.53
4CzDMAC-DPS	26.4/0.46	21.0/0.41	10.6/0.24	7.5/0.27	1.2/0.26

Table S2. FRET rate constants from TADF hosts to R-D2.

k_{FRET} [10^8 s]	0 wt.%	1 wt.%	5 wt.%	10 wt.%	50 wt.%
DMAC-DPS:R-D2	--	0.28	0.52	1.49	1.68
4CzDMAC-DPS:R-D2	--	0.12	0.40	1.26	1.58

Table S3. Transient lifetime constants of R-D2 in the doped films.

k_{Ph} [μs]	1 wt.%	5 wt.%	10 wt.%	50 wt.%	100 wt.%
DMAC-DPS	2.69	1.75	1.55	0.62	0.19
4CzDMAC-DPS	0.80	0.70	0.72	0.37	0.19

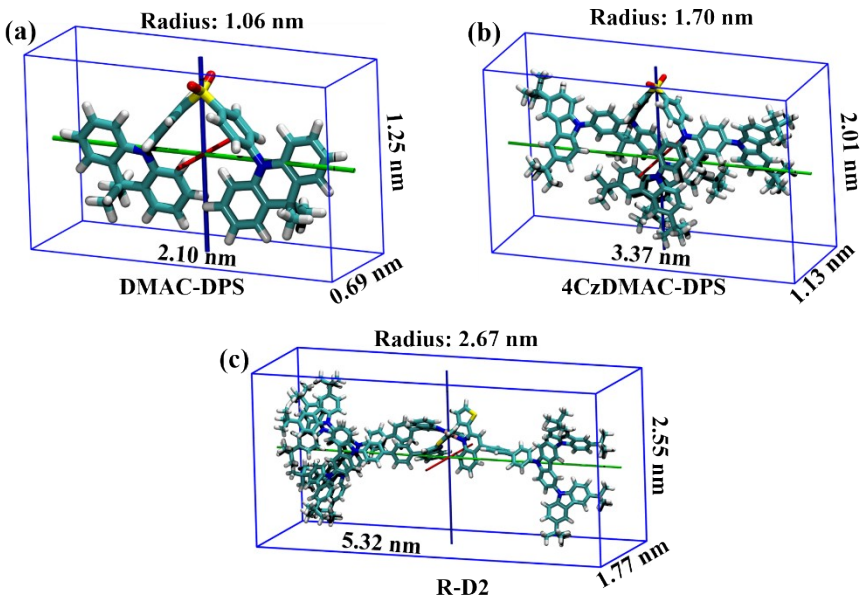

Figure S1. The VDW radius of DMAC-DPS, 4CzDMAC-DPS and R-D2 calculated by Multiwfn program, in which the VDW surface is defined by the lengths of the three sides of the cube. The ground state structures of these compounds were acquired by adopting PM7 semi-empirical method with Gaussian 16 program.

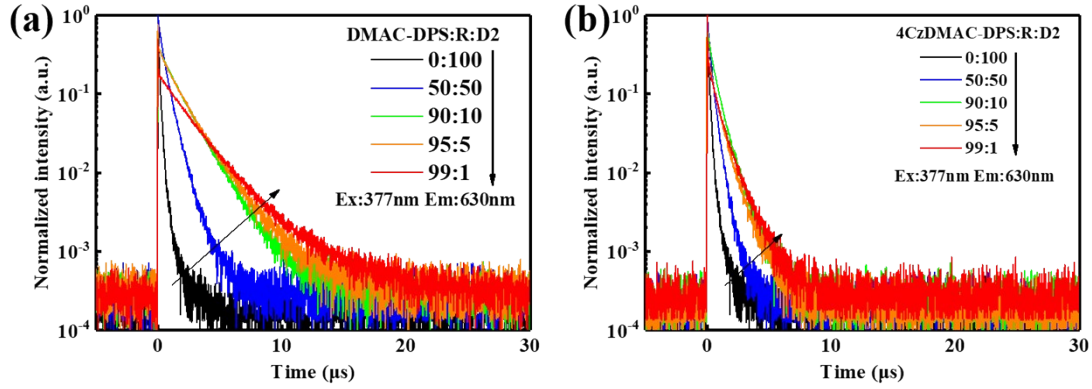

Figure S2. Transient PL decays of the emitting layer (a) DMAC-DPS:R-D2 and (b) 4CzDMAC-DPS:R-D2 observed at 630 nm.

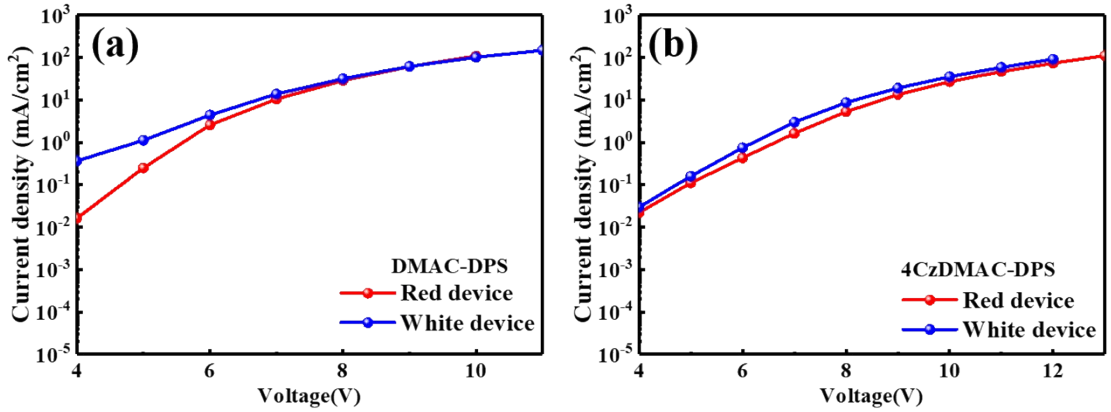

Figure S3. Comparison of current densities between red (B3 and B4) and white (C3 and C4) OLEDs based on DMAC-DPS (a) and 4CzDMAC-DPS (b) hosts.

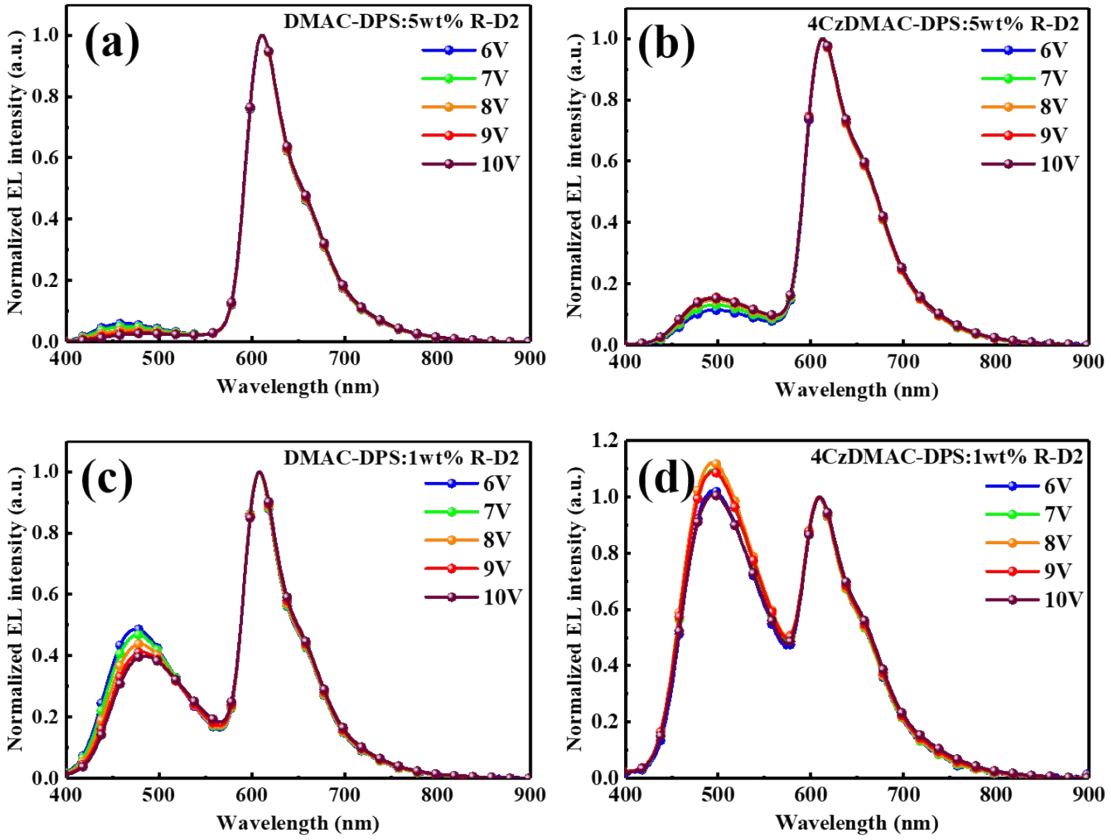

Figure S4. Normalized EL spectra of the devices (a) B3, (b) C3, (c) B4 and (d) C4.

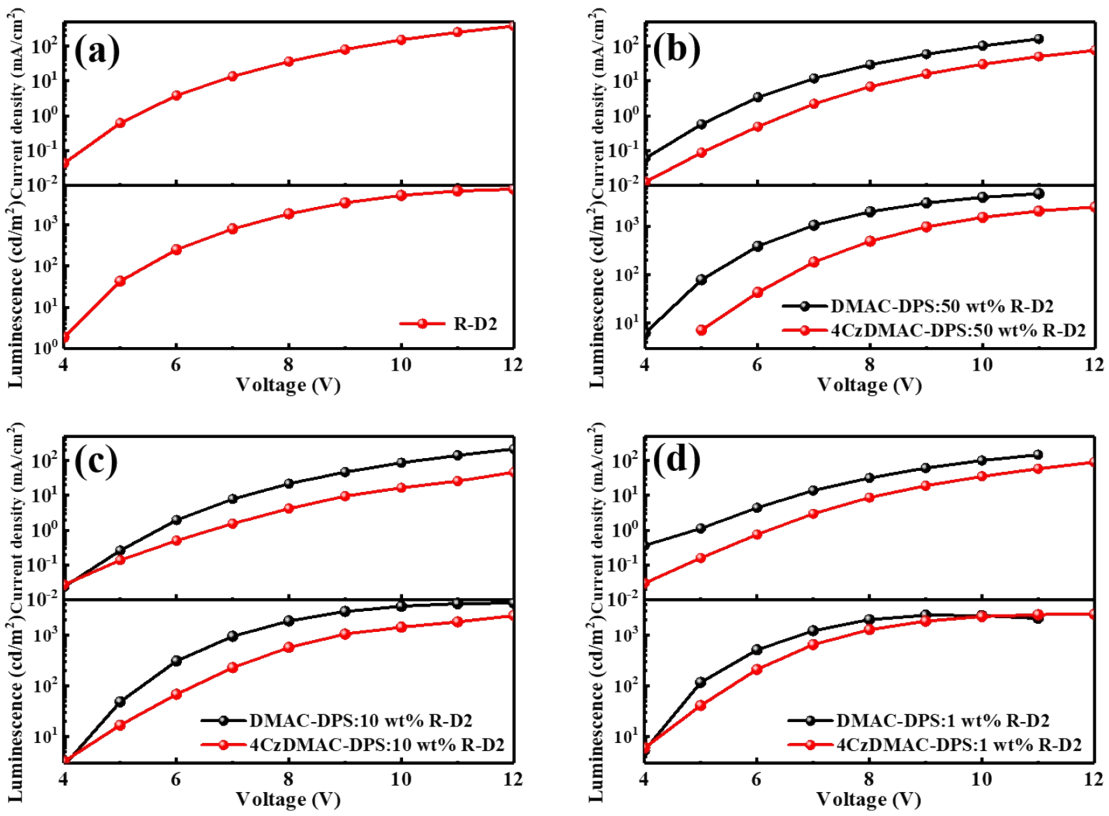

Figure S5. Current density (upper) and luminance (lower) versus driving voltage curves of the devices (a) A, (b) B1 and C1, (c) B2 and C2, and (d) B4 and C4.

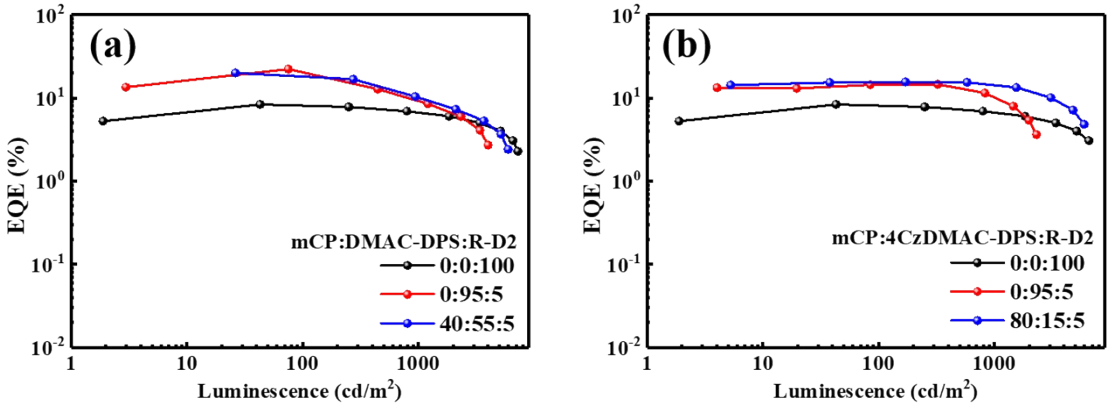

Figure S6. EQE versus luminance curves of the devices (a) A, B3 and B5, and (b) A, C3 and C7.