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

Supporting information

Triphenylamine disubstituted naphthalene diimide: elucidation of excited states involved in TADF and application in near-infrared organic light emitting diodes

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S1 – Additional steady-state and time-resolved data of TPA-cNDI in zeonex film

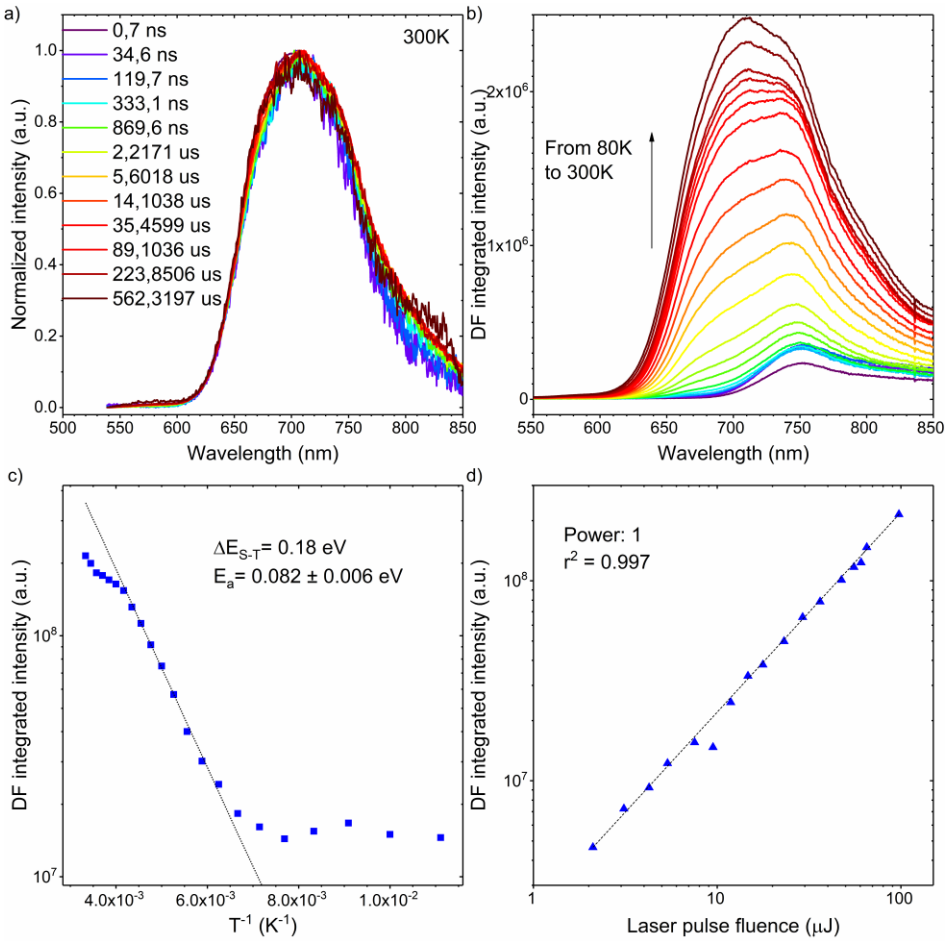

Figure S1. Photophysical analysis 1% **TPA-cNDI** film in Zeonex®; a) the emission spectrum at different time delay, b) integrated spectra at delay 1 ms at different temperatures, c) Arrhenius plot of activation energy, d) laser fluence behaviour.

S2 – Additional steady-state and time-resolved data of TPA-cNDI in CBP film

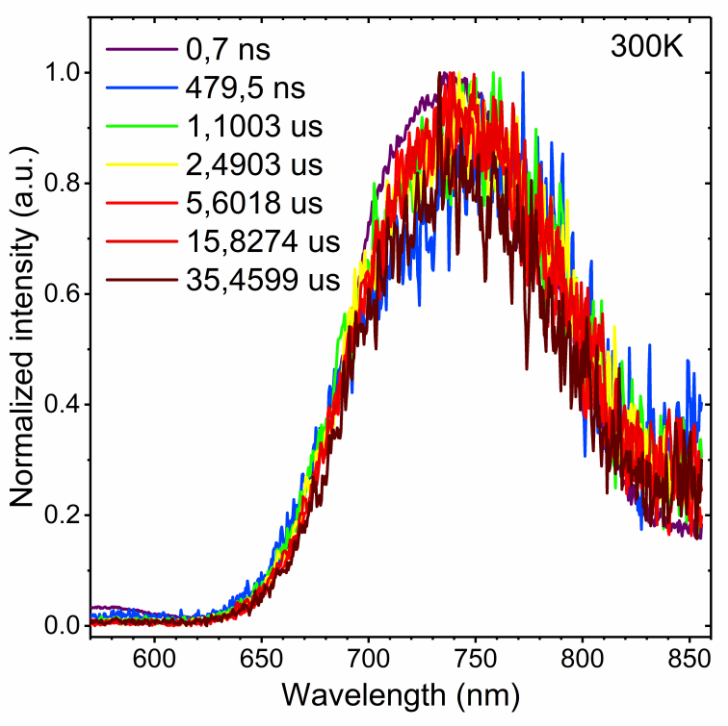

Figure S2. Photophysical analysis 10% **TPA-cNDI** film in CBP; the emission spectrum at different time delay.

S3 – Additional steady state and time-resolved data of TPA-cNDI in MCH

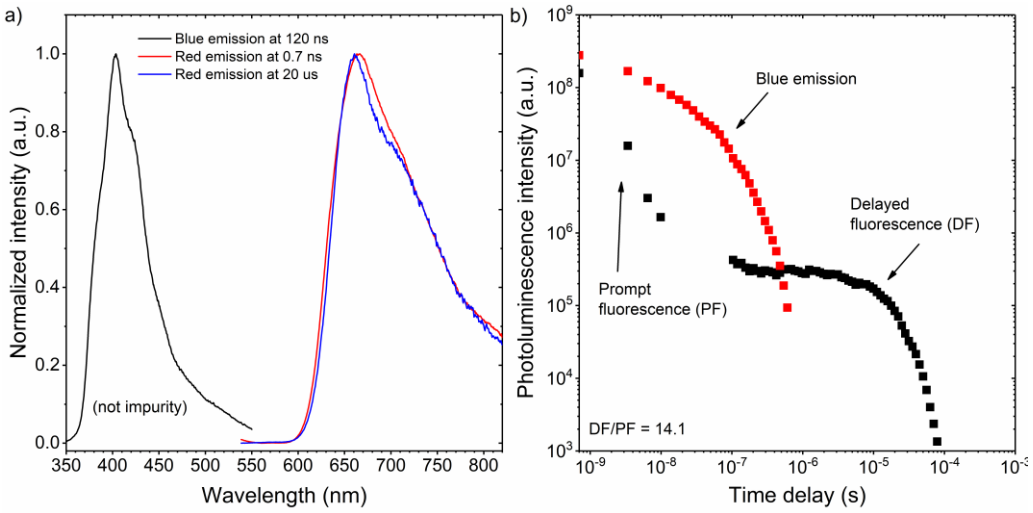

Figure S3. Photophysical analysis of 20 µM **TPA-cNDI** in MCH, a) Time-resolved spectra. Spectra of deep-red prompt and delayed fluorescence are shown together with observed short-lived blue emission, b) decay of red component and blue component.

S4 – Additional time-resolved data of cNDI

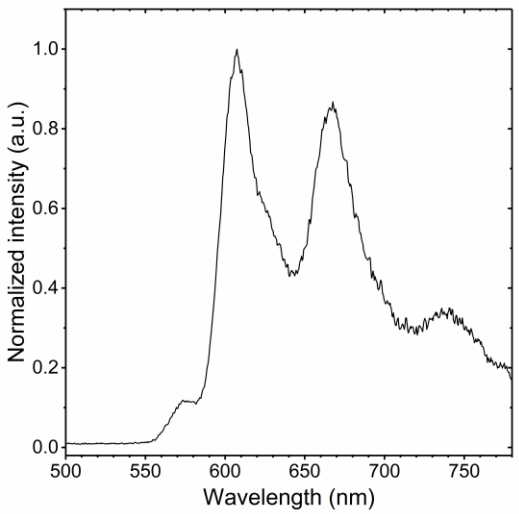

Figure S4. The time-resolved spectrum of cNDI phosphorescence spectrum taken at 1 ms delay, 80 K.

S5 – Device fabrication experimental details

All organic evaporated compounds were purified by Creaphys organic sublimation system, TAPC - 4,4′-Cyclohexylidenebis[*N*,*N*-bis(4-methylphenyl)benzenamine] (97%, Sigma Aldrich), NPB - *N,N′*-Di-1-naphthyl-*N,N′*-diphenylbenzidine (TCI-Europe), CBP - 4,4′-Bis(N-carbazolyl)-1,1′-biphenyl (TCI-Europe), TPBi - 2,2',2"-(1,3,5-Benzinetriyl)-tris(1-phenyl-1-H-benzimidazole) (LUMTEC), PO-T2T - 2,4,6-Tris[3-(diphenylphosphinyl)phenyl]-1,3,5-triazine (Lumtec), LiF (99.995%, Sigma Aldrich), Aluminium wire (99.9995%, Alfa Aesar). OLED devices were fabricated using pre-cleaned indium-tin-oxide (ITO) coated glass substrates with a sheet resistance of 20 Ω/cm^2 and ITO thickness of 100 nm. The formed OLED devices had a pixel size of 4 mm by 2 mm. All organic and cathode layers were thermally evaporated using Kurt J. Lesker Spectros II deposition at 10^{-6} mbar. All organic materials and aluminium were deposited at a rate of 1 Å s^{-1} and between 0.1 – 2 Å s^{-1} for coevaporated layers. The LiF layer was deposited at 0.2 Å s^{-1}. Characteristics of OLED devices was conducted in the 10-inch integrating sphere (Labsphere) connected to a Source Measure Unit.