Supplementary Information

Thermally Activated Delayed Fluorescence Polymers with Well-defined Structure to Explore Structure-Performance Correlation

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General characterizations

General characterizations

All reagents and solvents were obtained from commercial suppliers and used without further purification unless otherwise stated. The NMR spectra were measured on Bruker Avance (400 MHz and 500 MHz) spectrometers. MALDI-TOF mass spectra were performed on AXIMA CFR MS apparatus (COMPACT). Molecular weights of the polymers were determined by gel permeation chromatography (GPC) on Waters 410 instrument with polystyrene as a standard and tetrahydrofuran (THF) as eluent. Thermal properties were recorded on Perkin-Elmer DSC-7

Electrochemical and Optical measurements

Electrochemical characterization was carried out using a CHI760D electrochemical workstation in a standard three-electrode configuration. ITO glass was used as the working electrode, a titanium plate (2 × 3 cm) as the counter electrode, and an Ag/Ag^+ electrode (0.1 M $AgNO_3$ in acetonitrile) as the reference electrode. The supporting electrolyte was tetrabutylammonium hexafluorophosphate (0.1 M), and the concentration of the sample was 0.6 mg/mL in a mixed solvent of dichloromethane/acetonitrile (v/v = 4:1). The measurements were performed in the potential range of 0-1.0 V with a scan rate of 100 mV/s. The HOMO energy levels were calculated according to the equation: EHOMO = -[E(onset,ox/Fc) + 4.8] (eV). UV-Vis absorption spectra were measured by a Perkin-Elmer Lambda 35 UV-Vis spectrometer. Steady State photoluminescence spectra were recorded on a Perkin-Elmer LS 50B spectrofluorometer. Absolute quantum efficiencies were measured by HAMAMATSU C9920 with an integration sphere. Fluorescence lifetimes were carried out with Edinburgh fluorescence spectrometer (FLS1000) and measured using picosecond pulsed diode laser under the excitation at 370 nm.

Device fabrication and measurements

The light-emitting layers were fabricated via spin-coating. For devices based on PxCzABP, PxCzABP was dissolved in chlorobenzene at a concentration of 11 mg/mL. The solution was spin-coated at 3000 rpm to form a uniform film with a thickness of approximately 50 nm.

For host-guest doped devices, P1CzABP (as the guest) was mixed with a wide-bandgap host material at different weight ratios (100 wt%, 50 wt%, 25 wt%, and 10 wt%) and co-dissolved in chlorobenzene. Apart from the doping ratio, the solution concentration (11 mg/mL), spin-

coating parameters (3000 rpm), and the resulting film thickness (~50 nm) remained consistent with those used for the pure guest devices described above.

The OLEDs have a structure of ITO/PEDOT:PSS (30 nm)/EML (50 nm)/ TPBi (60 nm)/LiF (1 nm)/Al (100 nm) (PEDOT: poly(ethylenedioxythiophene), PSS: poly(styrenesulfonate), TPBi: 2,2′,2″-(1,3,5-benzinetriyl)-tris(1-phenyl-1-H-benzimidazole)). PEDOT:PSS (CLEVIOS™ P VP AI 4083, from Heraeus) was spin-coated onto pre-cleaned ITO substrates as the hole injection layer and annealed at 135 °C for 30 minutes to remove residual solvents. Subsequently, the emissive materials dissolved in organic solvent were spin-coated to form the emission layer in the glove box(Chlorobenzene as solvent, with a concentration of 10mg/mL). The electron transport layer (TPBi), electron injection layer (LiF), and cathode (Al) were then thermally evaporated onto the emissive layer under a vacuum of 1×10^{-6} Pa (M. Braun thin film control and vacuum evaporation chamber operation). For host-doped devices, the emissive material was blended with hosts at doping ratios of 50 wt%, 25 wt%, and 10 wt%, and dissolved in organic solvent for spin-coating. The J-V-L characteristics were measured by a Keithley source measurement unit (Keithley 2400) with a calibrated silicon photodiode. The EL spectra of the devices were measured by CS2000A spectrophotometer. All measurements were carried out at room temperature under ambient conditions. EQEs of the devices were calculated from the luminance, current density, and EL spectrum, assuming a Lambertian distribution.

Morphological characterization

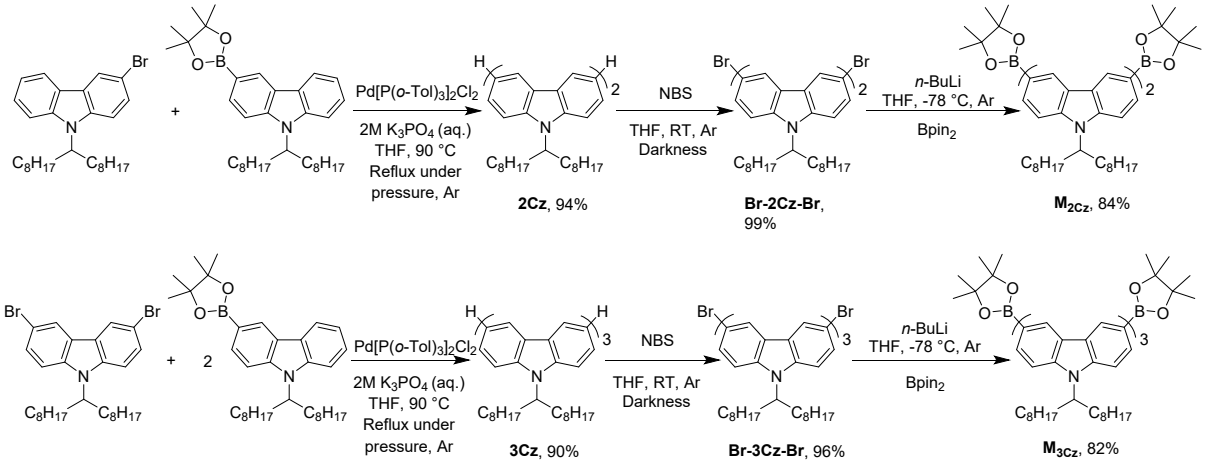
The solutions of corresponding concentrations were spin-coated onto glass substrates, and the film thickness was measured using DektakXT Stylus Profiler from Bruker, Germany. The surface Topography of Semiconductor Thin Films was Characterized Atomic Force Microscope from Germany's Bruker Company.

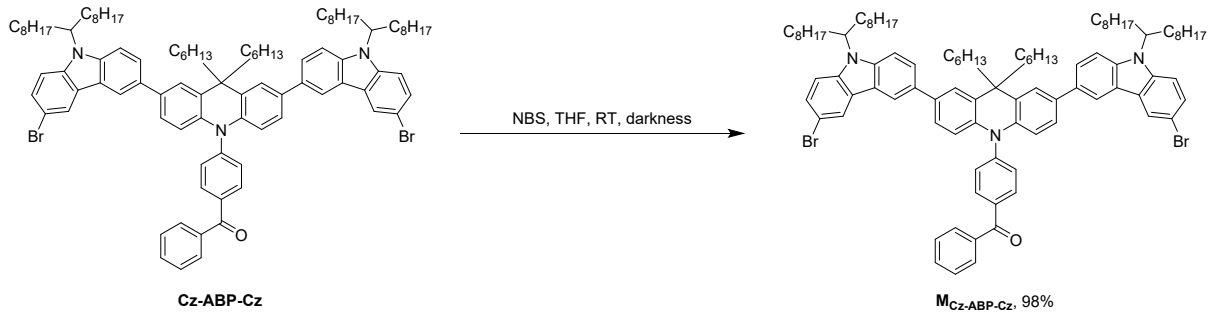
Quantum Chemical Calculations

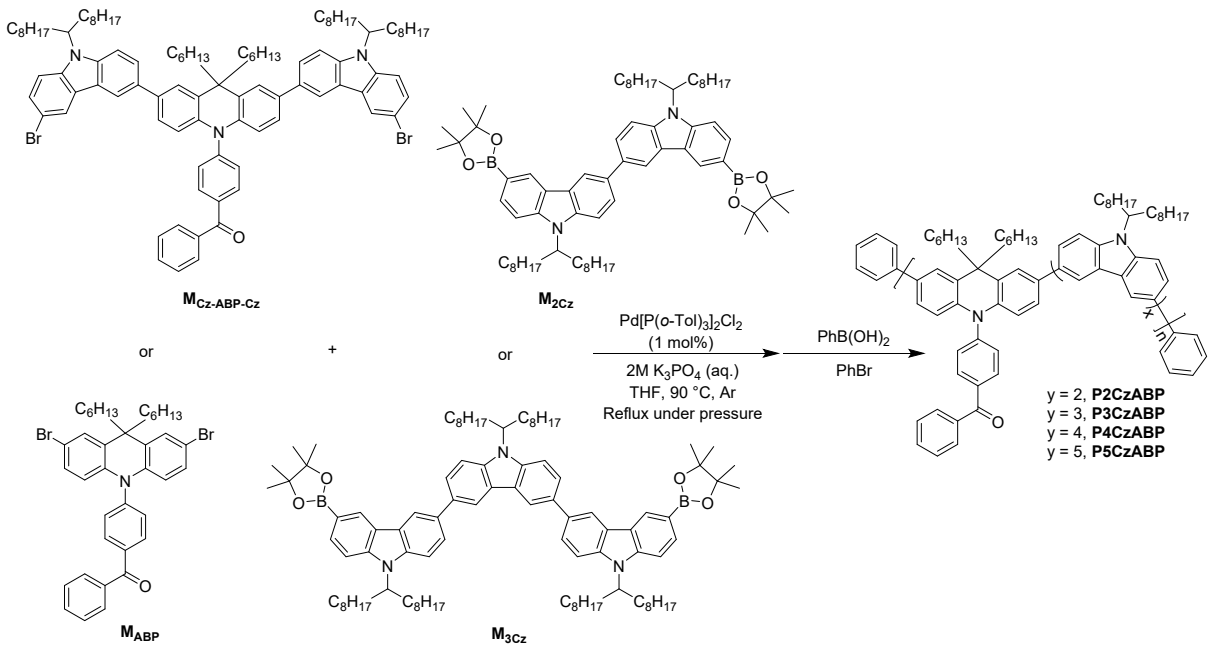
Based on density-functional theory (DFT) and time-dependent DFT (TD-DFT), quantum-chemical calculations were performed to obtain the optimized geometries and excited-state electronic structures for yCz-ABP-yCz (y = 1-5). The ground-state geometries were optimized at the camb3lyp/6-31g(d,p) level. All simulations were carried out for isolated molecules using the Gaussian 09 software package.[1] To analyze the electron excitation properties, the electron−hole (e−h) distribution analysis of the lowest excited states was performed on the Multiwfn.[2]

Experimental Synthesis Section

1. Synthesis routes for polymer PyCzABP







2. General procedure and Analytical data for polymer PyCzABP

2.1 Monomers synthesis of polymer PyCzABP

The two dimeric and trimeric carbazole derivative monomers (M_{2Cz} and M_{3Cz}) were synthesized via three steps according to the literature methods, including Suzuki coupling under reflux, argon atmosphere, and pressure conditions, bromination using N-Bromosuccinimide (NBS), and halogen-lithium exchange followed by borylation with B_2pin_2.[3a] The TADF chromophore compound 9,9-dihexal-10-(4'-benzophenone)-2,7-bis(N-(heptadecane-9-yl)carbazol-3-yl)-9,10-dihydroacridine ($M_{Cz\text{-}ABP\text{-}Cz}$) and the TADF monomer 9,9-dihexal-10-(4'-benzophenone)-2,7-dibromo-9,10- dihydroacridine (M_{ABP}) were prepared according to our previous work.[3]

Carbazole dimer 2Cz: ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.42 (d, *J* = 12.0 Hz, 2H), 8.22 – 8.17 (m, 2H), 7.83 – 7.77 (m, 2H), 7.64 (dd, *J* = 22.5, 8.5 Hz, 2H), 7.50 – 7.44 (m, 4H), 7.24 (t, *J* = 8.0 Hz, 2H), 4.62 – 4.57 (m, 2H), 2.36 – 2.28 (m, 4H), 1.98 – 1.92 (m, 4H), 1.27 – 1.06 (m, 48H), 0.83 (t, *J* = 7.0 Hz, 12H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 142.4, 141.1, 139.0, 137.6, 133.0, 125.5, 125.4, 125.1, 125.0, 124.4, 124.1, 123.0, 122.7, 120.4, 120.1, 118.8, 118.6, 118.4, 111.7, 109.0, 108.8, 56.5, 56.4, 33.8, 31.8, 29.4, 29.3, 29.2, 26.8, 22.6, 14.1. MALDI-TOF $[M]^+$ calcd. for $C_{58}H_{84}N_2$: 808.6635; found, 808.6665.

Carbazole trimer 3Cz: ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.49 (dd, *J* = 31.5, 11.5 Hz, 4H), 8.24 – 8.19 (m, 2H), 7.86 – 7.80 (m, 4H), 7.71 – 7.60 (m, 3H), 7.53 – 7.43 (m, 5H), 7.25 (t, *J* = 8.5 Hz, 2H), 4.67 – 4.56 (m, 3H), 2.43 – 2.28 (m, 6H), 2.03 – 1.93 (m, 6H), 1.33 – 1.08 (m, 72H), 0.86 – 0.83 (m, 18H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 142.4, 141.5, 141.1, 139.0, 138.0, 137.6, 132.9, 125.4, 125.0, 124.7, 124.5, 124.1, 123.2, 123.0, 122.7, 120.5, 120.2, 118.9, 118.6, 118.4, 111.7, 109.0, 108.8, 56.6, 56.4, 33.9, 33.8, 31.7(8), 31.7(6), 29.5, 29.4, 29.3(4), 29.3(1), 29.2(0), 29.1(7), 26.9, 26.8, 22.6, 14.1. MALDI-TOF $[M]^+$ calcd. for $C_{87}H_{125}N_3$: 1211.9874; found, 1211.9912.

Bromide carbazole dimer Br-2Cz-Br: ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.35 – 8.27 (m, 4H), 7.78 (s, 2H), 7.67 (s, 1H), 7.54 – 7.48 (m, 4H), 7.31 (s, 1H), 4.52 (s, 2H), 2.28 (s, 4H), 1.93 (s, 4H), 1.25-1.13 (m, 48H), 0.82 (t, *J* = 6.8 Hz, 12H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 141.5, 141.1, 137.9, 137.6, 133.1, 128.3, 127.9, 126.1, 125.9, 125.6, 124.4, 123.4, 123.2, 122.9, 122.0, 119.0, 118.7, 112.9, 112.0, 111.6, 111.2, 110.4, 109.3, 56.7, 33.7, 31.7, 29.4, 29.3, 29.1, 26.8, 22.7, 14.0. MALDI-TOF $[M]^+$ calcd. for $C_{58}H_{82}Br_2N_2$: 964.4845; found, 964.4861.

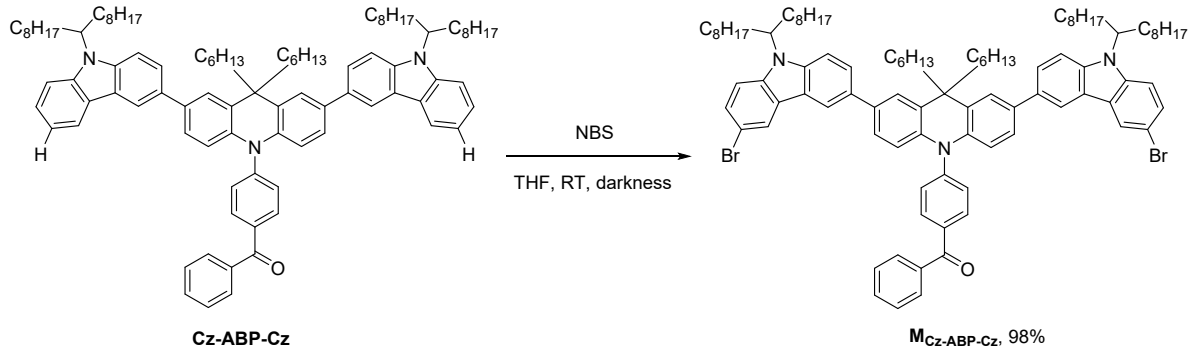
Bromide carbazole trimer Br-3Cz-Br: ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.50 – 8.29 (m, 6H), 7.89 – 7.66 (m, 6H), 7.54 – 7.48 (m, 5H), 7.30 (d, *J* = 8.8 Hz, 1H), 4.64 – 4.52 (m, 3H), 2.41 – 2.33 (m, 6H), 2.02 – 1.91 (m, 6H), 1.29 – 1.01 (m, 72H), 0.83 (t, *J* = 6.8 Hz, 18H). ^{13}C

NMR (126 MHz, $CDCl_3$) δ 141.4, 137.8, 133.4, 132.6, 128.2, 125.8, 124.4, 123.2, 118.9, 118.6, 112.9, 111.9, 110.3, 109.2, 56.7, 33.7, 31.8, 31.7, 29.4(5), 29.4(0), 29.3(3), 29.3(0), 29.2, 29.1, 26.9, 26.8, 22.6(1), 22.6(0), 14.1. MALDI-TOF $[M]^+$ calcd. for $C_{87}H_{123}Br_2N_3$: 1367.8084; found, 1367.8137.

Carbazole dimer monomer M_{2Cz}: ^1H NMR (400 MHz, $CDCl_3$) δ 8.72 (d, *J* = 8.8 Hz, 2H), 8.51 (d, *J* = 8.8 Hz, 2H), 7.94 – 7.78 (m, 4H), 7.67 – 7.41 (m, 4H), 4.65 – 4.57 (m, 2H), 2.34 (s, 4H), 1.99 – 1.91 (m, 4H), 1.42 (s, 24H), 1.22 – 1.06 (m, 48H), 0.83 (t, *J* = 6.8 Hz, 12H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 144.5, 141.2, 137.7, 133.0, 132.0, 131.5, 127.9, 127.7, 125.1, 124.8, 124.7, 123.9, 123.3, 122.5, 118.9, 118.6, 117.9, 111.8, 111.0, 109.1, 108.3, 83.5, 56.5, 33.8, 31.8, 29.4, 29.3, 29.2, 26.8, 24.9, 22.6, 14.1. MALDI-TOF $[M]^+$ calcd. for $C_{70}H_{106}B_2N_2O_4$: 1060.8339; found, 1060.8375.

Carbazole trimer monomer M_{3Cz}: ^1H NMR (400 MHz, $CDCl_3$) δ 8.72 (d, *J* = 7.6 Hz, 2H), 8.55 (s, 4H), 7.94 – 7.85 (m, 6H), 7.69 – 7.41 (m, 6H), 4.67 – 4.57 (m, 3H), 2.44 – 2.34 (m, 6H), 2.05 – 1.91 (m, 6H), 1.41 (s, 24H), 1.30 – 1.14 (m, 72H), 0.86 – 0.81 (m, 18H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 144.6, 141.2, 137.7, 133.3, 132.7, 132.0, 131.4, 127.9, 127.7, 125.3, 124.8, 123.9, 123.3, 122.6, 118.8, 117.8, 111.8, 111.0, 109.1, 108.3, 83.5, 56.6, 33.8, 31.8, 31.7, 29.5, 29.4, 29.3(5), 29.3(0), 29.2(2), 29.2(0), 26.9, 26.8, 24.9, 22.6(2), 22.6(0), 14.0(8), 14.0(6). MALDI-TOF $[M]^+$ calcd. for $C_{99}H_{147}B_2N_3O_4$: 1464.1578; found, 1464.1539.

TADF chromophore monomer $M_{Cz\text{-}ABP\text{-}Cz}$

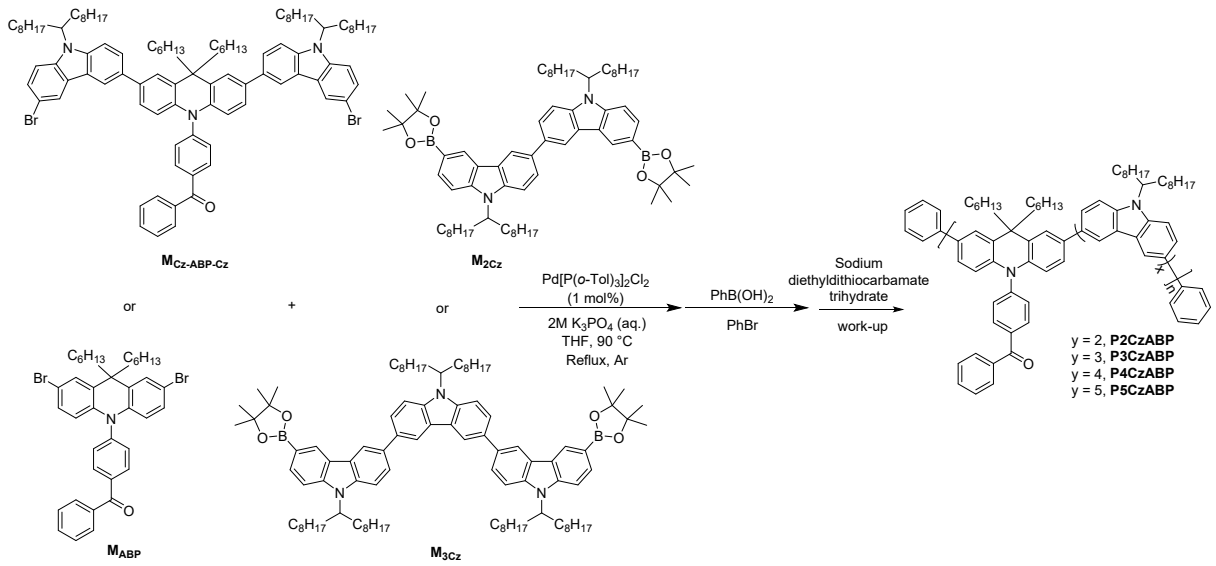


Cz-ABP-Cz **$M_{Cz\text{-}ABP\text{-}Cz}$**, 98%

Compound Cz-ABP-Cz (1.00 g, 0.75 mmol), NBS (0.27 g, 1.52 mmol) and THF (20 ml) were added into a 100 ml flask. The mixture was stirred at room temperature in the dark. After 12 h, the solvent was removed using a rotary evaporator. The crude product was purified by flash chromatography using petroleum ether/DCM (1:1) as eluent. Yield: 1.10 g, 98%. ^1H NMR (400 MHz, $CDCl_3$) δ 8.28 – 8.14 (m, 6H), 7.96 (d, *J* = 6.8 Hz, 2H), 7.71 – 7.45 (m, 14H), 7.30 (dd, *J* = 8.4, 1.6 Hz, 3H), 6.31 (s, 2H), 4.53 (s, 2H), 2.28 – 2.16 (m, 8H), 1.97 – 1.89 (m, 4H), 1.27 – 0.97 (m, 64H), 0.82 (t, *J* = 6.8 Hz, 18H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 196.0, 141.4,

141.1, 140.6, 137.8, 137.5, 137.3(3), 137.3(0), 132.9, 132.8, 130.1, 128.5, 128.3, 127.8, 125.8, 125.1, 124.3, 123.2, 122.8, 121.9, 118.1, 114.3, 112.9, 111.9, 111.5, 111.2, 110.4, 109.2, 56.7, 33.7, 31.7, 29.8, 29.7, 29.3(4), 29.3(0), 29.1, 26.9, 26.7, 25.1, 22.7, 22.6, 14.1, 14.0. MALDI-TOF $[M\text{-}C_6H_{13}]^+$ calcd. for $C_{96}H_{123}Br_2N_3O\text{-}C_6H_{13}$: 1406.7016; found, 1406.7067.

2.2 General synthetic procedures for the TADF polymer PyCzABP



The polymerization was performed via palladium(II) catalyzed Suzuki polycondensation according to general procedures. Under argon atmosphere, TADF bromide monomer (M_{ABP} or $M_{Cz\text{-}ABP\text{-}Cz}$), carbazole derivative monomer (M_{2Cz} or M_{3Cz}), potassium phosphate (1 mL, 2M), $Pd(P(o\text{-tol})_3)Cl_2$ (1.2 mg, 1.5×10^{-3} mmol) and 5 mL THF were added into a 50 mL flask, and the resulting mixture was stirred at 90 °C reflux for 24 h. Then the polymers were capped by adding phenylboronic acid (3.0 mg in 1 mL THF) by continuous stirring for 6 h, and then bromobenzene (0.5 mL) followed by reacting for another 6 h. Then sodium diethyldithiocarbamate trihydrate (500 mg) and deionized water (10 ml) were added to the mixture. The solution was kept at 80 °C with vigorous stirring under argon for 12 h. After cooled to room temperature, the resulting mixture was diluted with dichloromethane, and then washed three times with deionized water. After concentration, the resulting polymers were received by precipitation in methanol. The final purification was carried out by Soxhlet apparatus with acetone for about 24 h and then precipitated in methanol. After that, the resulting polymer was dried under vacuum at room temperature to provide a yellow powder.

P2CzABP: $\mathbf{M_{ABP}}$ (103.1 mg, 0.15 mmol) and $\mathbf{M_{2Cz}}$ (159.2 mg, 0.15 mmol) were used in the polymerization (yield: 88%). ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.44 (d, J = 13.0 Hz, 2H), 8.34 (d, J = 13.0 Hz, 2H), 8.11 (d, J = 8.0 Hz, 2H), 7.92 (d, J = 6.0 Hz, 2H), 7.88 – 7.58 (m, 10H),

7.55 – 7.47 (m, 6H), 7.35 (d, *J* = 8.5 Hz, 2H), 6.32 (d, *J* = 8.5 Hz, 1H), 4.61 (s, 2H), 2.35 – 2.19 (m, 8H), 1.97 (s, 4H), 1.26 – 1.15 (m, 64H), 0.84 – 0.77 (m, 18H). GPC: *M*n = 13.9 kDa, PDI = 2.17.

P3CzABP: $\mathbf{M_{ABP}}$ (103.1 mg, 0.15 mmol) and $\mathbf{M_{3Cz}}$ (219.7 mg, 0.15 mmol) were used in the polymerization (yield: 85%). ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.47 (t, *J* = 13.0 Hz, 4H), 8.34 (d, *J* = 13.0 Hz, 2H), 8.12 (d, *J* = 8.5 Hz, 2H), 7.95 – 7.92 (m, 2H), 7.84 (d, *J* = 17.0 Hz, 4H), 7.75 – 7.47 (m, 16H), 7.35 (d, *J* = 8.5 Hz, 2H), 6.32 (d, *J* = 8.5 Hz, 1H), 4.60 (s, 3H), 2.35 – 2.20 (m, 10H), 1.96 (s, 6H), 1.27 – 1.14 (m, 90H), 0.83 – 0.77 (m, 24H). GPC: *M*n = 12.8 kDa, PDI = 2.18.

P4CzABP: $\mathbf{M_{Cz\text{-}ABP\text{-}Cz}}$ (224.3 mg, 0.15 mmol) and $\mathbf{M_{2Cz}}$ (159.2 mg, 0.15 mmol) were used in the polymerization (yield: 86%). ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.51 – 8.34 (m, 8H), 8.13 – 8.09 (m, 2H), 7.95 – 7.83 (m, 7H), 7.75 – 7.44 (m, 18H), 7.40 – 7.35 (m, 2H), 6.33 (dd, *J* = 8.5, 3.0 Hz, 2H), 4.61 (s, 4H), 2.36 – 1.97 (m, 20H), 1.27 – 1.15 (m, 112H), 0.88 – 0.77 (m, 30H). GPC: *M*n = 12.5 kDa, PDI = 1.78.

P5CzABP: $\mathbf{M_{Cz\text{-}ABP\text{-}Cz}}$ (224.3 mg, 0.15 mmol) and $\mathbf{M_{3Cz}}$ (219.7 mg, 0.15 mmol) were used in the polymerization (yield: 89%). ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.52 – 8.46 (m, 7H), 8.35 (d, *J* = 13.5 Hz, 2H), 8.10 (d, *J* = 8.0 Hz, 2H), 7.95 – 7.83 (m, 10H), 7.74 – 7.46 (m, 20H), 7.35 (t, *J* = 8.5 Hz, 2H), 6.32 – 6.23 (m, 2H), 4.61 (s, 5H), 2.36 – 1.96 (m, 24H), 1.26 – 1.10 (m, 136H), 0.83 – 0.77 (m, 36H). GPC: *M*n = 9.7 kDa, PDI = 1.80.

Characterization of photophysical properties

Table S1. Thermal properties, weight-average molecular weight and number-average molecular weight (M_w and M_n) and polydispersity index (PDI) values of the polymers evaluated by TGA and GPC.

Polymer	T_d (°C)	M_w (kDa)	M_n (kDa)	PDI
P1CzABP	387	46.7	16.1	2.89
P2CzABP	387	30.3	13.9	2.17
P3CzABP	391	27.9	12.8	2.18
P4CzABP	392	22.3	12.5	1.78
P5CzABP	396	17.5	9.7	1.80

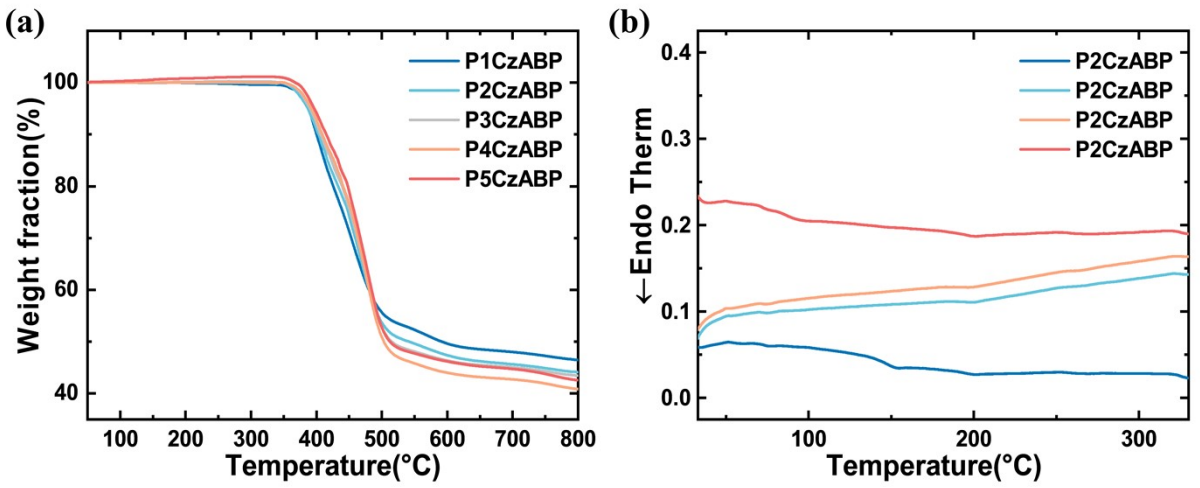


Figure S1. (a) TGA traces of the polymers recorded at a heating rate of 10 °C min^{-1}; (b) DSC traces of the polymers recorded at a heating rate of 10 °C min^{-1}.

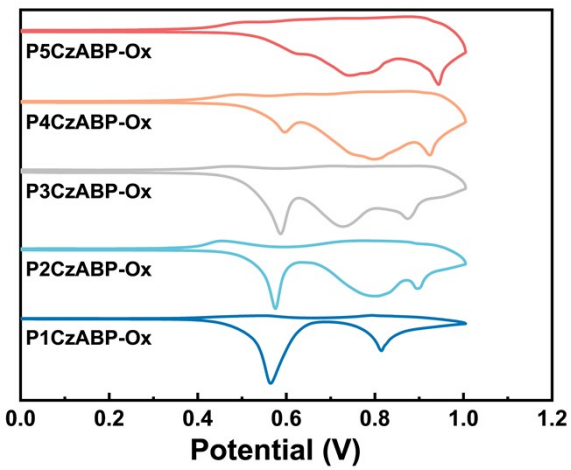


Figure S2. Cyclic voltammograms of the polymer films in acetonitrile using ferrocene as an internal reference and *n*-Bu_4NClO_4 as the supporting electrolyte.

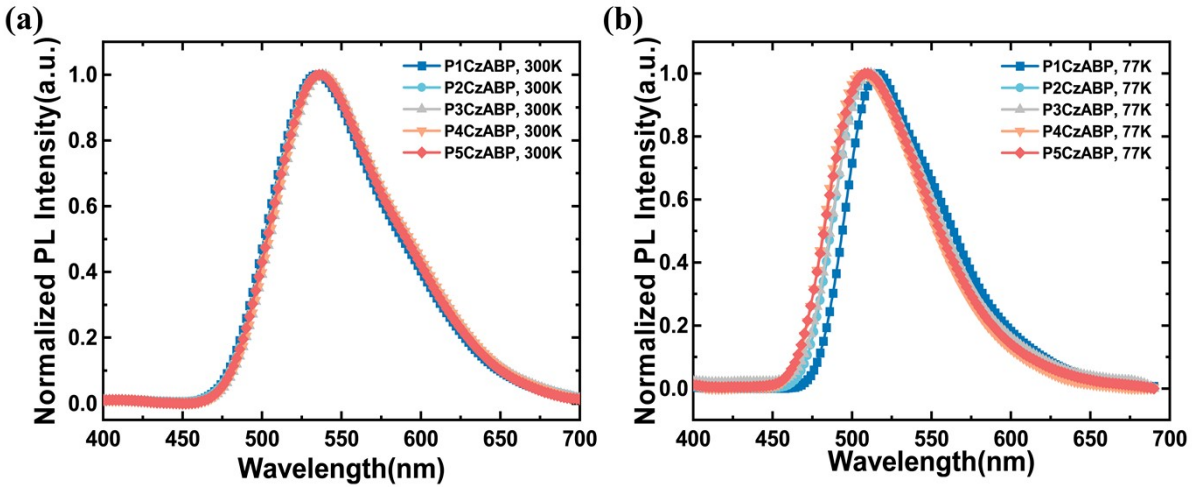


Figure S3. (a) PL spectra of the polymers in oxygen-free toluene at 300 K; (b) Phosphorescence spectra (delayed by 10 ms) in oxygen-free toluene at 77 K.

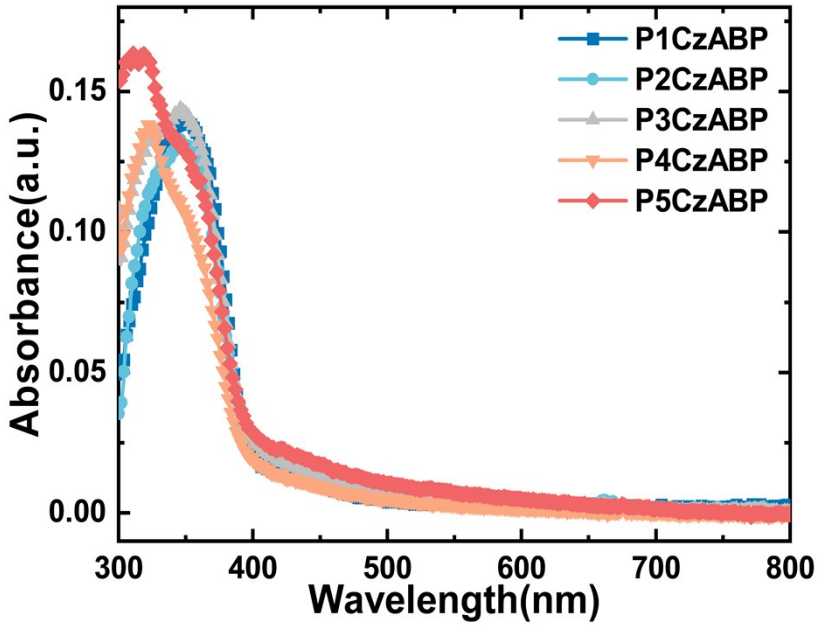


Figure S4. UV-Vis absorption spectra of PyCzABP in neat film.

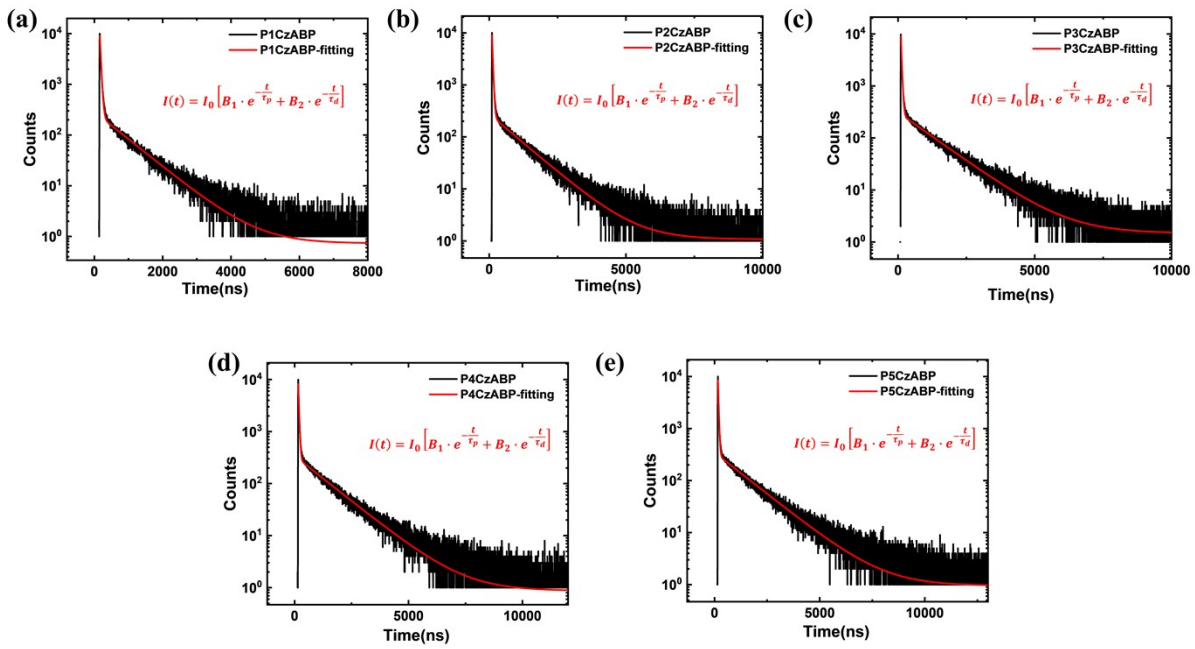


Figure S5. Transient PL decay spectra and double exponential fitting curves of the polymers in film at 300 K.

Table S2. Overlap integral of orbitals calculated via DFT for yCz–ABP–yCz (y = 1–3).

E/eV	1Cz-ABP-1Cz 213-214	2Cz-ABP-2Cz 323-324	3Cz-ABP-3Cz 433-434
Orbital centroid distance [Å]	7.454636	7.943086	8.214799
Overlap integral of norm of the two orbitals	0.0891046137	0.0791538473	0.0737525360
Overlap integral of square of the two orbitals	0.0000265831	0.0000204980	0.0000176187

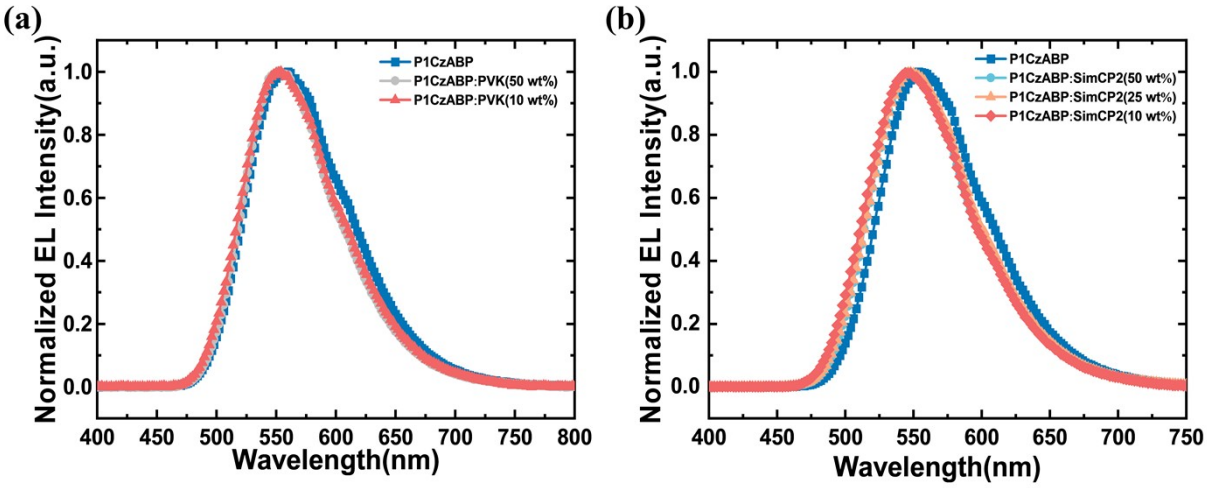


Figure S6. (a) EL spectra of the P1CzABP blended with PVK in various ratios; (b) EL spectra of the P1CzABP blended with SimCP2 in various ratios.

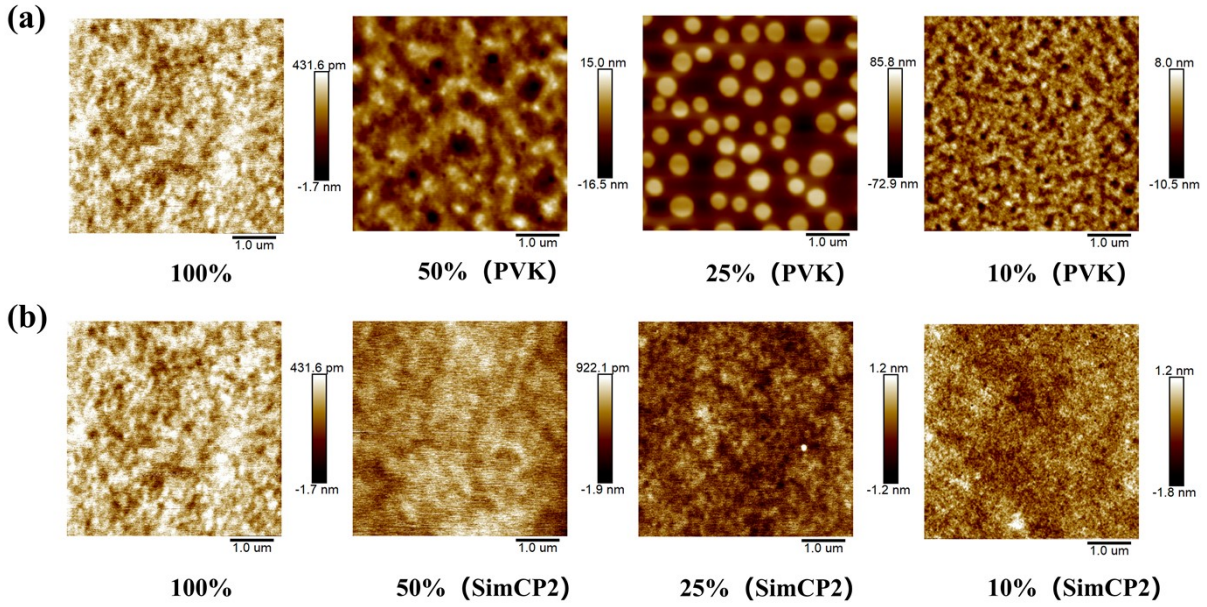


Figure S7. The morphology characterization (AFM) of P1CzABP blended with (a) PVK and (b) SimCP2 in various ratios.

Time-dependent density functional theory (TD-DFT) calculations

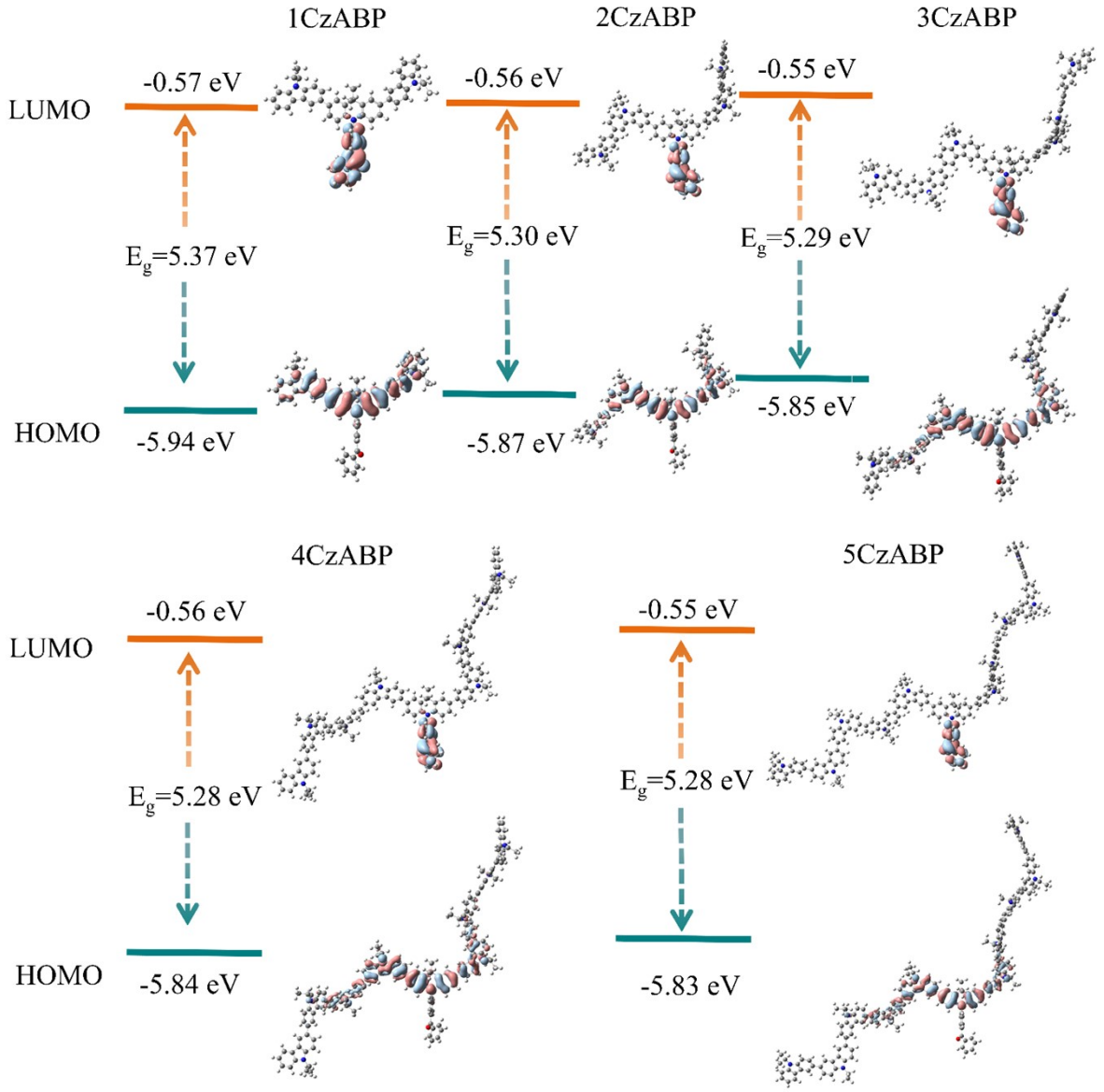


Figure S8. The HOMO and LUMO distributions of yCz–ABP–yCz (y = 1-5) calculated by TD-DFT.

Reference:

[1] M. J. Frisch, G. W. Trucks, H. B. Schlegel, G. E. Scuseria, M. A. Robb, J. R. Cheeseman, G. Scalmani, V. Barone, B. Mennucci, G. A. Petersson, H. Nakatsuji, M. Caricato, X. Li, H. P. Hratchian, A. F. Izmaylov, J. Bloino, G. Zheng, J. L. Sonnenberg, M. Hada, M. Ehara, K. Toyota, R. Fukuda, J. Hasegawa, M. Ishida, T. Nakajima, Y. Honda, O. Kitao, H. Nakai, T. Vreven, J. A. Montgomery, Jr., J. E. Peralta, F. Ogliaro, M. Bearpark, J. J. Heyd, E. Brothers, K. N. Kudin, V. N. Staroverov, R. Kobayashi, J. Normand, K. Raghavachari, A. Rendell, J. C. Burant, S. S. Iyengar, J. Tomasi, M. Cossi, N. Rega, J. M. Millam, M. Klene, J. E. Knox, J. B. Cross, V. Bakken, C. Adamo, J. Jaramillo, R. Gomperts, R. E. Stratmann, O. Yazyev, A. J. Austin, R. Cammi, C. Pomelli, J. W. Ochterski, R. L. Martin, K. Morokuma, V. G. Zakrzewski, G. A. Voth, P. Salvador, J. J. Dannenberg, S. Dapprich, A. D. Daniels, Ö. Farkas, J. B. Foresman, J. V. Ortiz, J. Cioslowski, and D. J. Fox, Gaussian 09, Revision E.01; 2013, Gaussian, Inc.: Wallingford CT.

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[3] (a) Y. Yang, S. Wang, Y. Zhu, Y. Wang, H. Zhan and Y. Cheng, *Adv. Func. Mater.,* **2018**, *28*, 1706916; (b) Y. Yang, Y. Zhu, Y. Wang, H. Zhan and Y. Cheng, *Polym. Chem.,* **2018**, *56*, 1989; (c) Y. Yang, K. Li, C. Wang, H. Zhan and Y. Cheng, *Chem. Asian J.*, **2019**, *14*, 574.

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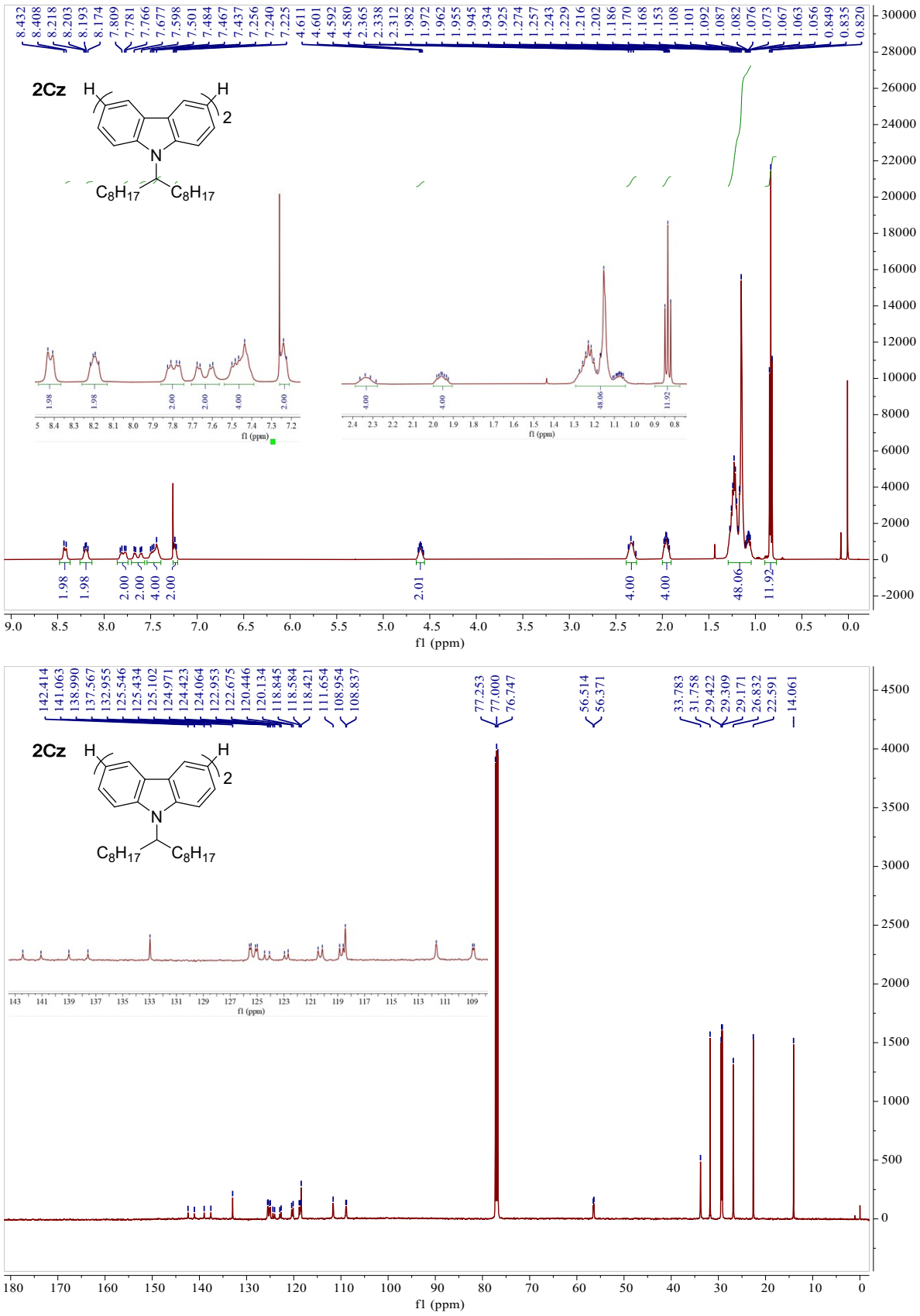


Figure S9 ^{1}H NMR and ^{13}C NMR Spectrum of **2Cz** in $CDCl_3$

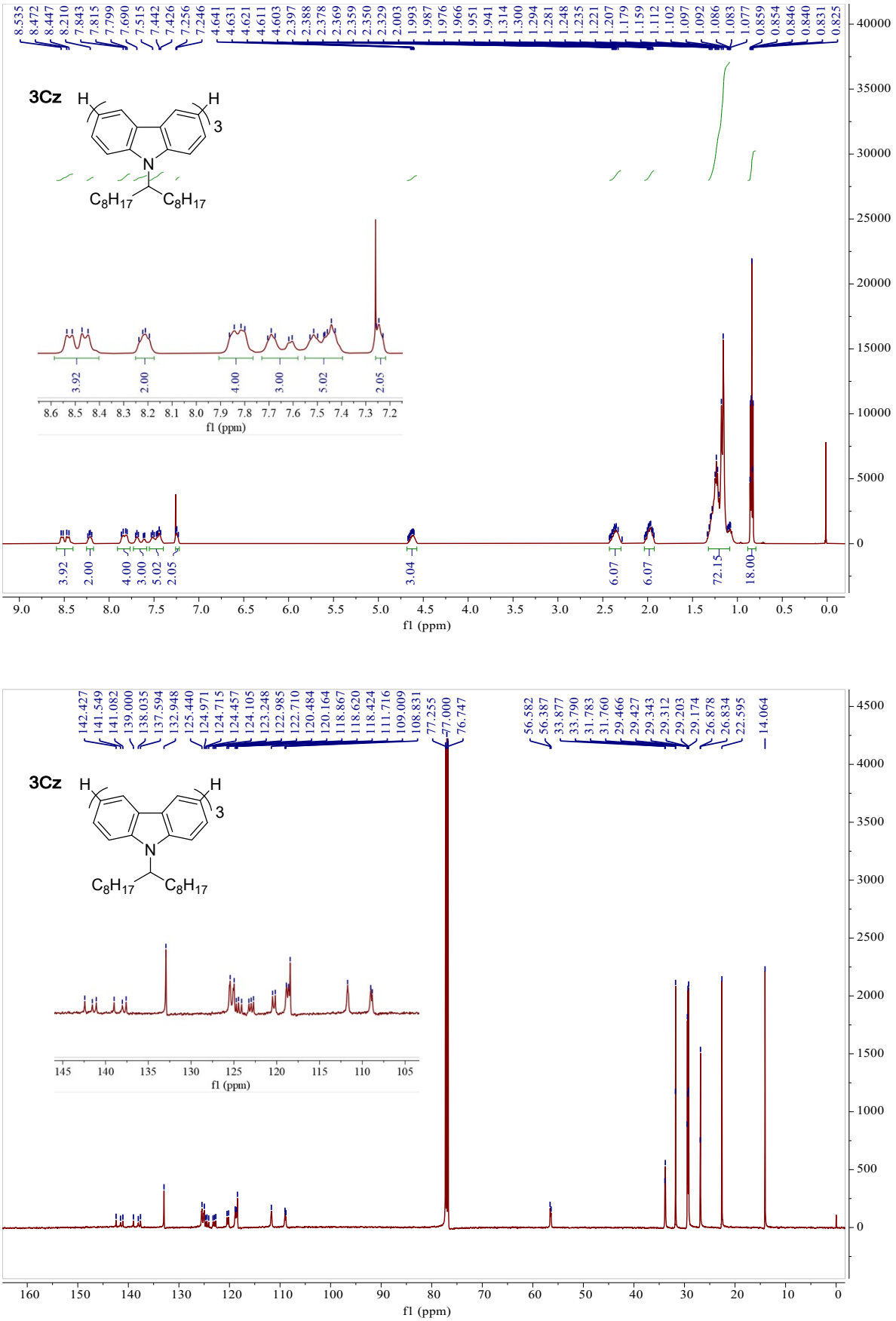


Figure S10 ^{1}H NMR and ^{13}C NMR Spectrum of **3Cz** in $CDCl_3$

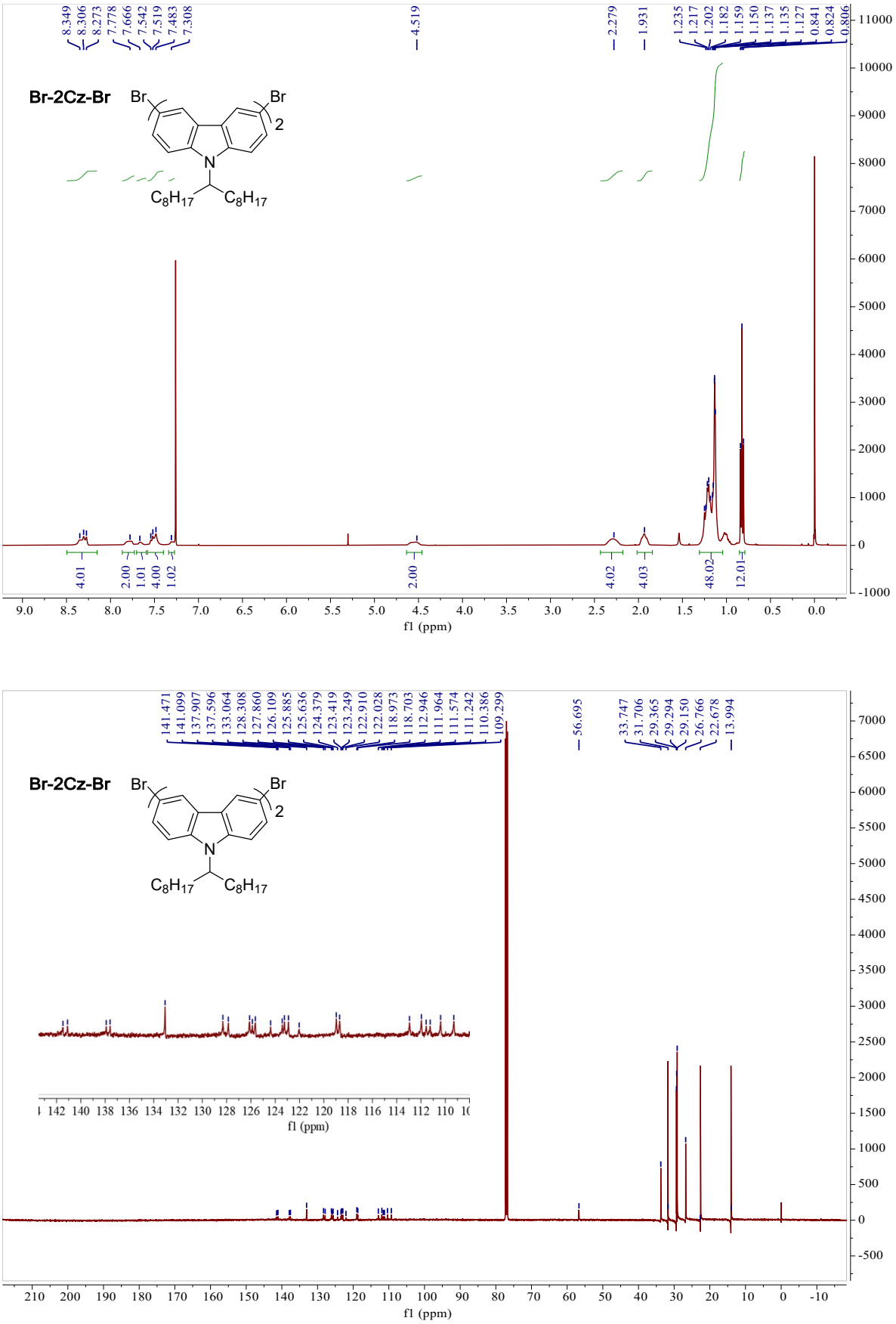
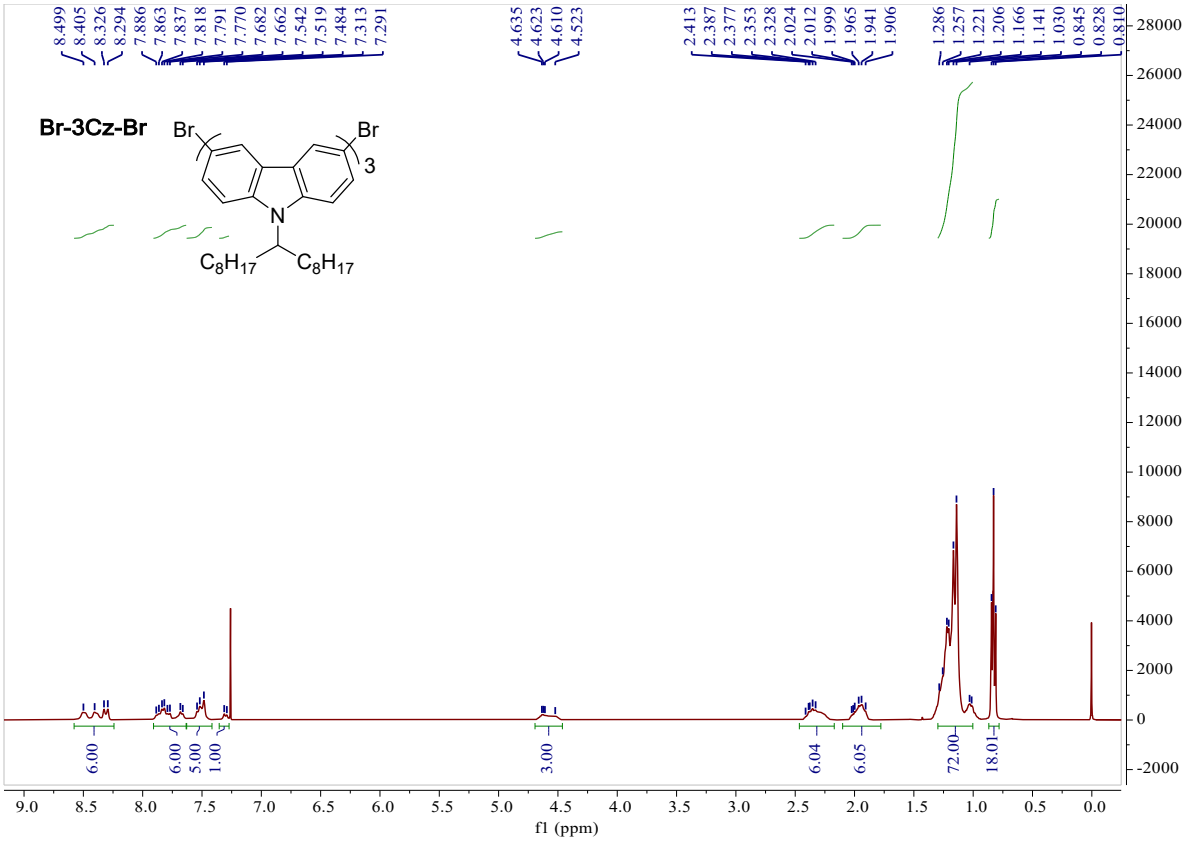


Figure S11 ^{1}H NMR and ^{13}C NMR Spectrum of **Br-2Cz-Br** in $CDCl_3$



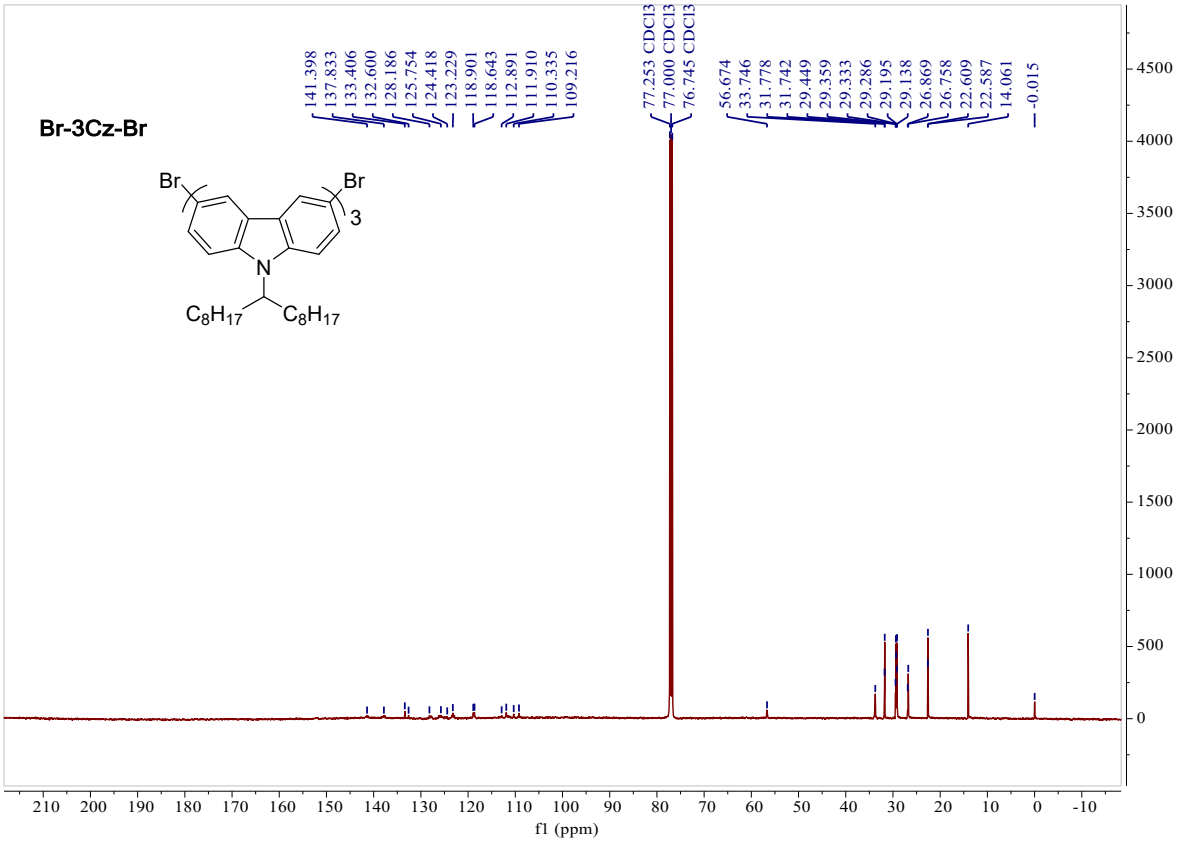


Figure S12 ^{1}H NMR and ^{13}C NMR Spectrum of **Br-3Cz-Br** in $CDCl_3$

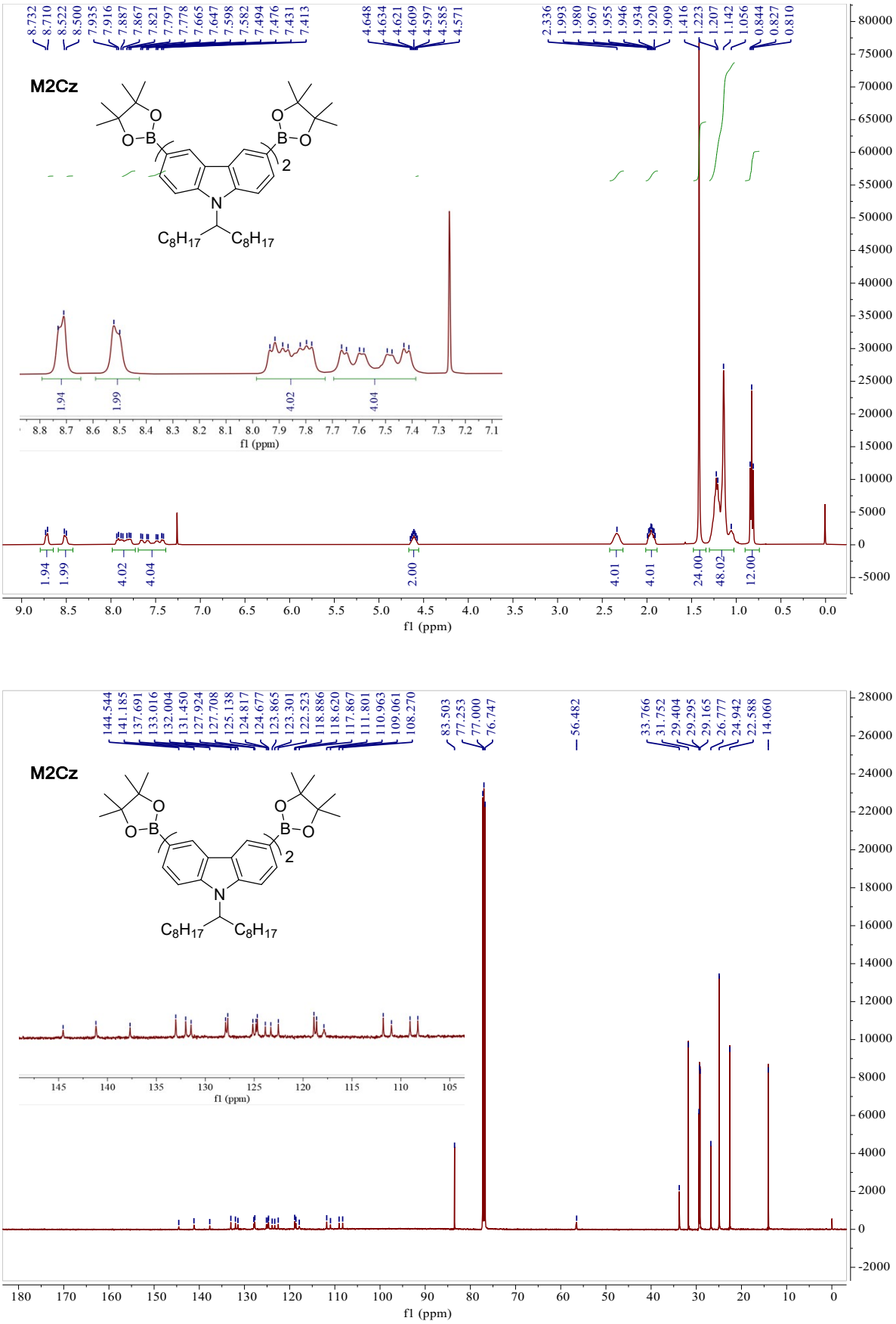


Figure S13 ^{1}H NMR and ^{13}C NMR Spectrum of **M2Cz** in $CDCl_3$

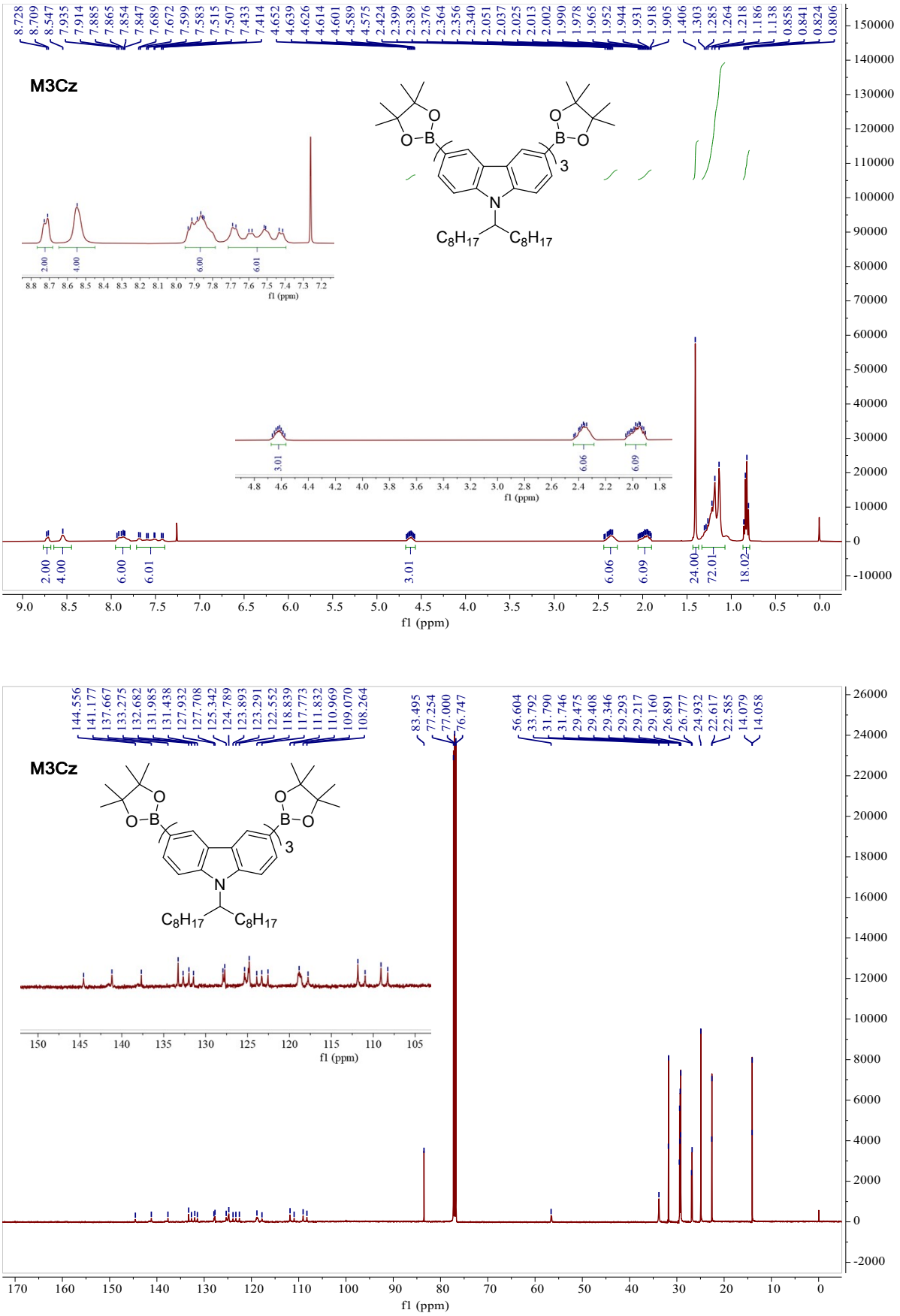


Figure S14 ^{1}H NMR and ^{13}C NMR Spectrum of **M3Cz** in $CDCl_3$

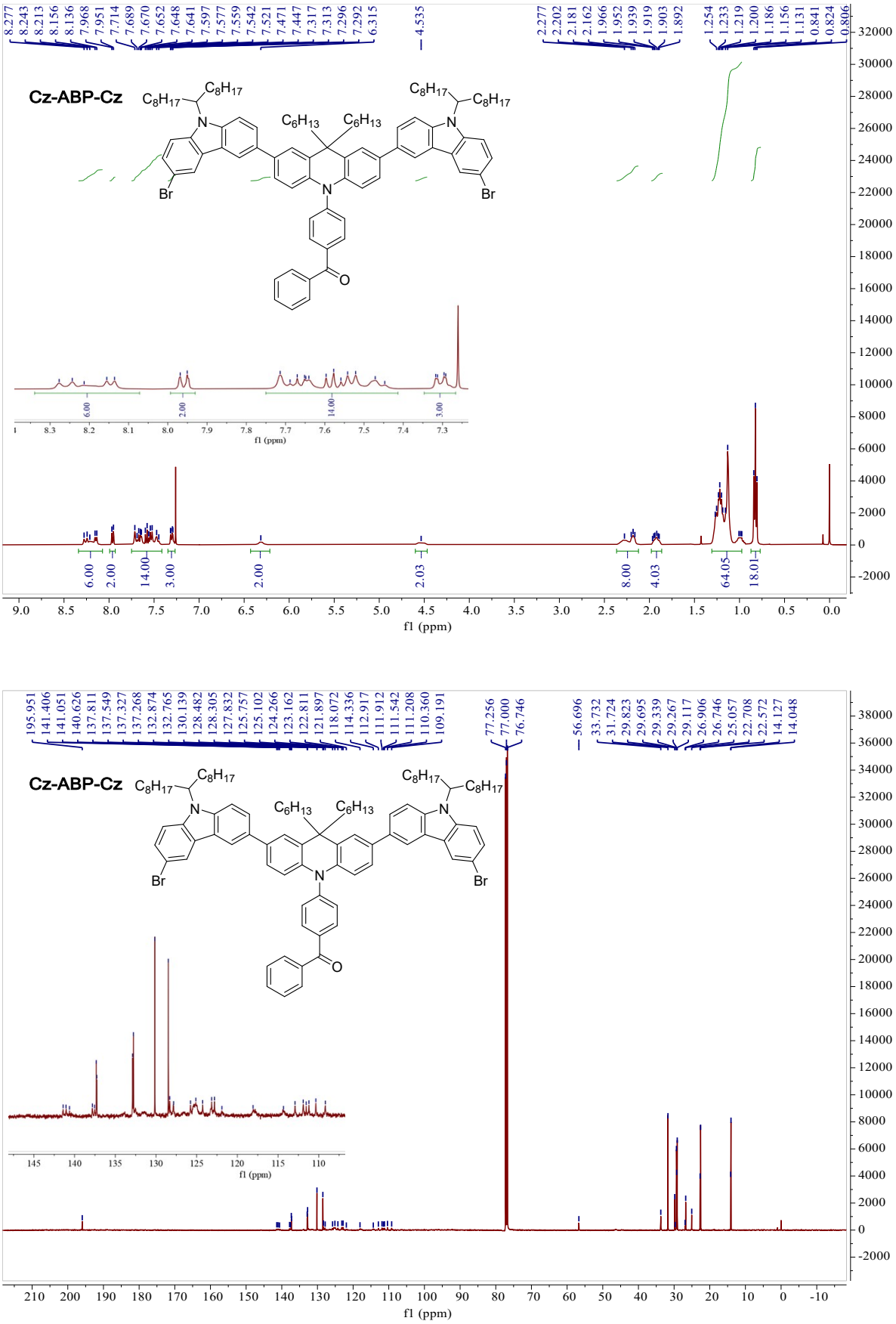


Figure S15 ^{1}H NMR and ^{13}C NMR Spectrum of **Cz-ABP-Cz** in $CDCl_3$

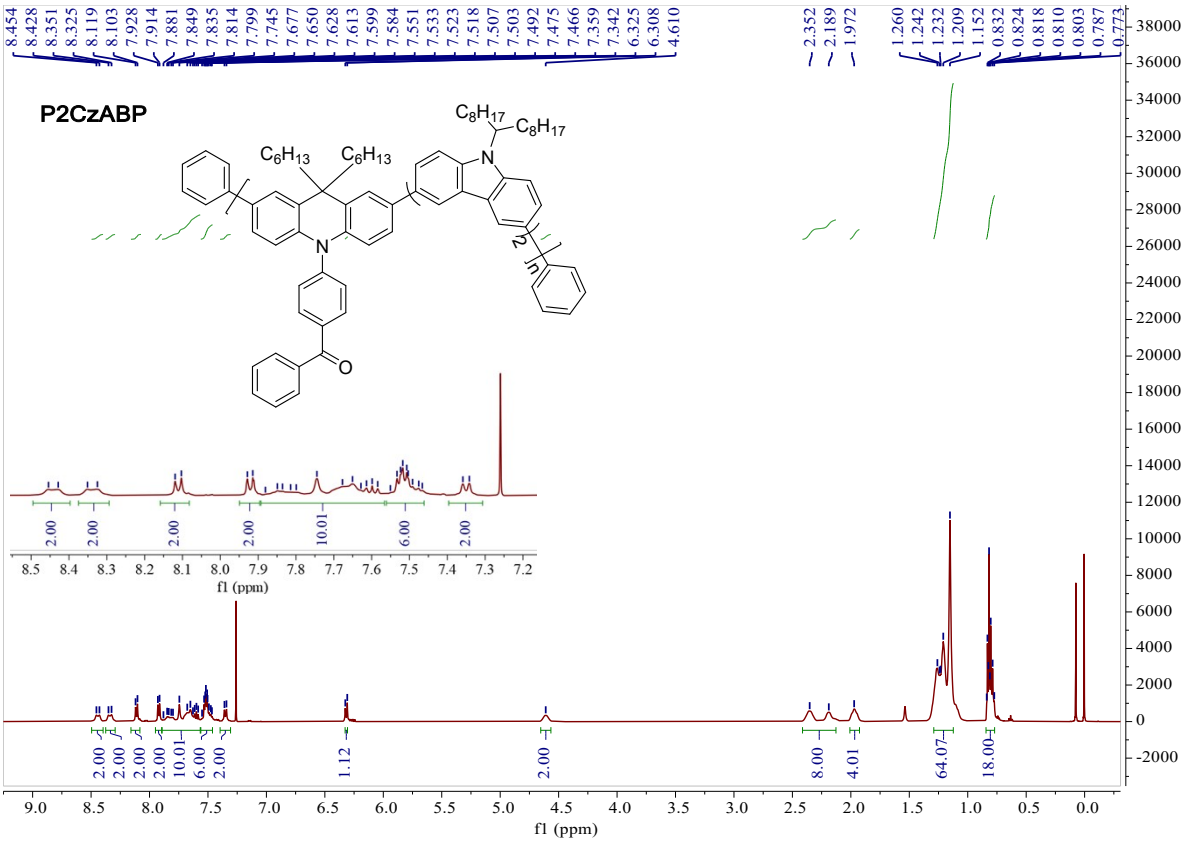


Figure S16 ^{1}H NMR Spectrum of the polymer **P2CzABP** in $CDCl_3$

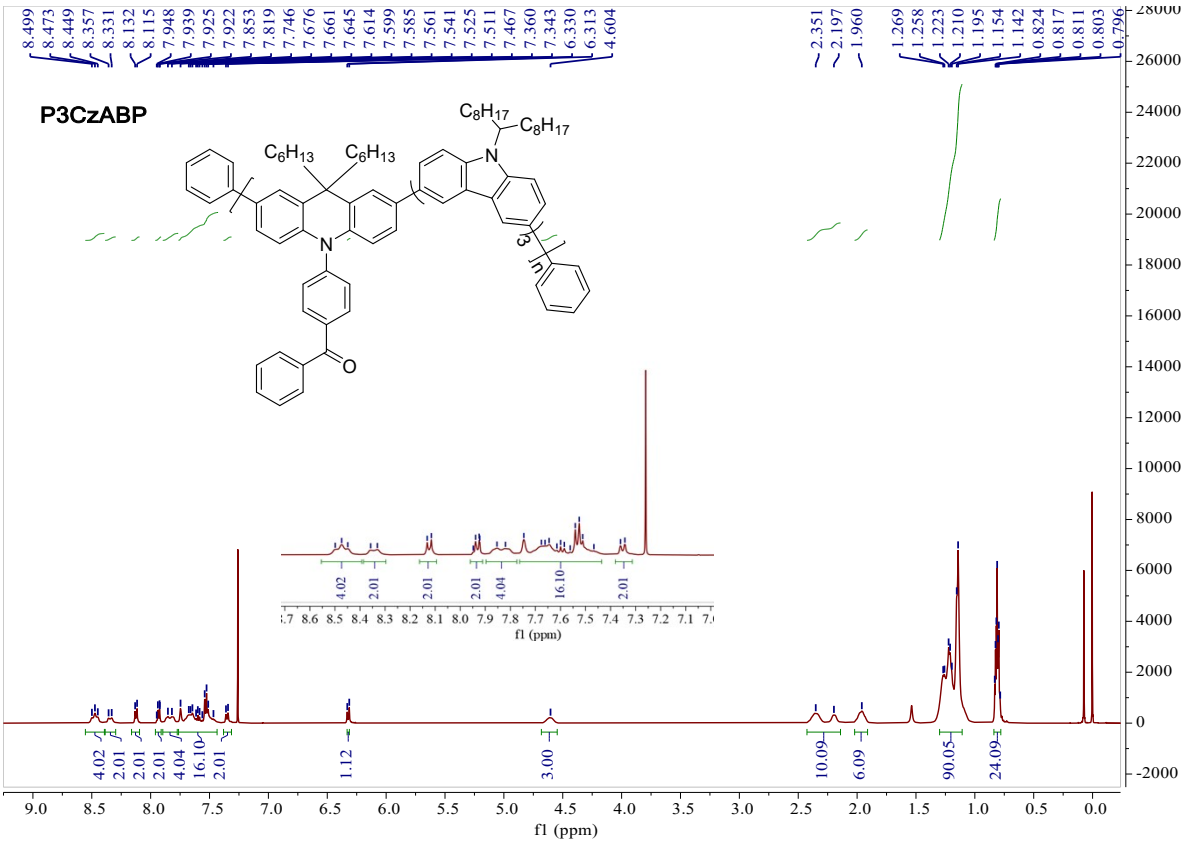


Figure S17 ^{1}H NMR Spectrum of the polymer **P3CzABP** in $CDCl_3$

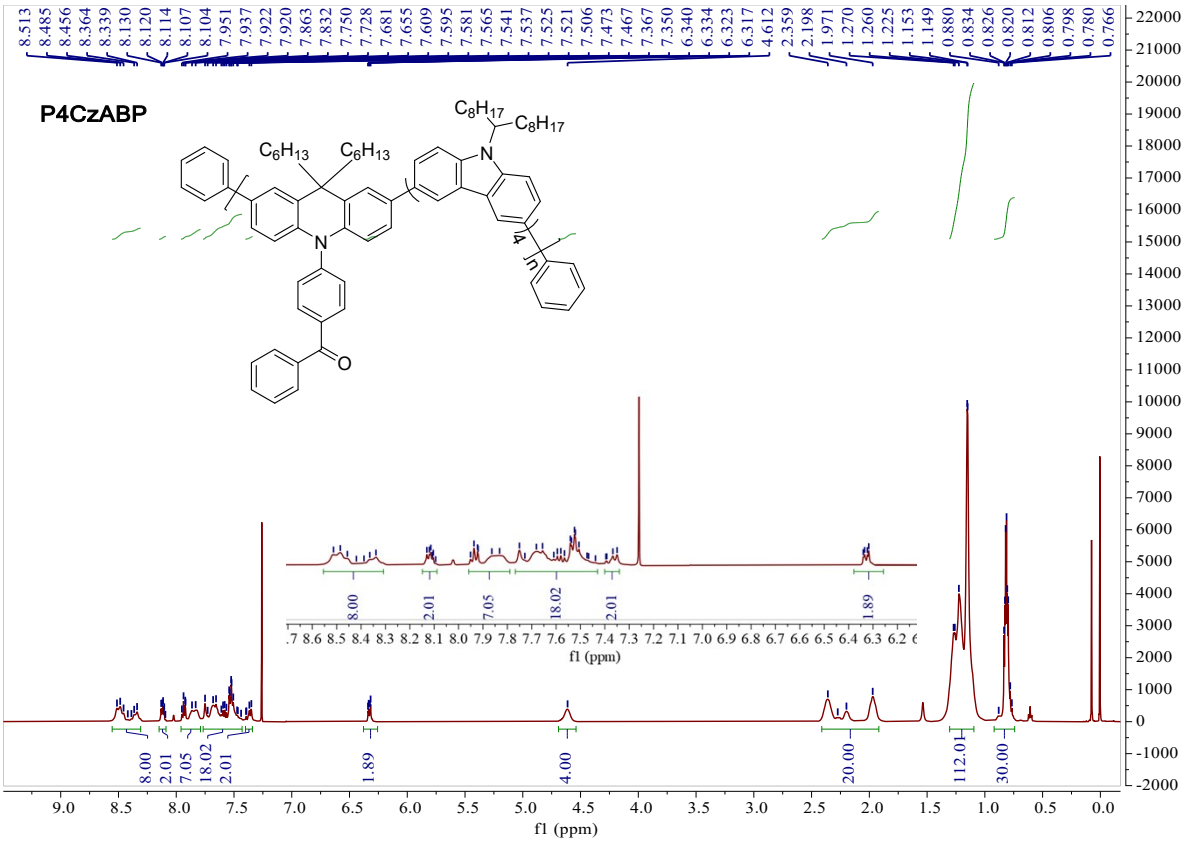


Figure S18 ^{1}H NMR Spectrum of the polymer **P4CzABP** in $CDCl_3$

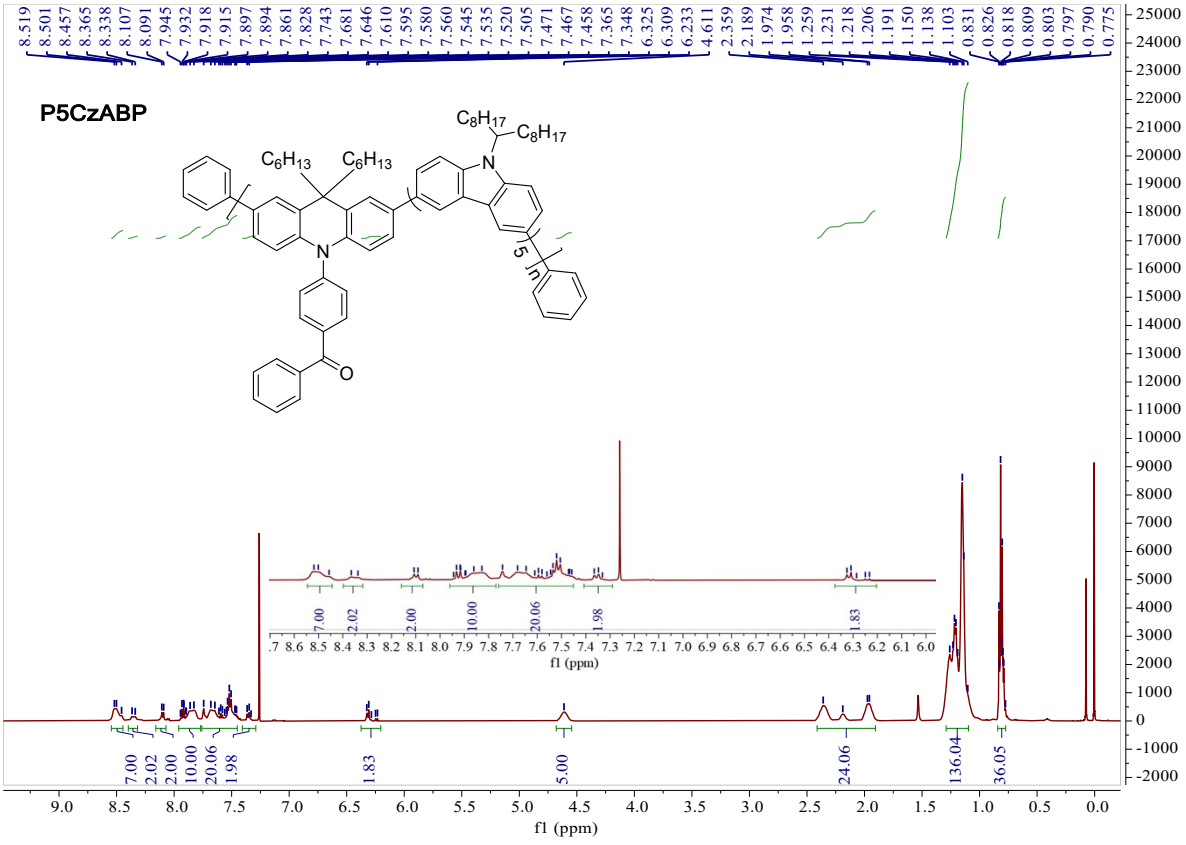


Figure S19 ^{1}H NMR Spectrum of the polymer **P5CzABP** in $CDCl_3$