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Supplementary data

FACILE SYNTHESIS OF PHOTOACTIVE DIARYL(HETARYL)CYCLOPENTENES BY IONIC HYDROGENATION

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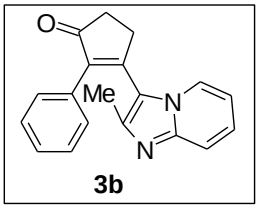
1. EXPERIMENTAL SECTION

General. Proton nuclear magnetic resonance spectra (^{1}H NMR) and carbon nuclear magnetic resonance spectra (^{13}C NMR) were recorded in deuterated solvents on a spectrometers working at 300 MHz for ^{1}H, 75 MHz for ^{13}C. Both ^{1}H and ^{13}C NMR chemical shifts are referenced relative to the solvents residual signals ($CHCl_3$: δ 7.27 for ^{1}H NMR and δ 77.16 for ^{13}C NMR) and reported in parts per million (ppm) at 293 K. Data are represented as follows: chemical shift, multiplicity (s, singlet; d, doublet; m, multiplet; br, broad), coupling constant in hertz (Hz), integration, and assignment. Melting points (Mp) were recorded using an apparatus and not corrected. Mass spectra were obtained on a mass spectrometer (70 eV) with direct sample injection into the ion source. High resolution mass spectra were obtained from a TOF mass spectrometer with an ESI source. All chemicals and anhydrous solvents were purchased from commercial sources and used without further purification. Silica column chromatography was performed using silica gel 60 (70−230 mesh); TLC analysis was conducted on silica gel 60 F254 plates.

Photochemical studies. UV−Vis spectra were recorded in 1.0 cm quartz cuvettes. The experimental measurements were performed at 293 K in the presence of air in acetonitrile solution. Photocoloration and photobleaching reactions were carried out using high-pressure mercury lamp as the exciting light source. The required wavelengths (313 and 517 nm) were isolated by the use of the appropriate filters.

Synthesis of diarylethenes 3

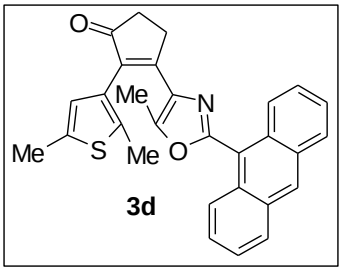
New diarylcyclopentenones **3b, 3d, 3e, 3h, 3i** were prepared according method [S1] from corresponding ketoesters and bromoketones. Compound **3d** was used without purification. Diarylethenes **3a** [S2], **3c** [S3], **3f** [S4], **3g** [S4], **3j** [S1], **3h** [S3] and **4a** [S2] were described previously.



3b

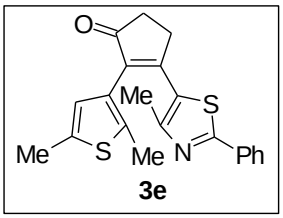
3-(2-Methylimidazo[1,2-*a*]pyridin-3-yl)-2-phenylcyclopent-2-en-1-one (3b). Yield 52%, yellow crystals, m.p. 145-146 ºC. ^{1}H NMR (300 MHz, $CDCl_3$): δ 2.58 (s, 3H, CH_3), 2.72-2.88 (m, 2H, CH_2), 3.15-3.27 (m, 2H, CH_2), 6.44 (t, J = 6.8 Hz, 1H, $H^{imidazopyridine}$), 7.05-7.33 (m, 7H, H^{arom}), 7.53 (d, J = 9.0 Hz, 1H, $H^{imidazopyridine}$). ^{13}C NMR (75 MHz, $CDCl_3$): 15.6, 29.8, 35.2, 112.0, 116.5, 117.8, 125.2, 125.6, 127.9, 128.3, 128.5, 131.9, 137.0, 145.0, 145.9, 156.2, 206.1. MS, *m/z* (%): 288 (100, $[M]^+$), 273 (10, $[M\text{-}CH_3]^+$). HRMS (ESI-TOF) m/z: $[M+H]^+$ calcd for $C_{19}H_{17}N_2O$: 289.1335; found: 289.1343.

2-(2,5-Dimethylthiophen-3-yl)-3-(2-antracen-9-yl-5-methyl-1,3-oxazol-4-yl)cyclopent-2-en-1-one (3d). Yield 15% (NMR data). ^{1}H NMR (300 MHz, $CDCl_3$): δ 1.98 (s, 3H, CH_3), 2.22 (s, 3H, CH_3), 2.46 (s, 3H, CH_3), 2.68-2.75 (m, 2H, CH_2), 3.22-3.29 (m, 2H, CH_2), 6.69 (s, 1H, $H^{thiophene}$), 7.47-7.58 (m, 4H, H^{arom}), 7.93-8.11 (m, 2H, H^{arom}), 8.62 (s, 1H, H^{arom}). ^{13}C NMR (75 MHz, $CDCl_3$): 11.2, 14.4, 15.3, 29.4, 34.6, 121.1, 125.3, 125.5, 126.8, 127.2, 127.3, 128.7, 129.0, 130.4, 131.0, 131.1, 131.3, 131.4, 133.1, 134.9, 135.7, 136.5, 149.7, 161.2, 207.8. MS, *m/z* (%): 449 (75, $[M]^+$), 434 (25, $[M\text{-}CH_3]^+$), 205 (100). HRMS (ESI-TOF) m/z: $[M+H]^+$ calcd for $C_{29}H_{24}NO_2S$: 450.1522; found: 450.1511.



3d

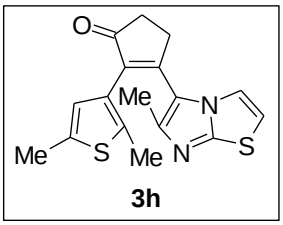
2-(2,5-Dimethylthiophen-3-yl)-3-(4-methyl-2-phenyl-1,3-thiazol-5-yl)cyclopent-2-en-1-one



3e

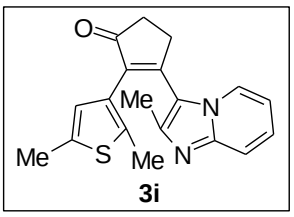
(3e). Yield 32%, light red crystalls, m.p. 142-144 °C. ^{1}H NMR (300 MHz, $CDCl_3$): δ = 2.04 (s, 3H, CH_3), 2.33 (s, 3H, CH_3), 2.42 (s, 3H, CH_3), 2.65-2.74 (m, 2H, CH_2), 3.07-3.20 (m, 2H, CH_2), 6.45 (s, 1H, $H^{thiophene}$), 7.37-7.50 (m, 3H, H^{arom}), 7.83-7.94 (m, 2H, H^{arom}). ^{13}C NMR (75 MHz, $CDCl_3$): δ = 14.2, 15.3, 18.0, 31.5, 34.7, 126.1, 126.5, 128.0, 128.3, 129.0, 130.5, 133.0, 136.1, 136.8, 137.0, 154.4, 159.9, 168.7, 206.5. MS (EI, 70 eV): *m/z* (%) = 365 (100, $[M]^+$), 350 (60, $[M\text{-}CH_3]^+$). HRMS (ESI-TOF) m/z: $[M+H]^+$ calcd for $C_{21}H_{20}NOS_2$: 366.0981; found: 366.0971.

2-(2,5-Dimethylthiophen-3-yl)-3-(6-methylimidazo[2,1-b][1,3]thiazol-5-yl)cyclopent-2-en-1-one (3h). Yield 20%, yellow powder, m.p. 157-158 °C. ^{1}H NMR (300 MHz, $CDCl_3$): δ = 1.72 (s, 3H, CH_3), 2.36 (s, 3H, CH_3), 2.50 (s, 3H, CH_3), 2.58-2.75 (m, 2H, CH_2), 3.06-3.23 (m, 2H, CH_2), 6.44 (d, *J* = 4.2 Hz, 1H, $H^{imidazothiazole}$), 6.53 (d, *J* = 4.2 Hz, 1H, $H^{imidazothiazole}$), 6.61 (s, 1H, $H^{thiophene}$). ^{13}C NMR (75 MHz, $CDCl_3$): δ = 13.8, 15.2, 16.5, 29.7, 34.6, 111.1, 119.8, 126.2, 128.9, 132.1, 136.0, 137.2, 147.8, 151.5, 156.0, 206.4. MS (EI, 70 eV): *m/z* (%) = 328 (100, $[M]^+$), 313 (15, $[M\text{-}CH_3]^+$). HRMS (ESI-TOF) m/z: $[M+H]^+$ calcd for $C_{17}H_{17}N_2OS_2$: 329.0777; found: 329.0775.



3h

2-(2,5-Dimethylthiophen-3-yl)-3-(2-methylimidazo[1,2-a]pyridin-3-yl)cyclopent-2-en-1-one

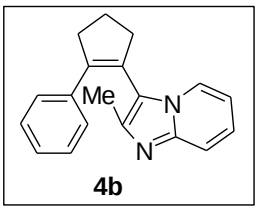


3i

(3i). Yield 34%, yellow powder, m.p. 161-163 °C. ^{1}H NMR (300 MHz, $CDCl_3$): δ = 1.54 (s, 3H, CH_3), 2.30 (s, 3H, CH_3), 2.55 (s, 3H, CH_3), 2.67-2.77 (m, 2H, CH_2), 3.12-3.26 (m, 2H, CH_2), 6.45-6.57 (m, 2H, $H^{thiophene}$ + $H^{imidazopyridine}$), 7.15 (m, 1H, $H^{imidazopyridine}$), 7.30 (d, *J* = 6.9 Hz, 1H, $H^{imidazopyridine}$), 7.50 (d, *J* = 8.9 Hz, 1H, $H^{imidazopyridine}$). ^{13}C NMR (75 MHz, $CDCl_3$): δ = 13.7, 15.1, 15.8, 29.9, 34.8, 111.8, 116.5, 118.4, 125.2, 125.5, 128.9, 134.2, 136.0, 136.9, 145.5, 145.9, 156.0, 206.5.

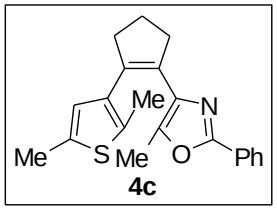
MS (EI, 70 eV): *m/z* (%) = 322 (100, $[M]^+$), 307 (35, $[M\text{-}CH_3]^+$). HRMS (ESI-TOF) m/z: $[M+H]^+$ calcd for $C_{19}H_{19}N_2OS$: 323.1213; found: 323.1211.

Di(het)arylcyclopentenes 4 (general). To a solution of initial diarylethene **3** (0.6 mmol) in abs. dichloromethane (3 ml) under inert atmosphere (argon) the triethylsilane (210 mg, 1.8 mmol) in abs. dichloromethane (3 ml) and trifluoromethanesulfonic acid (180 mg, 1.2 mmol) in abs. dichloromethane (3 ml) were added dropwise simultaneously. Resulting emulsion was mixed at ambient temperature (diarylethenes **3a**, **3c**, **3d**, **3e**) or refluxed (diarylethenes **3b**, **3f**, **3g**, **3h**, **3i**) until complete consumption of starting diarylcyclopentenone (monitored by TLC). Solution was poured into 5% water solution of $NaHCO_3$ (100 mL) and extracted with dichloromethane (2 x 30 ml). The combined organic phases were washed with water (100 ml), dried with magnesium sulfate, and evaporated in vacuum. The residue was purified by flash chromatography by petroleum ether (150 ml, for removing of silicon-containing impurities) and petroleum ether /ethyl acetate (6:1 or 4:1).



4b

2-Methyl-3-(2-phenylcyclopent-1-en-1-yl)imidazo[1,2-*a*]pyridine (4b). Yield 105 mg (64%), yellow amorphous powder. ^{1}H NMR (300 MHz, $CDCl_3$): δ = 2.12-2.25 (m, 2H, CH_2), 2.32 (s, 3H, CH_3), 2.89 (t, J = 7.4 Hz, 2H, CH_2), 3.06 (t, J = 7.3 Hz, 2H, CH_2), 6.60 (t, J = 6.8 Hz, 1H, $H^{imidazopyridine}$), 6.97-7.17 (m, 6H, H^{arom}), 7.57 (t, J = 8.3 Hz, 2H). ^{13}C NMR (75 MHz, $CDCl_3$): δ = 14.1, 22.6, 36.6, 37.6, 111.5, 116.4, 118.8, 123.8, 124.0, 125.3, 126.4, 127.3, 128.3, 136.8, 140.5, 142.8, 144.4. MS (EI, 70 eV): *m/z* (%) = 274 (10) $[M]^+$, 78 (100). HRMS (ESI-TOF) m/z: $[M+H]^+$ calcd for $C_{19}H_{19}N_2$: 275.1543; found: 275.1542.

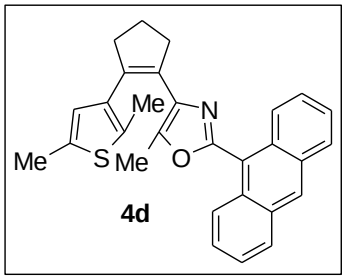


4c

4-[2-(2,5-Dimethylthiophen-3-yl)cyclopent-1-en-1-yl]-5-methyl-2-phenyl-1,3-oxazole (4c). Yield 130 mg (65%), yellow crystalls, m.p. 99-103 °C. ^{1}H NMR (300 MHz, $CDCl_3$): δ = 1.80 (s, 3H, CH_3), 2.02-2.12 (m, 2H, CH_2), 2.03 (s, 3H, CH_3), 2.38 (s, 3H, CH_3), 2.78 (t, J = 7.4 Hz, 2H, CH_2), 2.93 (t, J = 7.4

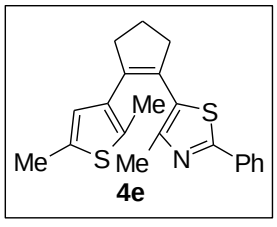
Hz, 2H, CH_2), 6.48 (s, 1H, $H^{thiophene}$), 7.48-7.47 (m, 3H, H^{arom}), 7.97-8.04 (m, 2H, H^{arom}). ^{13}C NMR (75 MHz, $CDCl_3$): δ = 10.6, 14.2, 15.1, 22.7, 36.8, 38.8, 126.0, 126.2, 127.7, 128.6, 129.7, 130.0, 132.0, 133.9, 135.2, 135.5, 135.8, 144.9, 159.2. MS (EI, 70 eV): *m/z* (%) = 335 (35) $[M]^+$, 320 (30) $[M\text{-}CH_3]^+$, 214 (100). HRMS (ESI-TOF) m/z: $[M+H]^+$ calcd for $C_{21}H_{22}NOS$: 336.1417; found: 336.1419.

4-[2-(2,5-Dimethylthiophen-3-yl)cyclopent-1-en-1-yl]-2-antracen-9-yl-5-methyl-1,3-oxazole



4d

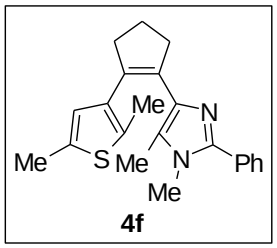
(4d). Yield 159 mg (61%), yellow powder, m.p. 137-138 °C. ^1H NMR (300 MHz, $CDCl_3$): δ = 1.95 (s, 3H, CH_3), 2.05-2.17 (m, 2H, CH_2), 2.21 (s, 3H, CH_3), 2.43 (s, 3H, CH_3), 2.81 (t, *J* = 7.4 Hz, 2H, CH_2), 3.06 (t, *J* = 7.4 Hz, 2H, CH_2), 6.60 (s, 1H, $H^{thiophene}$), 7.41-7.52 (m, 4H, H^{arom}), 8.00-8.10 (m, 4H, H^{arom}), 8.58 (s, 1H, H^{arom}). ^{13}C NMR (75 MHz, $CDCl_3$): δ = 10.7, 14.4, 15.2, 22.8, 37.0, 39.0, 122.2, 125.3, 125.7, 126.2, 126.7, 126.8, 128.5, 129.8, 130.3, 131.2, 131.3, 131.7, 131.8, 133.9, 135.4, 135.8, 135.9, 145.7, 157.7. MS (EI, 70 eV): *m/z* (%) = 435 (100) $[M]^+$, 420 (60) $[M\text{-}CH_3]^+$. HRMS (ESI-TOF) m/z: $[M+H]^+$ calcd for $C_{29}H_{26}NOS$: 436.1730; found: 436.1720.



4e

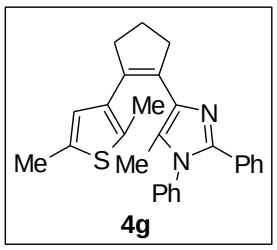
5-[2-(2,5-Dimethylthiophen-3-yl)cyclopent-1-en-1-yl]-4-methyl-2-phenyl-1,3-thiazole (4e). Yield 126 mg (60%), yellow crystalls, m.p. 130-131 °C. ^1H NMR (300 MHz, $CDCl_3$): δ = 2.00 (s, 3H, CH_3), 2.03-2.13 (m, 2H, CH_2), 2.10 (s, 3H, CH_3), 2.38 (s, 3H, CH_3), 2.75-2.95 (m, 4H, CH_2), 6.46 (s, 1H, H^{arom}), 7.35-7.46 (m, 3H, H^{arom}), 7.80-7.92 (m, 2H, H^{arom}). ^{13}C NMR (75 MHz, $CDCl_3$): δ = 14.2, 15.2, 16.5, 22.9, 38.9, 39.5, 125.7, 126.2, 128.8, 129.1, 129.5, 129.8, 132.9, 133.8, 134.6, 135.9, 138.0, 149.8, 164.8. MS (EI, 70 eV): *m/z* (%) = 351 (100) $[M]^+$. HRMS (ESI-TOF) m/z: $[M+H]^+$ calcd for $C_{21}H_{22}NS_2$: 352.1188; found: 352.1179.

4-[2-(2,5-Dimethylthiophen-3-yl)cyclopent-1-en-1-yl]-1,5-dimethyl-2-phenyl-1*H*-imidazole



4f

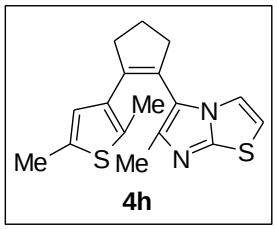
(4f). Yield 104 mg (50%), yellow amorphous powder. ^{1}H NMR (300 MHz, $CDCl_3$): δ = 1.65 (s, 3H, CH_3), 1.95 (s, 3H, CH_3), 1.97-2.09 (m, 2H, CH_2), 2.37 (s, 3H, CH_3), 2.71-2.83 (m, 2H, CH_2), 2.90-3.01 (m, 2H, CH_2), 3.48 (s, 3H, NCH_3), 6.49 (s, 1H, H^{arom}), 7.34-7.65 (m, 5H, H^{arom}). ^{13}C NMR (75 MHz, $CDCl_3$): δ = 9.4, 14.3, 15.1, 22.8, 31.8, 37.6, 38.8, 125.8, 126.5, 128.2, 128.4, 128.9, 131.2, 131.6, 133.0, 133.4, 134.8, 135.4, 136.1, 146.5. MS (EI, 70 eV): *m/z* (%) = 348 (100) $[M]^+$. HRMS (ESI-TOF) m/z: $[M+H]^+$ calcd for $C_{22}H_{24}N_2S$: 349.1733; found: 349.1179.



4g

4-[2-(2,5-Dimethylthiophen-3-yl)cyclopent-1-en-1-yl]-5-methyl-1,2-diphenyl-1*H*-imidazole (4g). Yield 98 mg (40%), yellow amorphous powder. ^{1}H NMR (300 MHz, $CDCl_3$): δ = 1.44 (s, 3H, CH_3), 2.03 (s, 3H, CH_3), 2.03-2.13 (m, 2H, CH_2), 2.37 (s, 3H, CH_3), 2.74-2.86 (m, 2H, CH_2), 2.99-3.12 (m, 2H, CH_2), 6.52 (s, 1H, H^{arom}), 7.04-7.44 (m, 10H, H^{arom}). ^{13}C NMR (75 MHz, $CDCl_3$): δ = 10.0, 14.3, 15.1, 22.9, 37.4, 38.8, 126.5, 127.1, 127.7, 127.8, 128.0, 128.2, 128.4, 129.4, 130.8, 131.6, 133.1, 133.8, 134.9, 135.9, 136.0, 137.7, 145.7. MS (EI, 70 eV): *m/z* (%) = 410 (40) $[M]^+$, 395 (100) $[M-CH_3]^+$. HRMS (ESI-TOF) m/z: $[M+H]^+$ calcd for $C_{22}H_{24}N_2S$: 411.1889; found: 411.1879.

5-[2-(2,5-Dimethylthiophen-3-yl)cyclopent-1-en-1-yl]-6-methylimidazo[2,1-*b*][1,3]thiazole

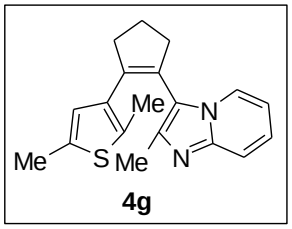


4h

(4h). Yield 107 mg (57%), light brown amorphous powder. ^{1}H NMR (300 MHz, $CDCl_3$): δ = 1.73 (s, 3H, CH_3), 2.00-2.13 (m, 2H, CH_2), 2.22 (s, 3H, CH_3), 2.34 (s, 3H, CH_3), 2.74-2.94 (m, 4H, CH_2), 6.41-6.53 (m, 2H, $H^{thiophene}$+$H^{imidazothiazole}$), 6.67 (d, J = 4.4 Hz, 1H, $H^{imidazothiazole}$). ^{13}C

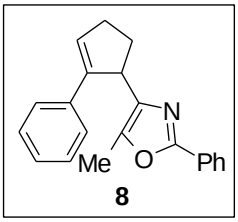
NMR (75 MHz, $CDCl_3$): δ = 13.8, 14.4, 15.1, 23.1, 37.0, 38.2, 110.5, 118.6, 125.3, 125.5, 126.4, 133.0, 134.4, 136.2, 136.3, 141.0, 147.4. MS (EI, 70 eV): *m/z* (%) = 314 (100) $[M]^+$. HRMS (ESI-TOF) m/z: $[M+H]^+$ calcd for $C_{17}H_{19}N_2S_2$: 315.0984; found: 315.0972.

3-[2-(2,5-Dimethylthiophen-3-yl)cyclopent-1-en-1-yl]-2-methylimidazo[1,2-a]pyridine (4g).



4g

Yield 88 mg (48%), yellow amorphous powder. ^{1}H NMR (300 MHz, $CDCl_3$): δ = 1.64 (s, 3H, CH_3), 2.07-2.18 (m, 2H, CH_2), 2.25 (s, 3H, CH_3), 2.28 (s, 3H, CH_3), 2.80-2.94 (m, 4H, CH_2), 6.39 (s, 1H, $H^{thiophene}$), 6.51-6.60 (m, 1H, $H^{imidazopyridine}$), 6.99-7.09 (m, 1H, $H^{imidazopyridine}$), 7.45 (d, *J* = 9.0 Hz, 1H, $H^{imidazopyridine}$), 7.56 (d, *J* = 6.9 Hz, 1H, $H^{imidazopyridine}$). ^{13}C NMR (75 MHz, $CDCl_3$): δ = 13.8, 14.3, 15.0, 23.3, 36.6, 38.1, 111.1, 116.3, 119.2, 123.2, 124.0, 125.0, 126.1, 133.0, 134.4, 135.8, 138.9, 141.1, 144.3. MS (EI, 70 eV): *m/z* (%) = 308 (100) $[M]^+$. HRMS (ESI-TOF) m/z: $[M+H]^+$ calcd for $C_{19}H_{21}N_2S$: 309.1420; found: 309.1422.

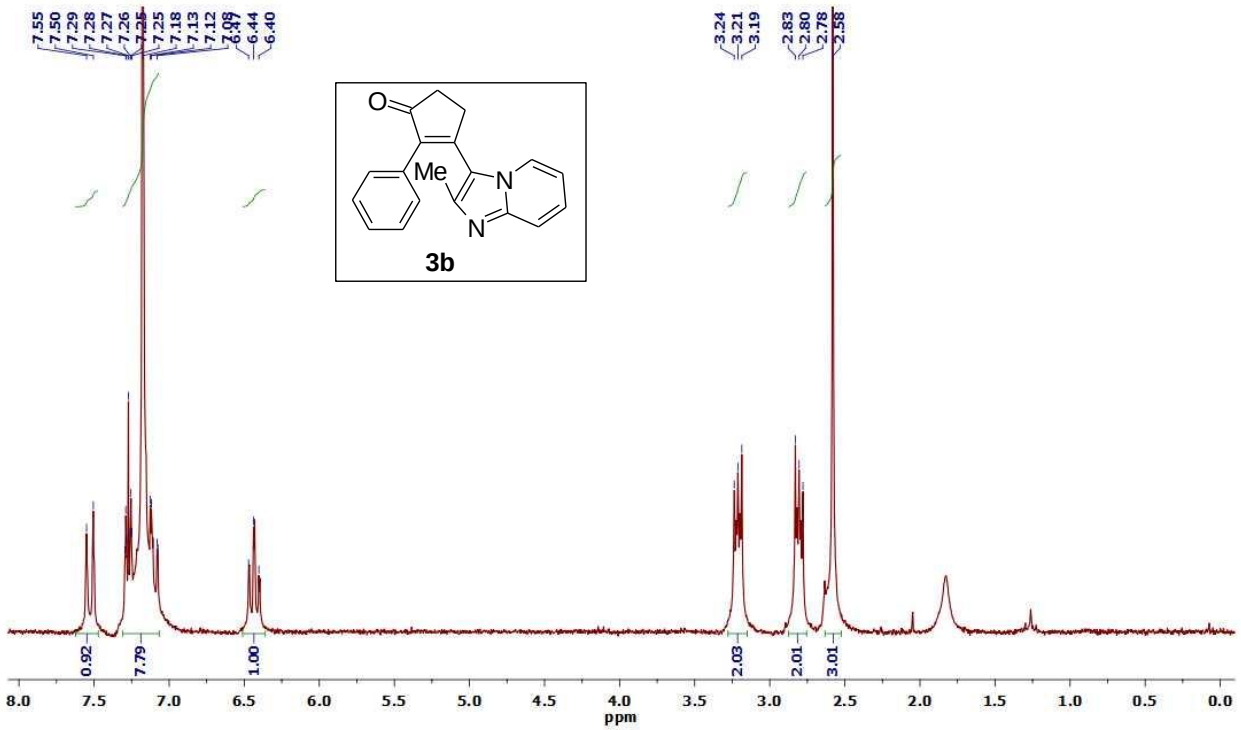


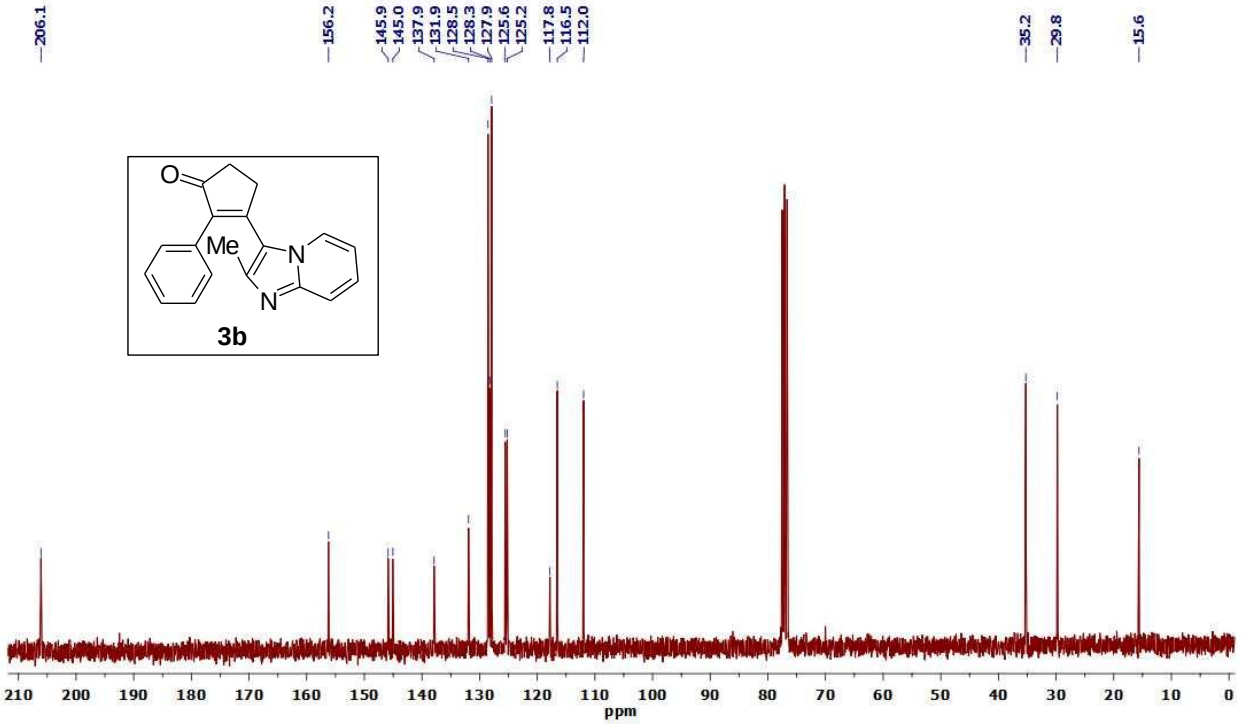
8

5-Methyl-2-phenyl-4-(2-phenylcyclopent-2-en-1-yl)-1,3-oxazole (8). Yield 18 mg (10%), yellow amorphous powder. ^{1}H NMR (300 MHz, $CDCl_3$): δ = 2.05-2.19 (m, 1H, ½ CH_2), 2.20 (s, 3H, CH_3), 2.48-2.80 (m, 3H, CH_2 + ½CH_2), 4.31-4.43 (s, 1H, CH), 7.12-7.46 (m, 8H, H^{arom}), 7.91-8.02 (m, 2H, H^{arom}). ^{13}C NMR (75 MHz, $CDCl_3$): δ = 10.5, 32.1, 32.6, 42.5, 126.0, 126.7, 127.1, 128.4, 128.7, 128.9, 129.5, 131.1, 135.6, 136.6, 142.4, 144.2, 159.1. MS (EI, 70 eV): *m/z* (%) = 301 (100) $[M]^+$, 286 (95). HRMS (ESI-TOF) m/z: $[M+H]^+$ calcd for $C_{21}H_{20}NO$: 302.1539; found: 302.1539.

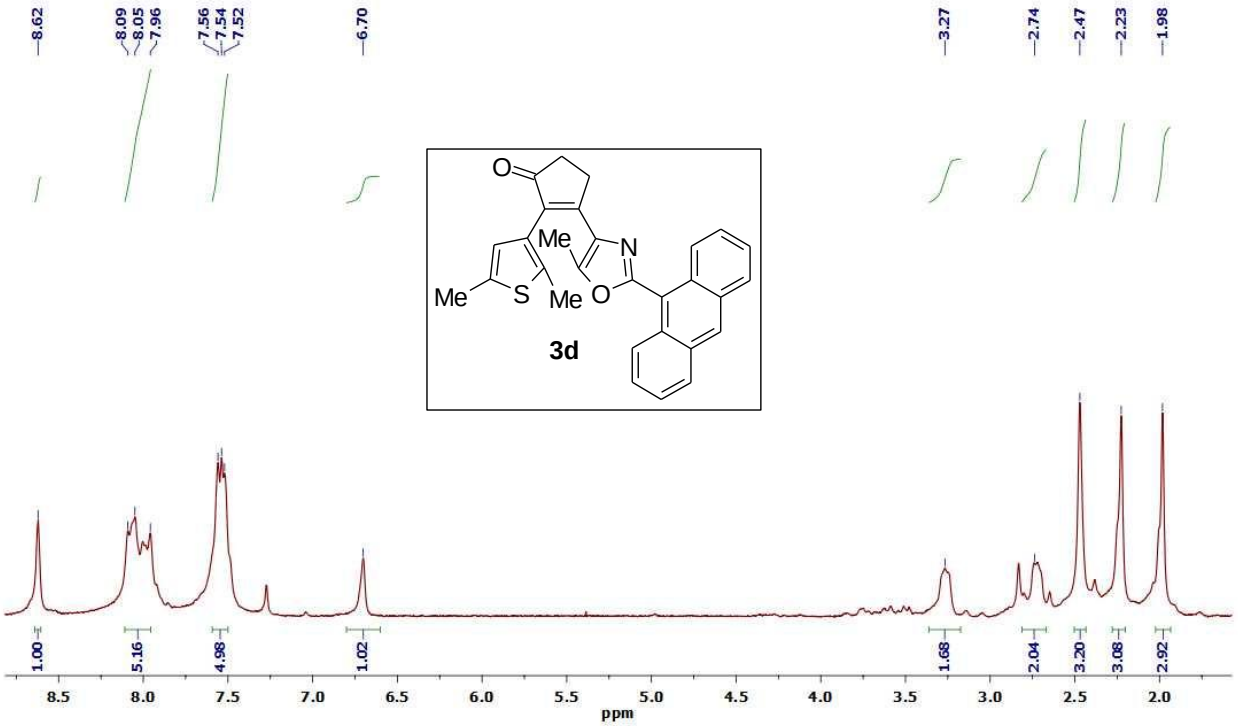
2. COPIES OF ^{1}H AND ^{13}C NMR SPECTRA OF DIARYLETHENES 3 AND 4

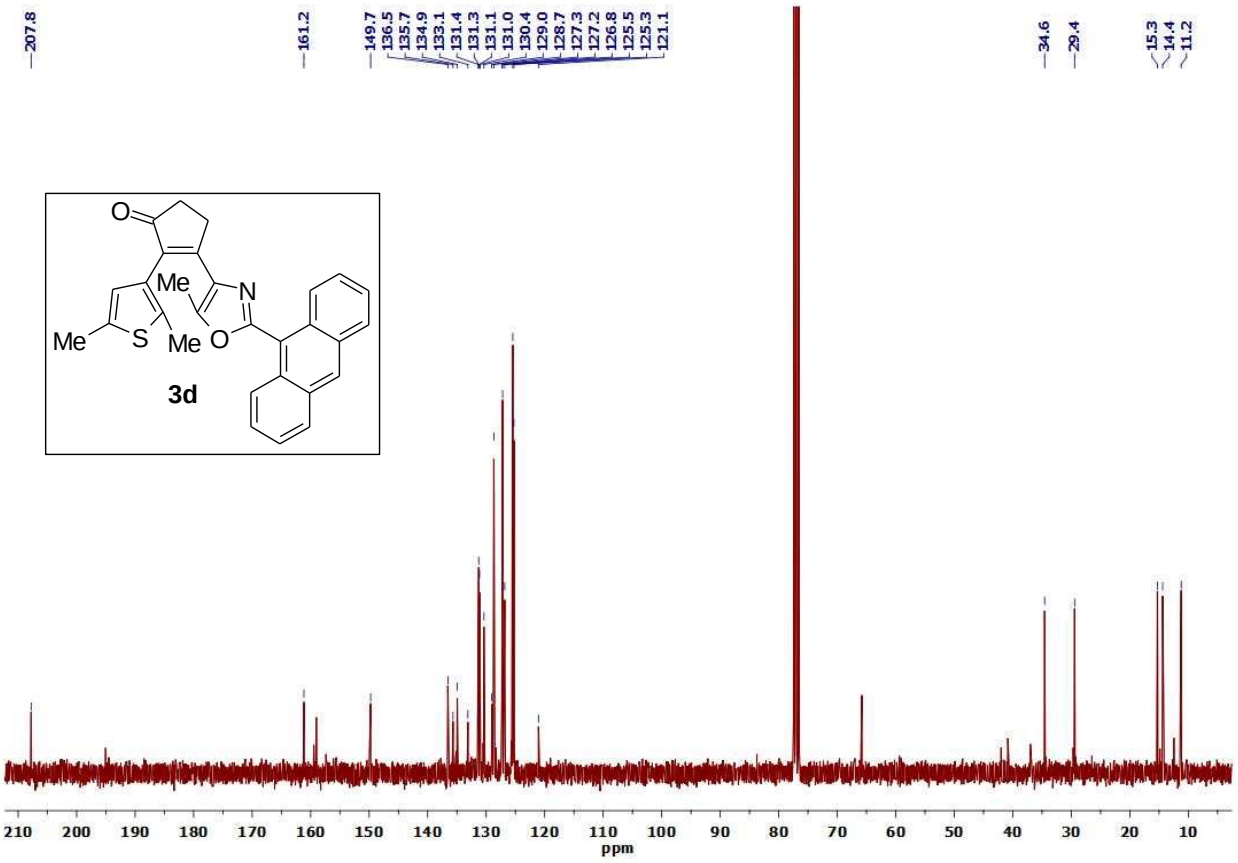
3-(2-Methylimidazo[1,2-*a*]pyridin-3-yl)-2-phenylcyclopent-2-en-1-one (3b)





2-(2,5-Dimethylthiophen-3-yl)-3-(2-antracen-9-yl-5-methyl-1,3-oxazol-4-yl)cyclopent-2-en-1-one (3d)[1]

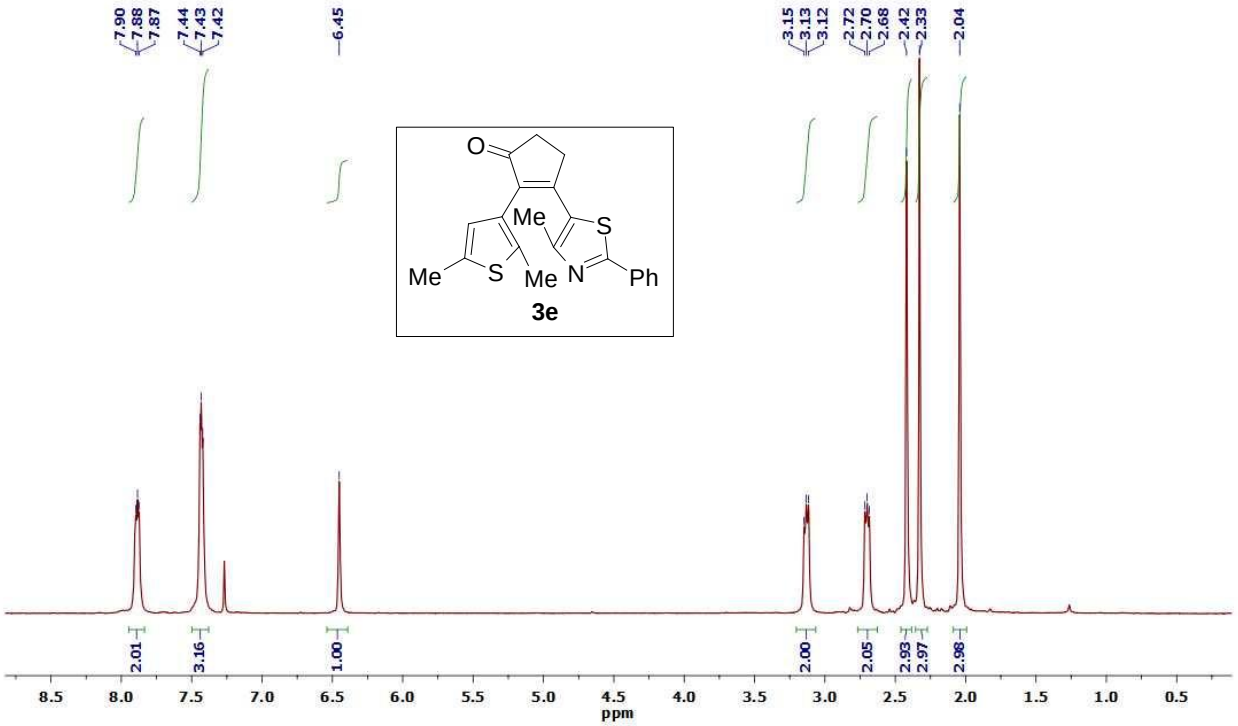


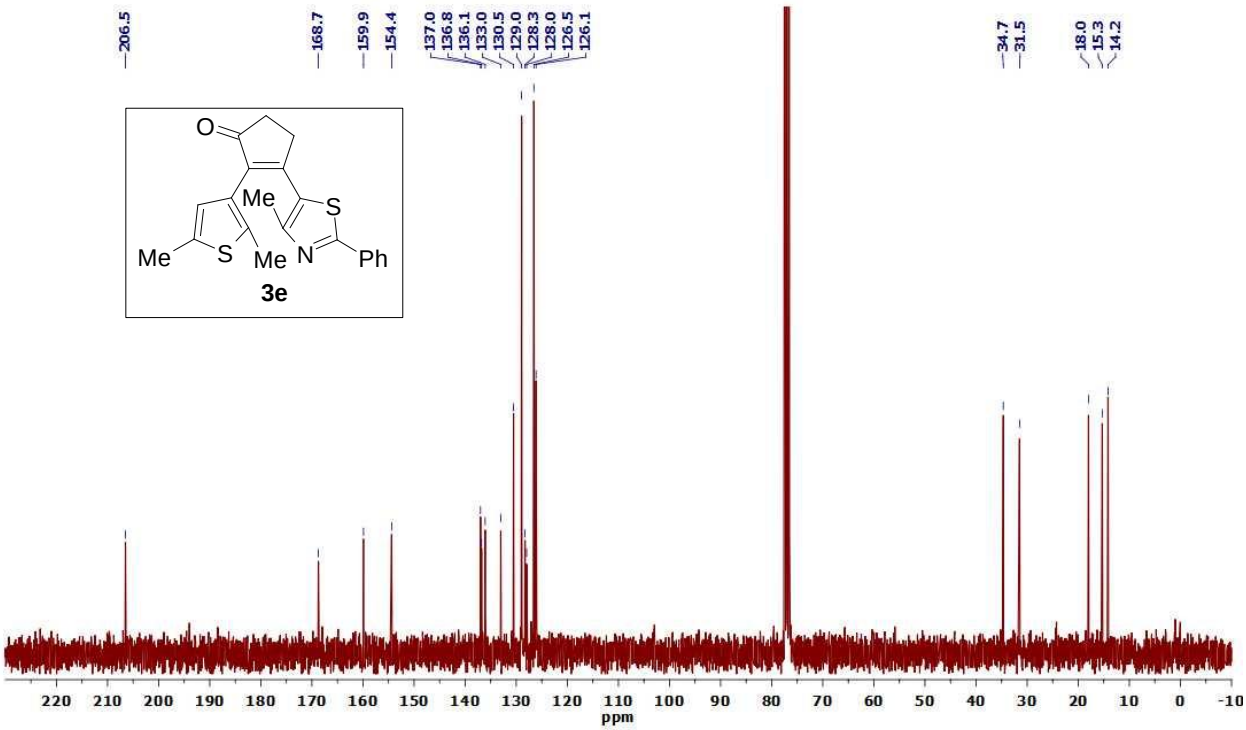


[1] NMR spectra are given for crude sample (without column chromatography)

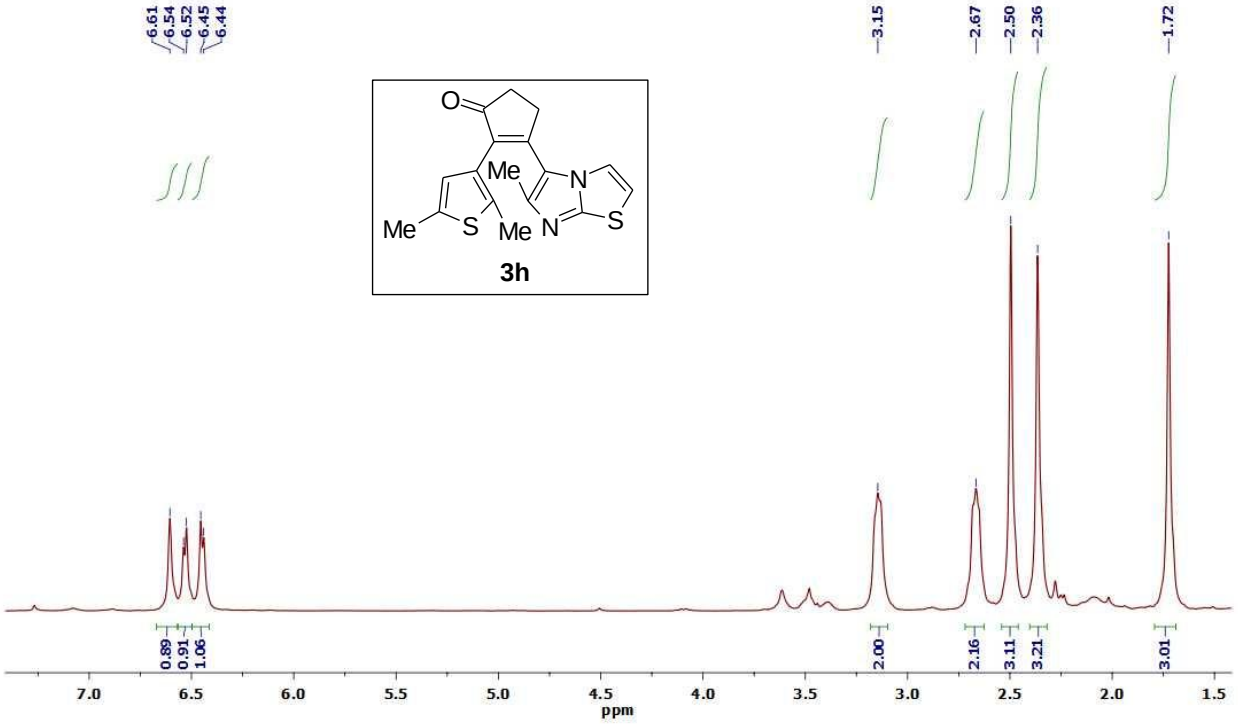
2-(2,5-Dimethylthiophen-3-yl)-3-(4-methyl-2-phenyl-1,3-thiazol-5-yl)cyclopent-2-en-1-one

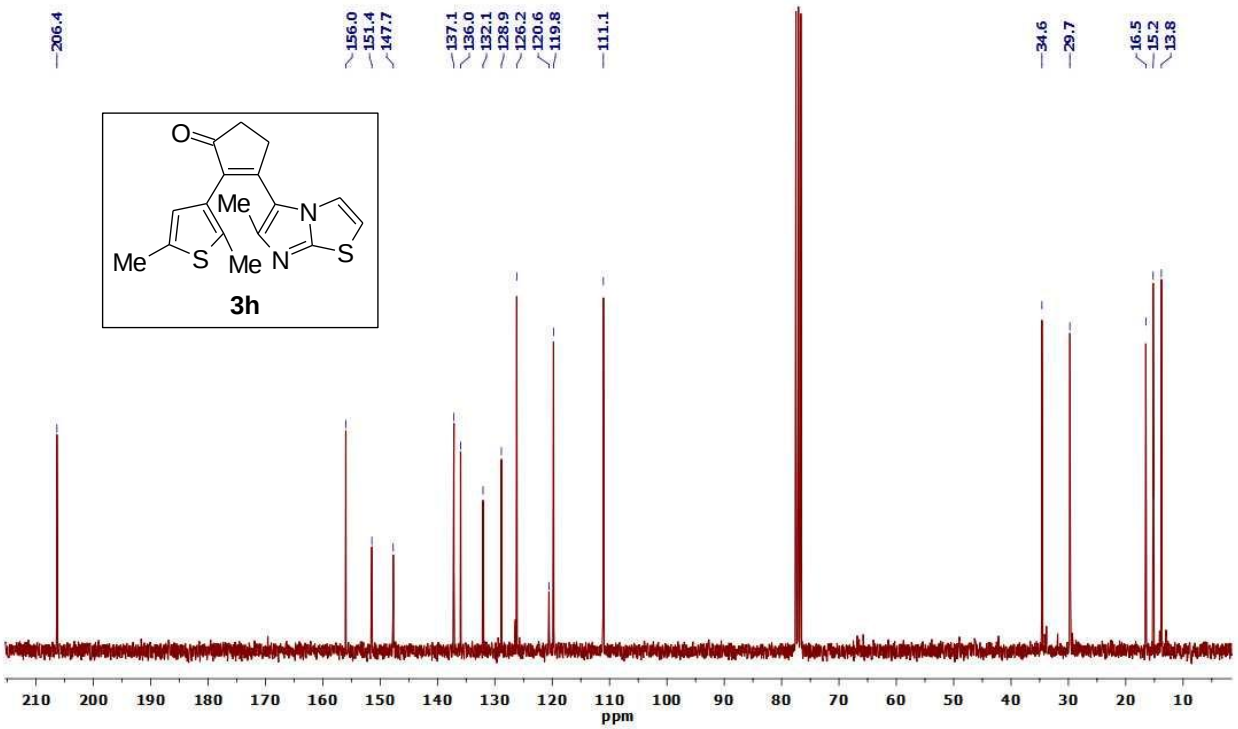
(3e)



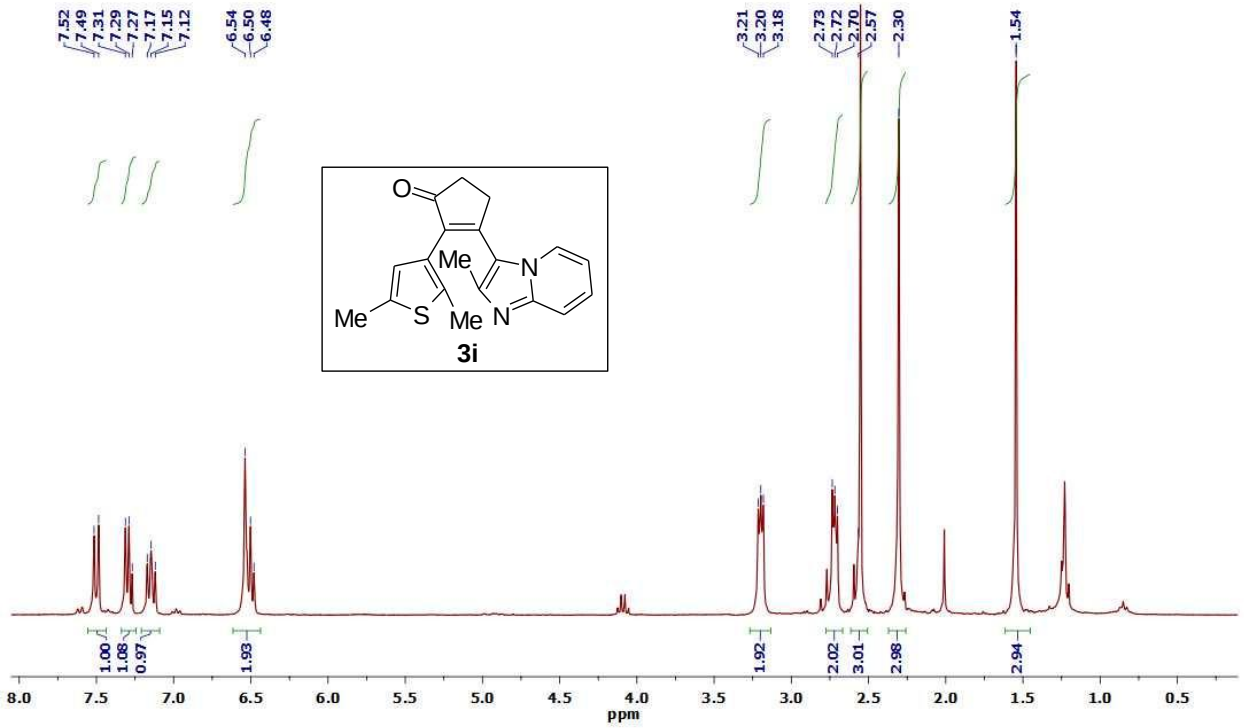


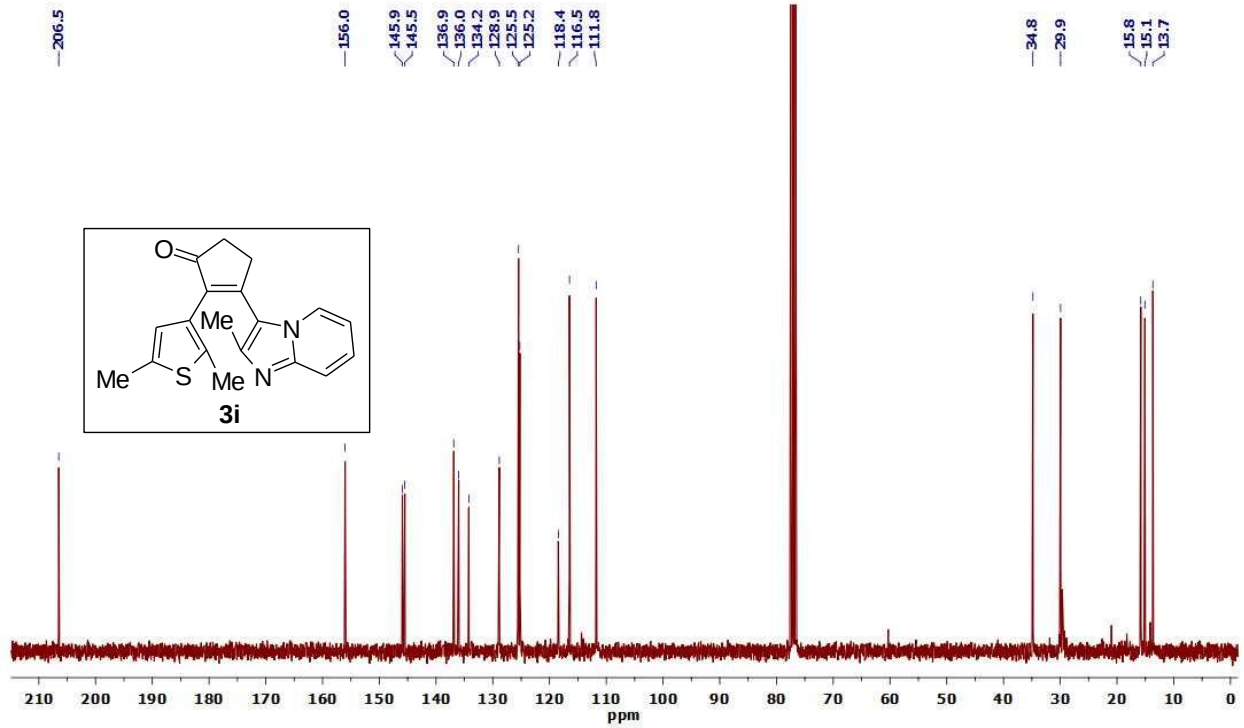
2-(2,5-Dimethylthiophen-3-yl)-3-(6-methylimidazo[2,1-*b*][1,3]thiazol-5-yl)cyclopent-2-en-1-one (3h)



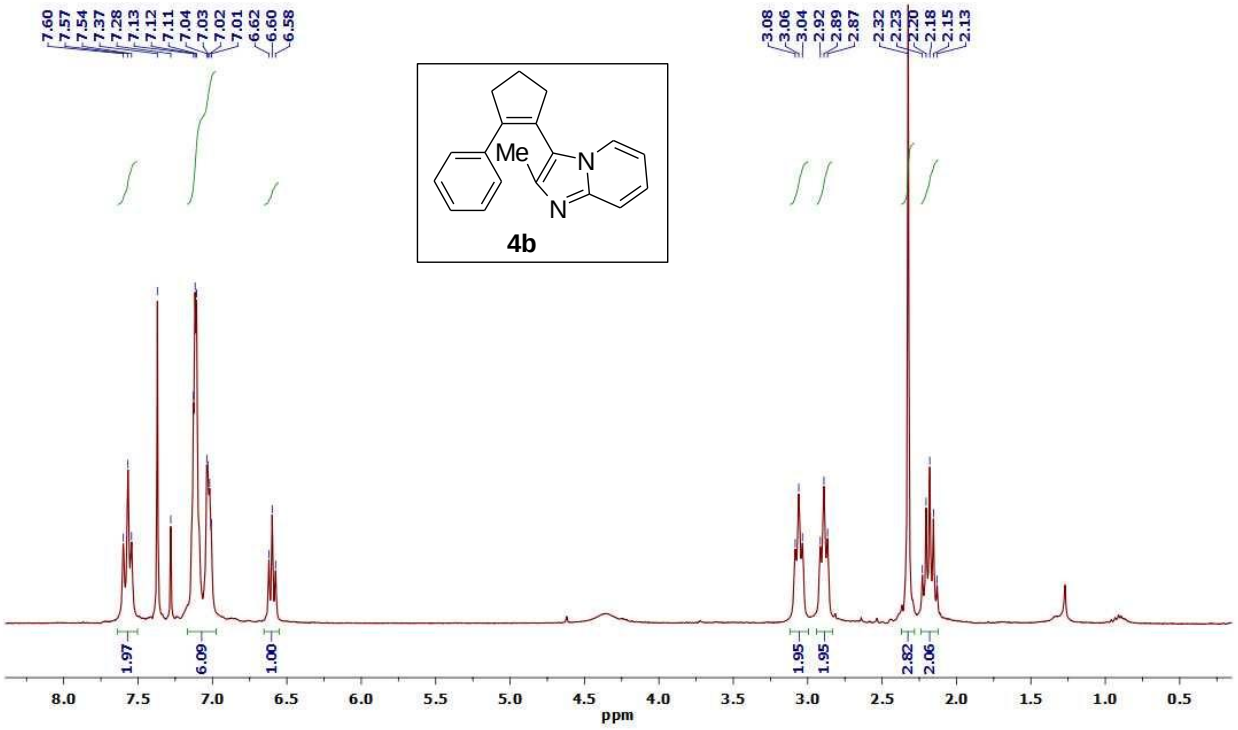


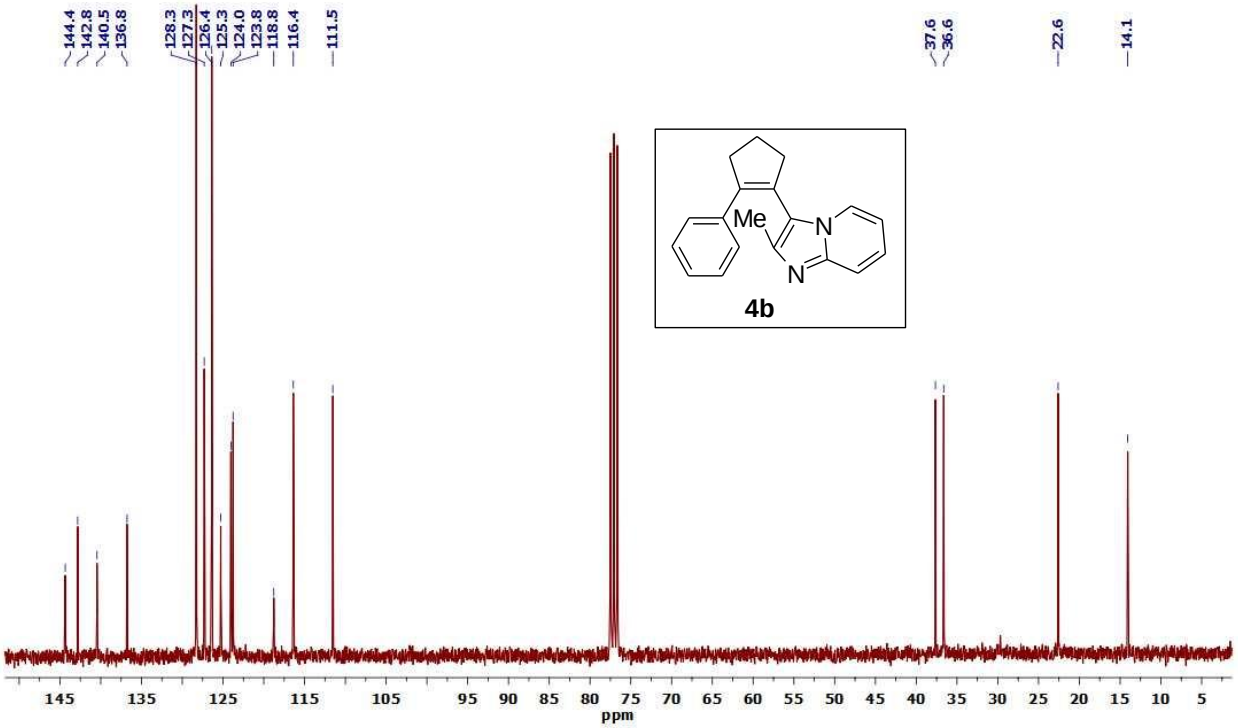
2-(2,5-Dimethylthiophen-3-yl)-3-(2-methylimidazo[1,2-*a*]pyridin-3-yl)cyclopent-2-en-1-one (3i)



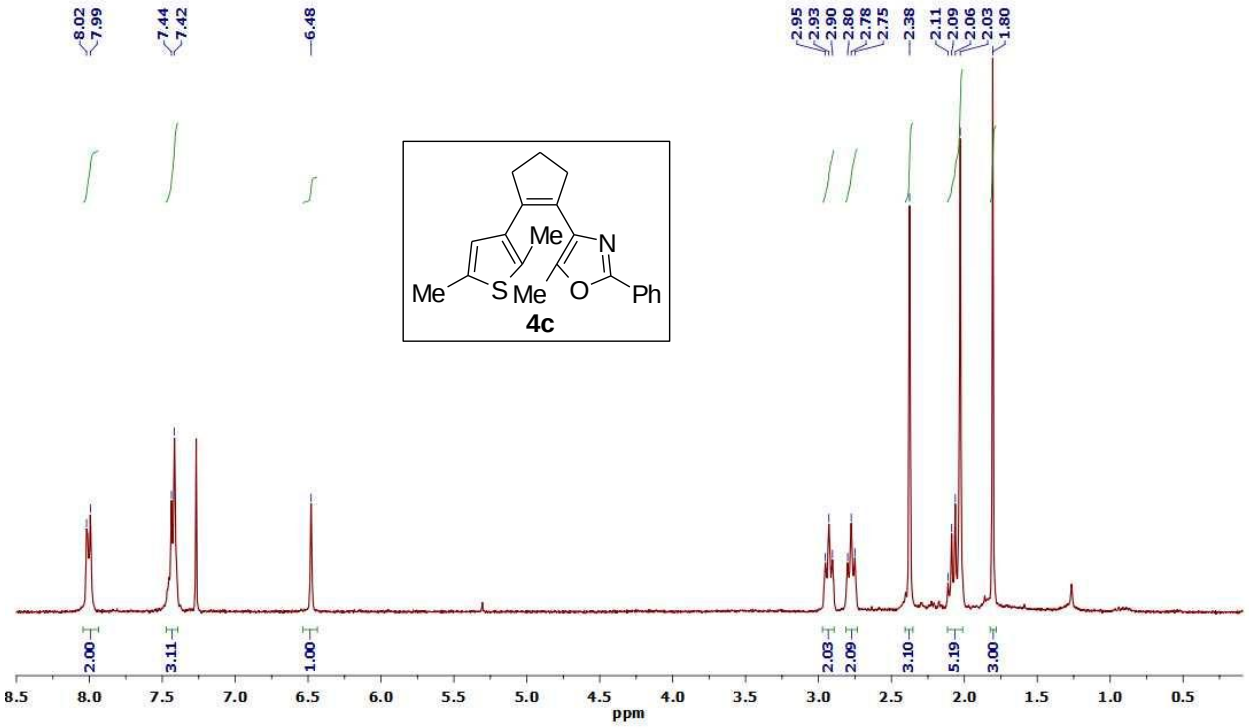


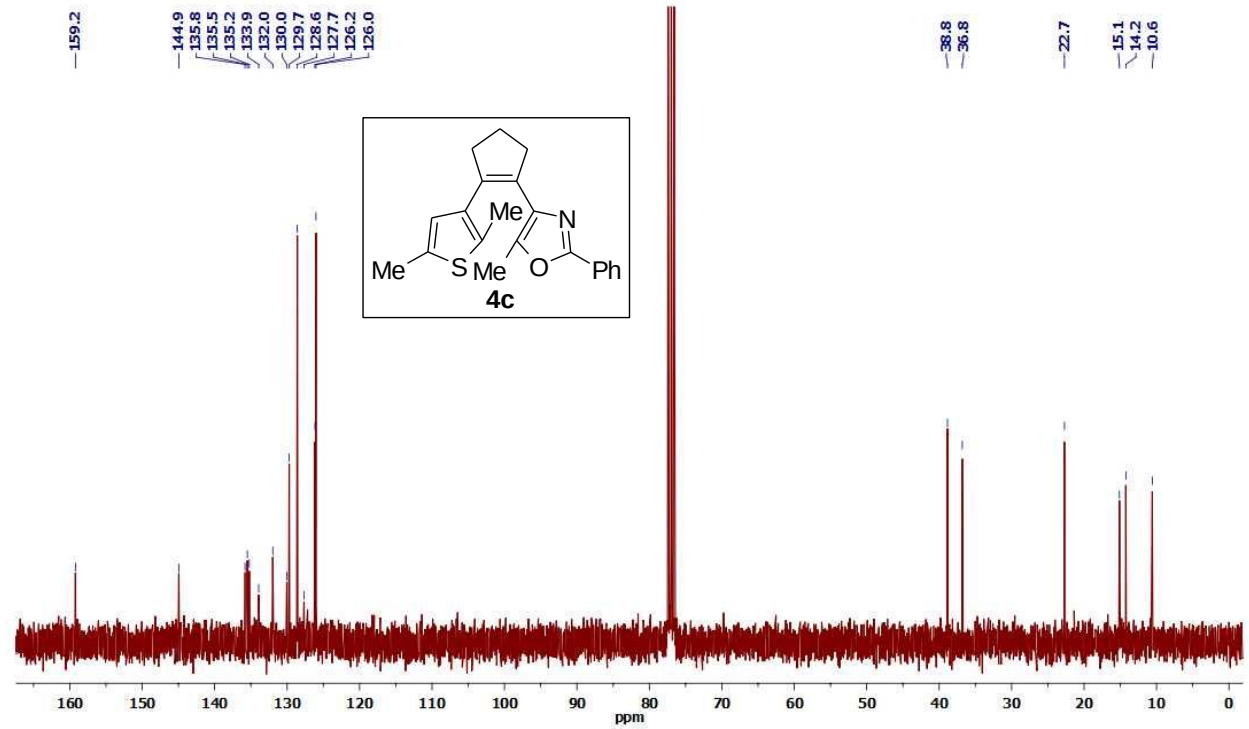
2-Methyl-3-(2-phenylcyclopent-1-en-1-yl)imidazo[1,2-*a*]pyridine (4b)



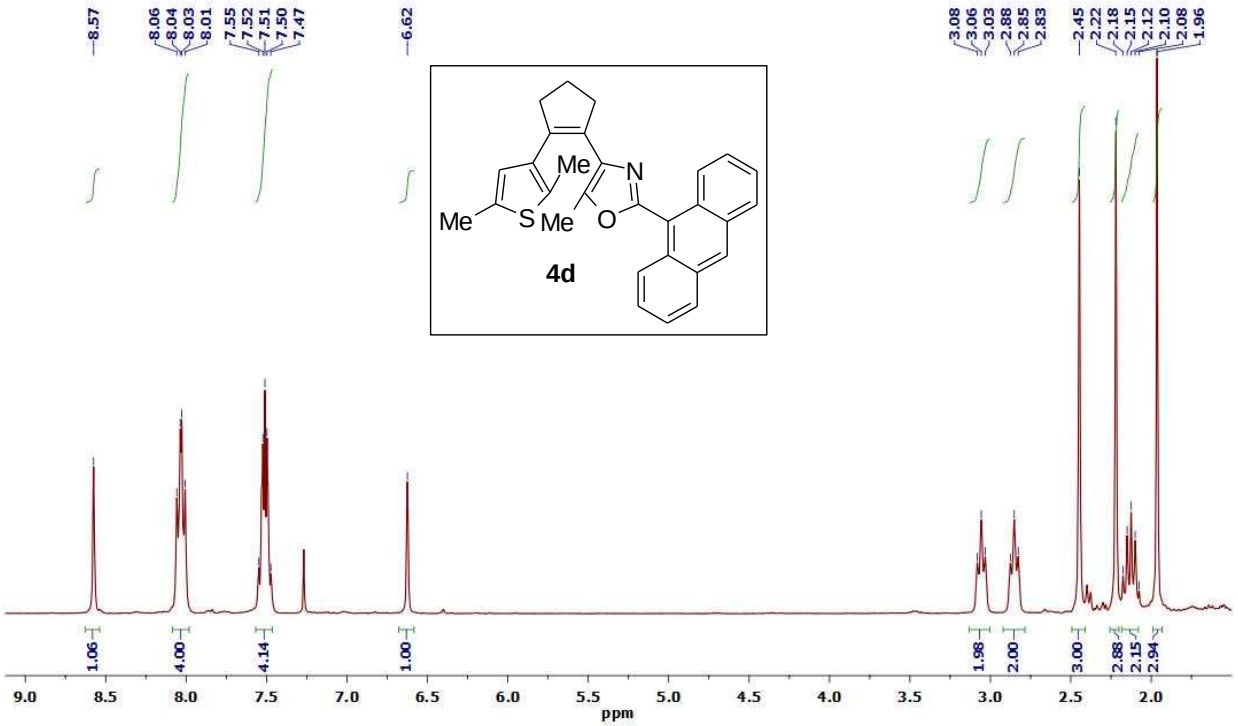


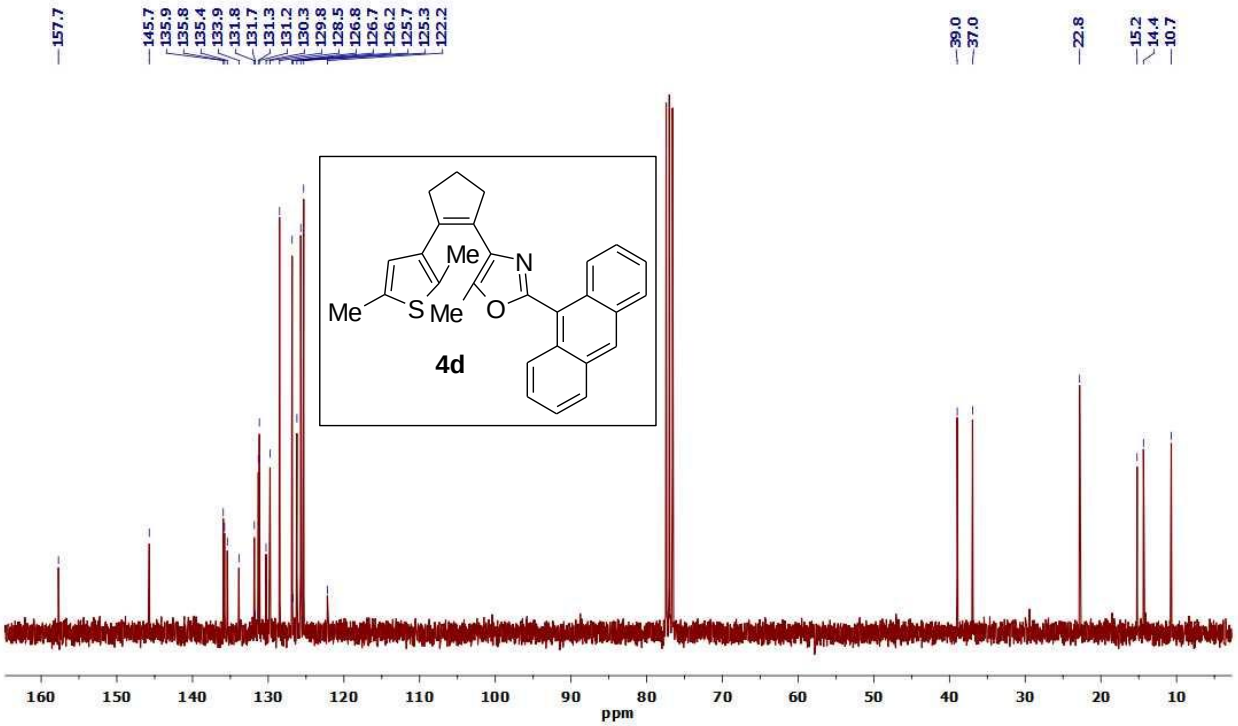
4-[2-(2,5-Dimethylthiophen-3-yl)cyclopent-1-en-1-yl]-5-methyl-2-phenyl-1,3-oxazole (4c)



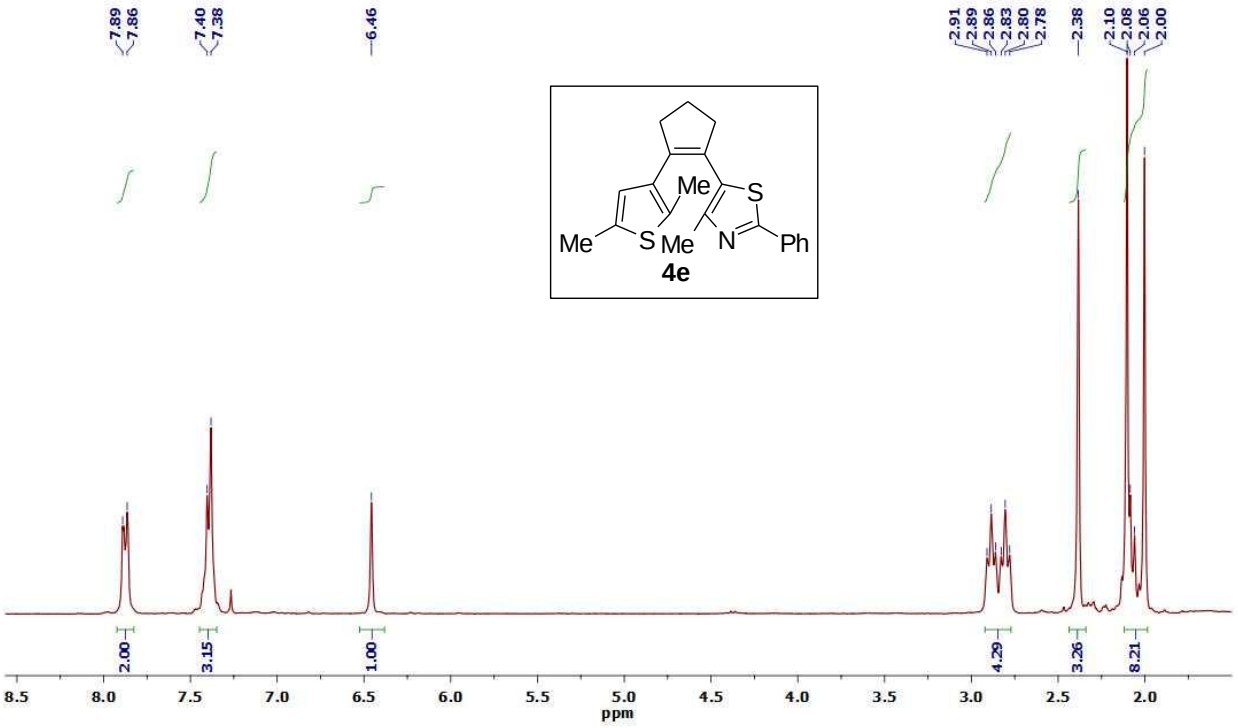


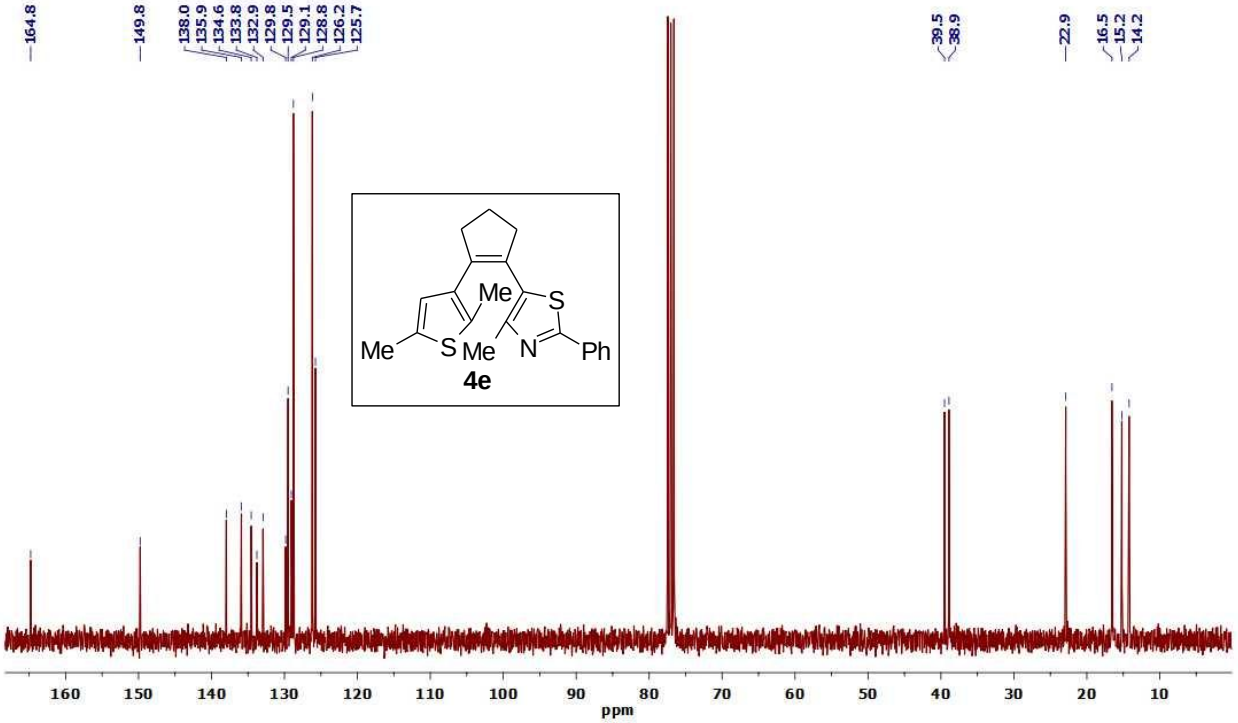
4-[2-(2,5-Dimethylthiophen-3-yl)cyclopent-1-en-1-yl]-2-antracen-9-yl-5-methyl-1,3-oxazole (4d)



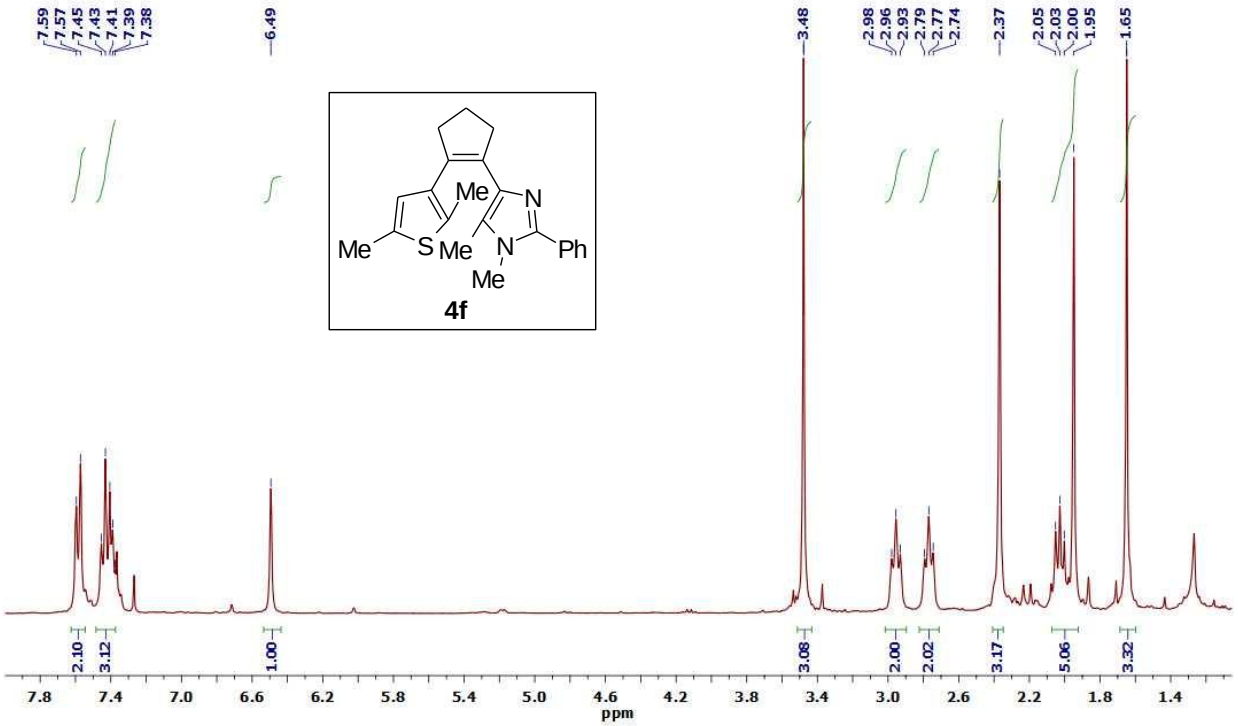


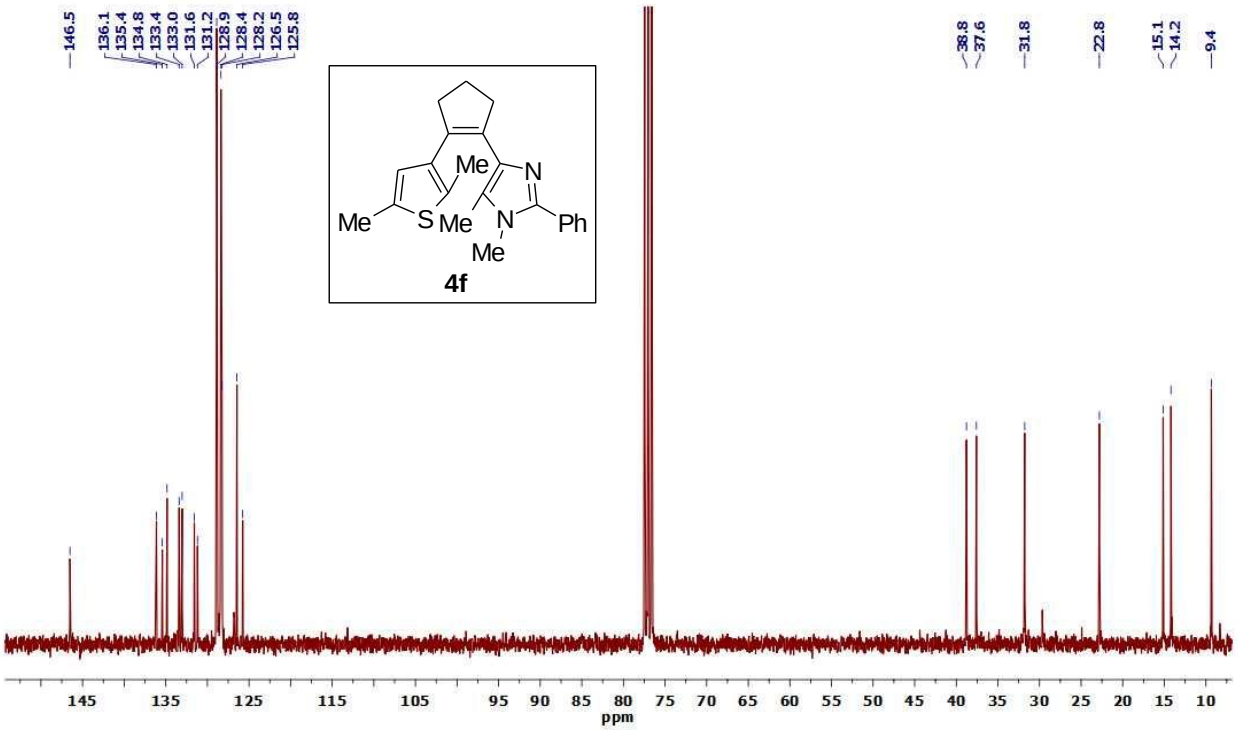
5-[2-(2,5-Dimethylthiophen-3-yl)cyclopent-1-en-1-yl]-4-methyl-2-phenyl-1,3-thiazole (4e)



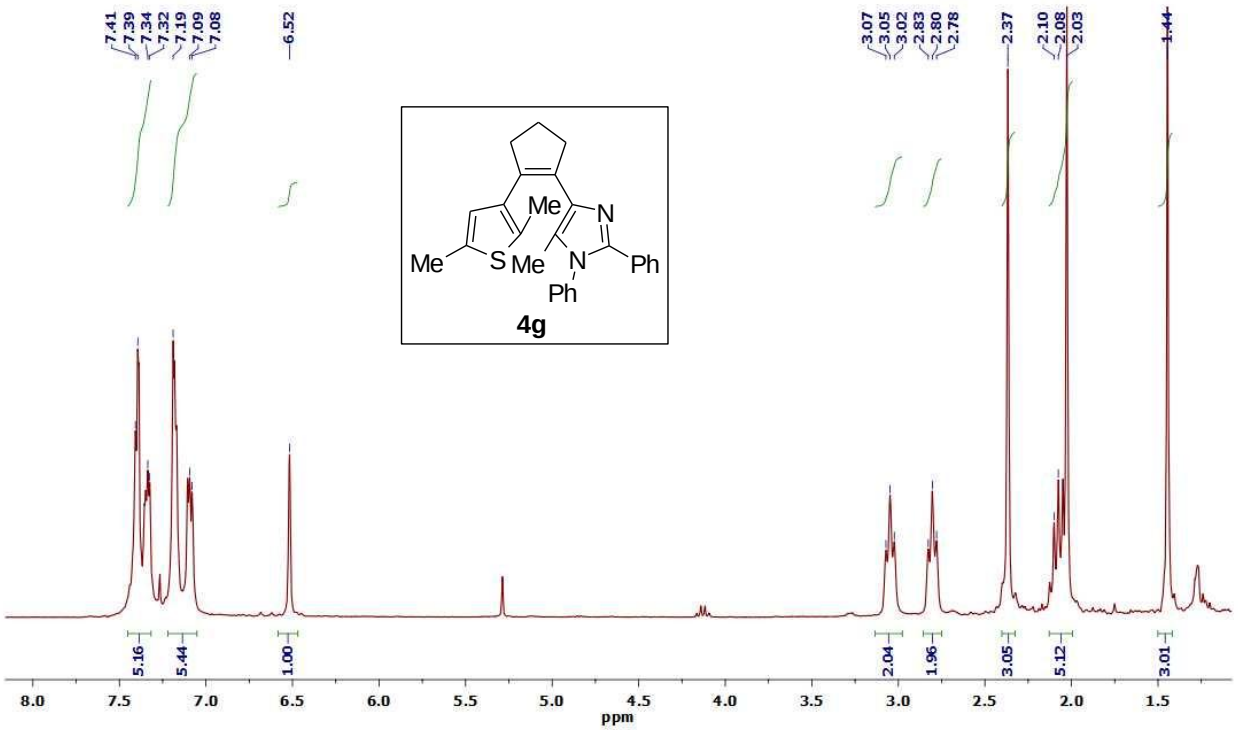


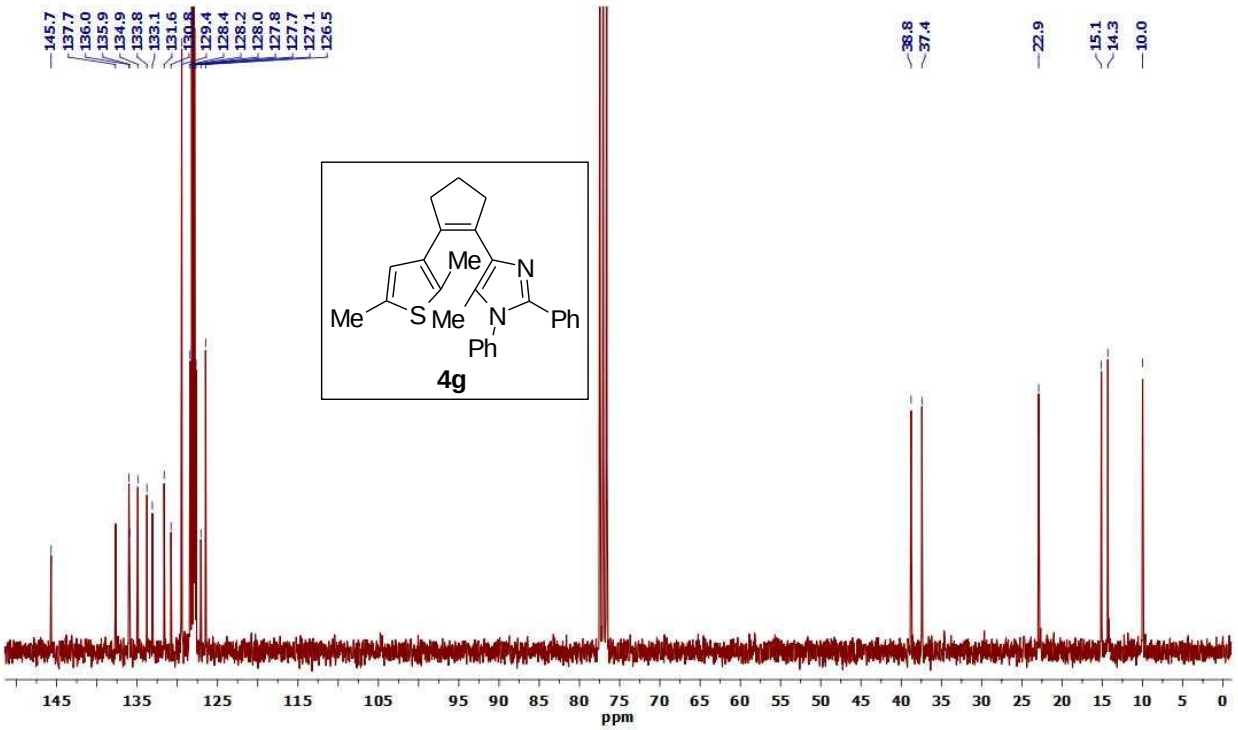
4-[2-(2,5-Dimethylthiophen-3-yl)cyclopent-1-en-1-yl]-1,5-dimethyl-2-phenyl-1*H*-imidazole (4f)



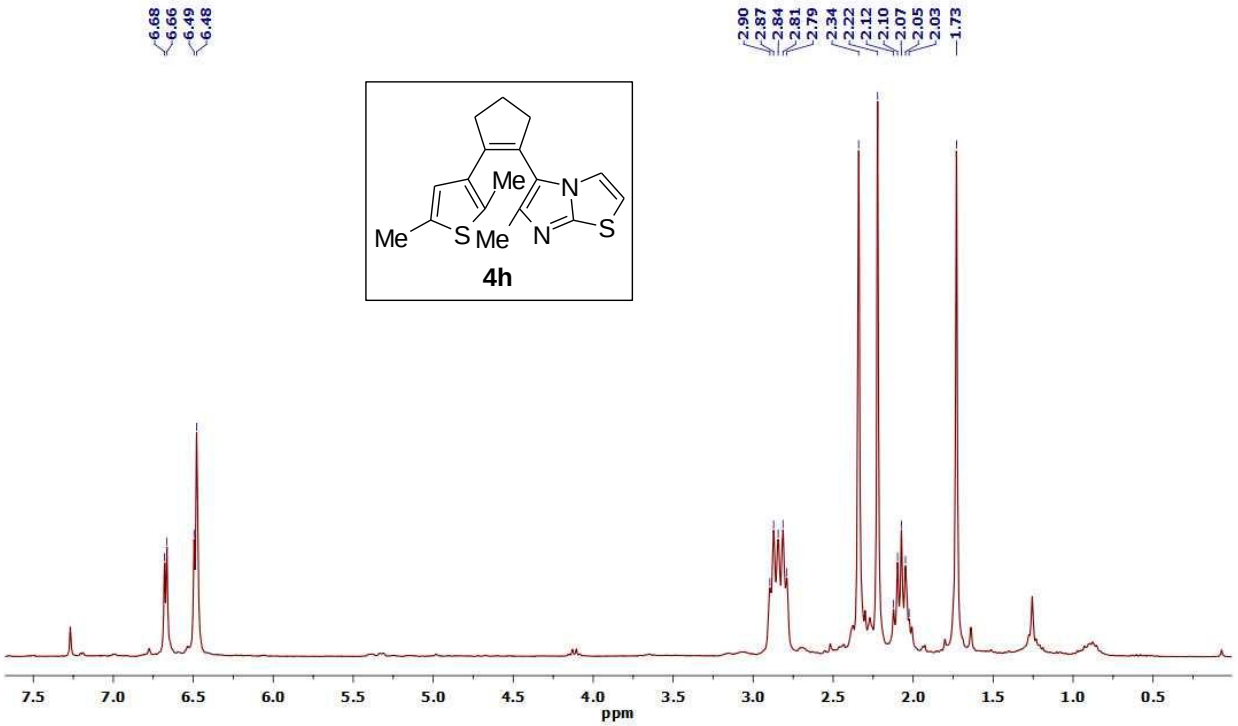


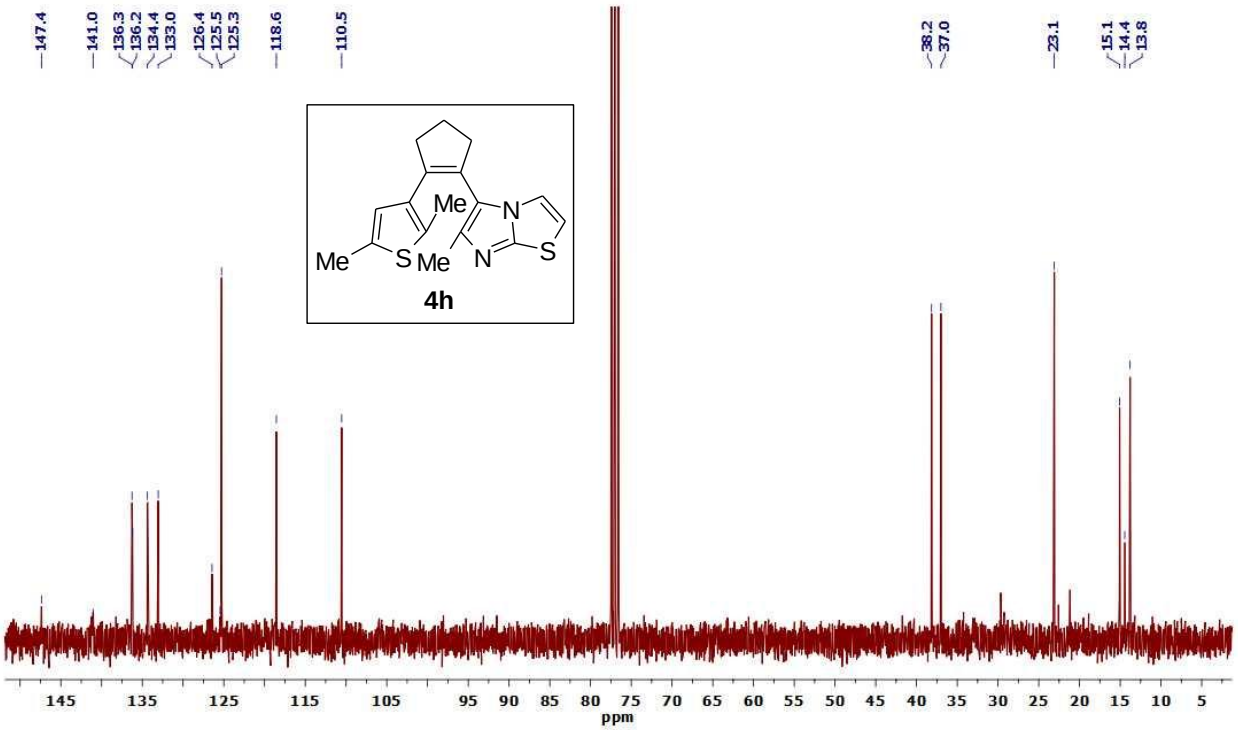
4-[2-(2,5-Dimethylthiophen-3-yl)cyclopent-1-en-1-yl]-5-methyl-1,2-diphenyl-1*H*-imidazole (4g)



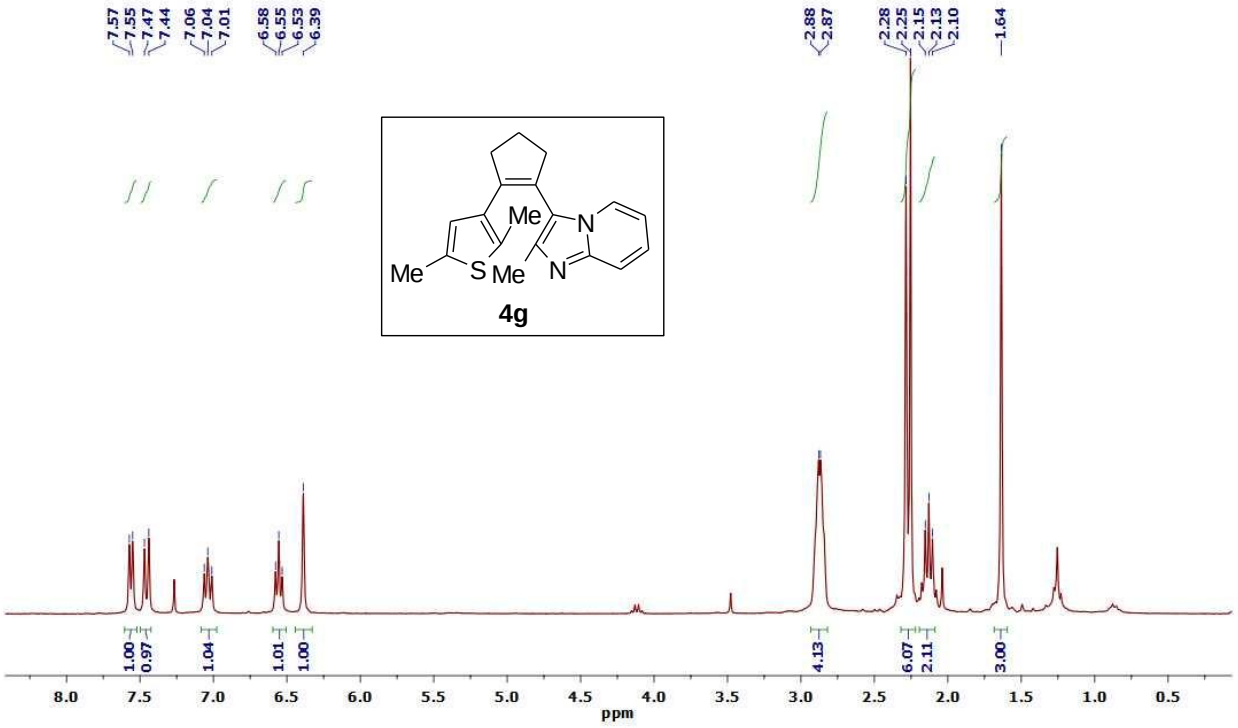


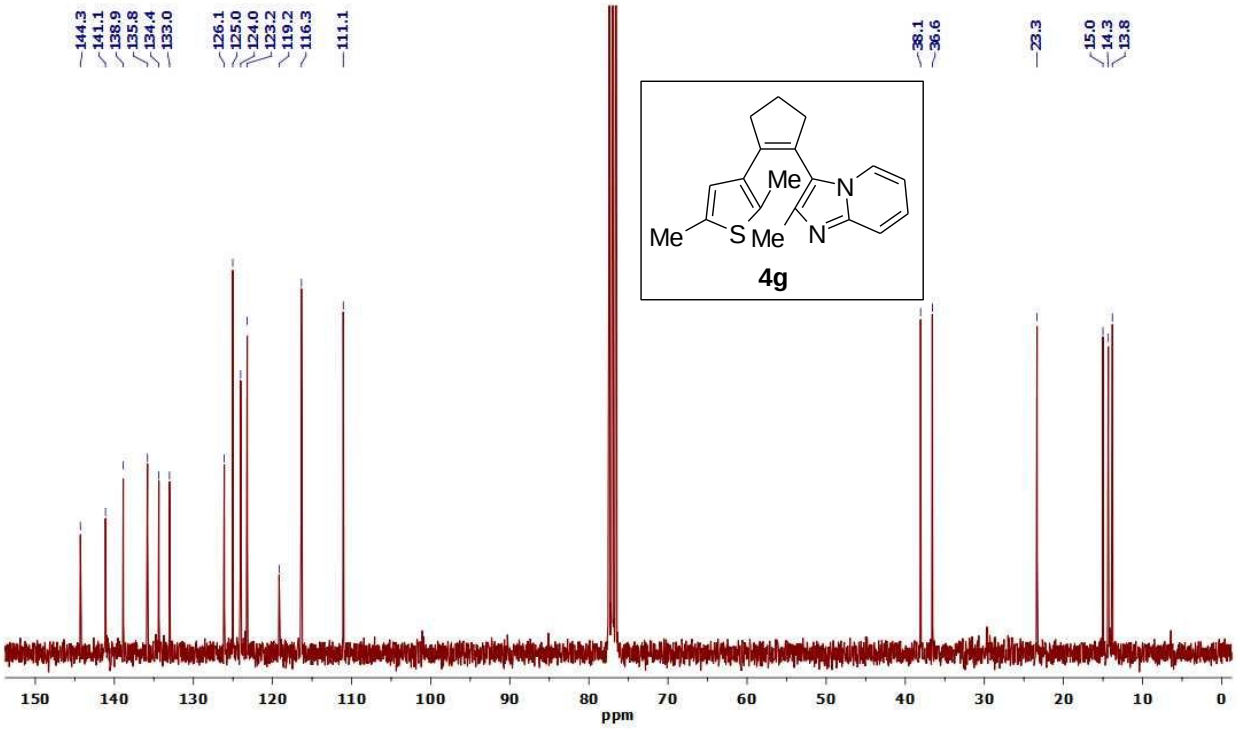
5-[2-(2,5-Dimethylthiophen-3-yl)cyclopent-1-en-1-yl]-6-methylimidazo[2,1-*b*][1,3]thiazole (4h)



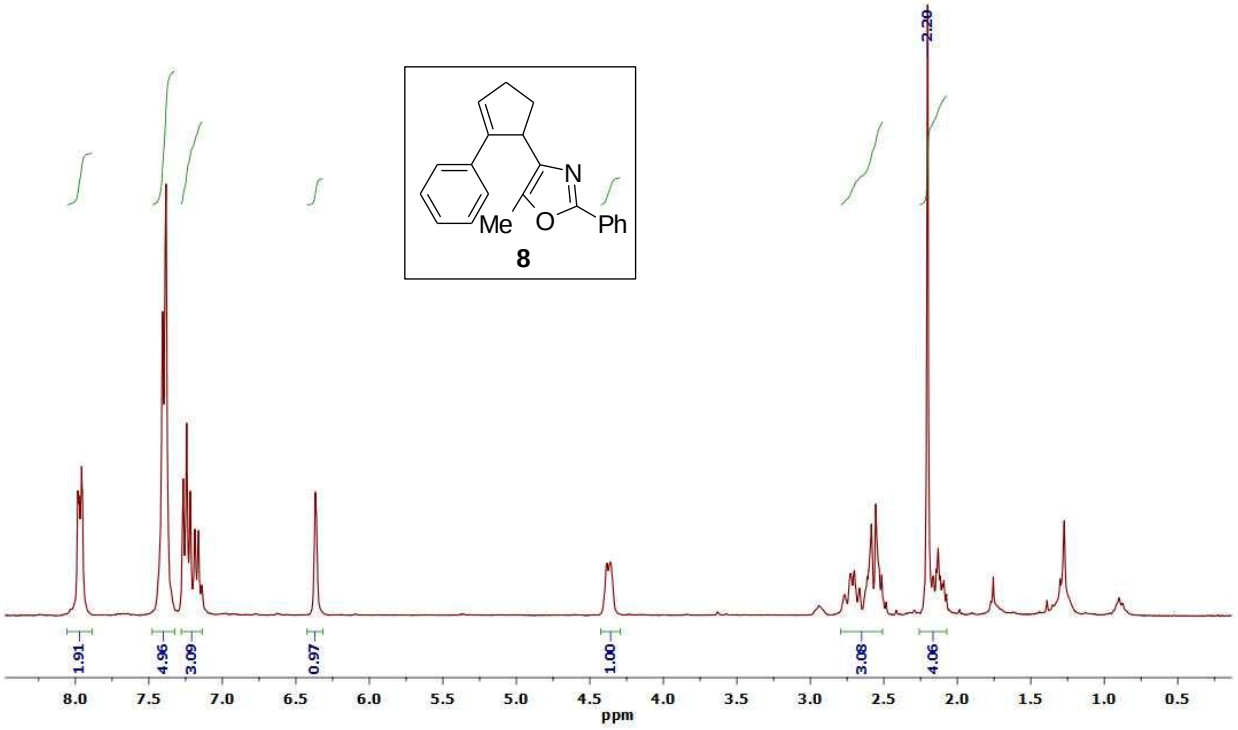


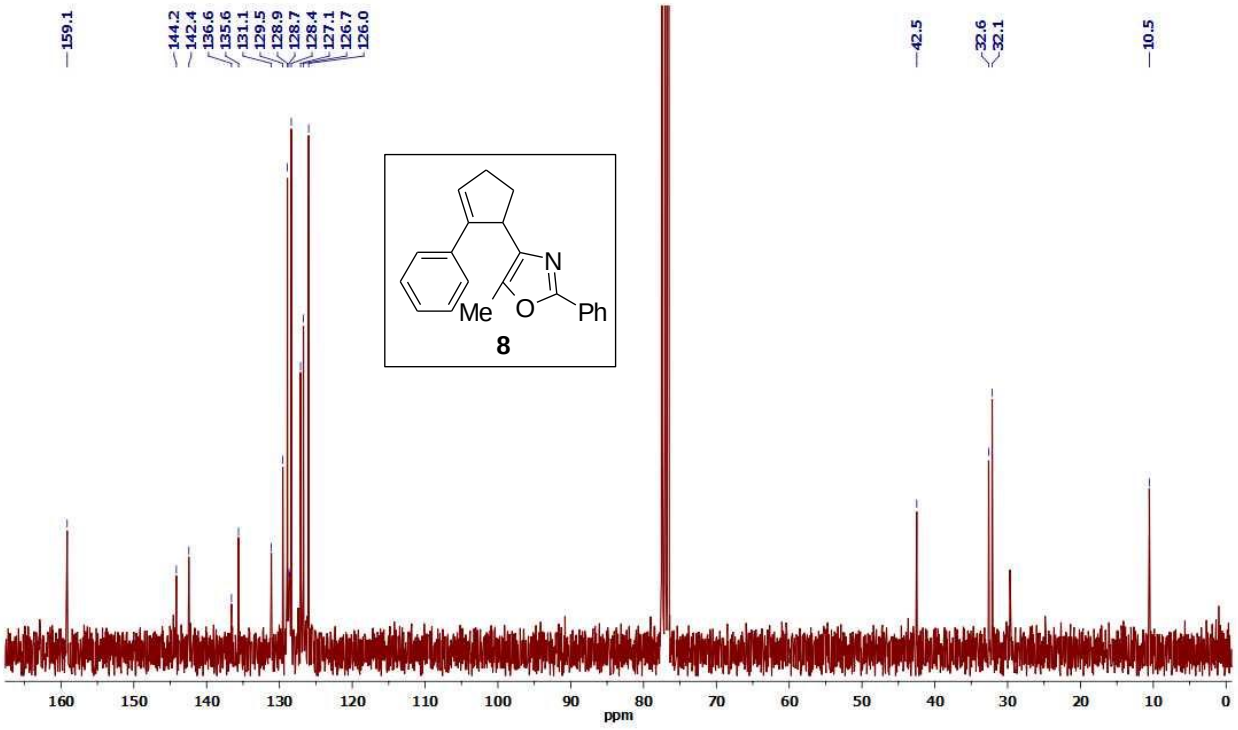
3-[2-(2,5-Dimethylthiophen-3-yl)cyclopent-1-en-1-yl]-2-methylimidazo[1,2-a]pyridine (4g)





5-Methyl-2-phenyl-4-(2-phenylcyclopent-2-en-1-yl)-1,3-oxazole (8)





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S4. V. Z. Shirinian, A. G. Lvov, E. Yu. Bulich, A. V. Zakharov and M. M. Krayushkin, *Tetrahedron Lett.,* 2015, **56**, 5477.