

Supporting Information for

A Facile Zr-Mediated Multicomponent Approach to Arylated Allylic Alcohols and Its Application to the Synthesis of Highly Substituted Indenes and Spiroindenes

Shenghai Guo and Yuanhong Liu*

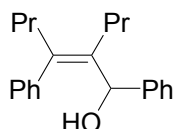
State Key Laboratory of Organometallic Chemistry

Shanghai Institute of Organic Chemistry, Chinese Academy of Sciences,

354 Fenglin Lu, Shanghai 200032, People's Republic of China

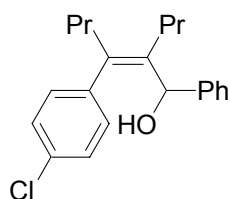
E-mail: yhliu@mail.sioc.ac.cn

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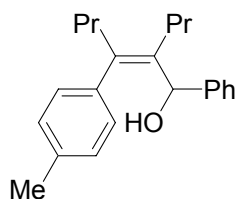
2Z-1,3-Diphenyl-2-propylhex-2-en-1-ol (2b).

The title product was obtained as yellow oil in 61% isolated yield (containing ca. 3% 2E-1-phenyl-2-propyl-hex-2-en-1-ol, which could not be separated from the main product). ^1H NMR (CDCl_3 , Me_4Si) δ 0.73-1.06 (m), 1.21-1.48 (m), 1.86-2.16 (m), 2.27-2.42 (m), 5.09(s, 0.05H), 5.32 (s, 1H), 5.58 (t, $J = 7.2$ Hz, 0.05H), 7.00-7.53 (m); ^{13}C NMR (CDCl_3 , Me_4Si) δ 14.11, 14.81, 21.02, 24.25, 29.66, 36.41, 73.65, 125.61, 126.38, 126.57, 127.85, 128.12, 128.62, 137.16, 140.92, 142.37, 143.02. HRMS (EI) calcd for $\text{C}_{21}\text{H}_{26}\text{O}$ $[\text{M}]^+$: 294.1984, found 294.1980.



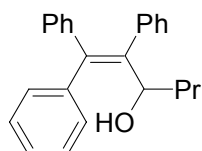
2Z-3-(4-Chlorophenyl)-1-phenyl-2-propylhex-2-en-1-ol (2c).

Column chromatography on silica-gel (petroleum ether / ethyl acetate = 20:1~15:1) afforded the title product as light yellow oil in 55% isolated yield. ^1H NMR (CDCl_3 , Me_4Si) δ 0.80 (t, $J = 7.5$ Hz, 3H), 0.87 (t, $J = 7.2$ Hz, 3H), 0.92-1.01 (m, 1H), 1.20-1.43 (m, 3H), 1.77 (d, $J = 3.0$ Hz, 1H), 1.89-1.99 (m, 1H), 2.07-2.17 (m, 1H), 2.27-2.38 (m, 2H), 5.29 (d, $J = 2.7$ Hz, 1H), 7.10-7.31 (m, 9H); ^{13}C NMR (CDCl_3 , Me_4Si) δ 14.02, 14.76, 20.93, 24.17, 29.68, 36.24, 73.63, 125.52, 126.74, 127.93, 128.31, 129.98, 132.22, 137.73, 139.65, 140.69, 142.76. HRMS (EI) calcd for $\text{C}_{21}\text{H}_{23}\text{Cl}$ $[\text{M}-\text{H}_2\text{O}]^+$: 310.1488, found 310.1485.



2Z-1-Phenyl-2-propyl-3-p-tolylhex-2-en-1-ol (2d).

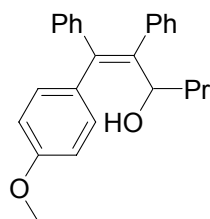
Column chromatography on silica-gel (petroleum ether / ethyl acetate = 20:1~ 15:1) afforded the title product as light yellow oil in 43% isolated yield. ^1H NMR (CDCl_3 , Me_4Si) δ 0.80 (t, $J = 7.2$ Hz, 3H), 0.87 (t, $J = 7.2$ Hz, 3H), 0.94-1.03 (m, 1H), 1.22-1.44 (m, 3H), 1.70 (s, 1H), 1.88-2.16 (m, 2H), 2.29-2.36 (m, 5H), 5.36 (s, 1H), 7.06-7.30 (m, 9H); ^{13}C NMR (CDCl_3 , Me_4Si) δ 14.14, 14.83, 21.08 (2 C), 24.30, 29.72, 36.47, 73.72, 125.64, 126.55, 127.86, 128.51, 128.83, 135.90, 137.06, 139.34, 140.95, 143.09. HRMS (EI) calcd for $\text{C}_{22}\text{H}_{26}$ $[\text{M}-\text{H}_2\text{O}]^+$: 290.2035, found 290.2040.



1,1,2-Triphenylhex-1-en-3-ol (2e).

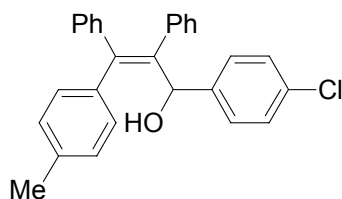
The title product was obtained as yellow oil in 62% isolated yield (containing ca. 8% 1E-1,2-diphenylhex-1-en-3-ol, which could not be separated from the main product). ^1H NMR (CDCl_3 , Me_4Si) δ 0.77-0.82 (t, $J = 7.2$ Hz, 3H), 0.87-0.91 (m), 1.21-1.52 (m), 4.42-4.46 (m, 0.13H), 4.62-4.64 (m, 1H), 6.64 (s, 0.13H), 6.91-7.08 (m), 7.13-7.37 (m); ^{13}C NMR (CDCl_3 , Me_4Si) δ 13.91, 19.07, 38.08, 71.75, 126.06, 126.52, 126.94, 127.32, 127.59, 128.22, 129.45, 130.03, 130.86, 138.27, 141.63, 141.73, 141.87, 142.02. HRMS (EI) calcd for $\text{C}_{24}\text{H}_{24}\text{O}$ $[\text{M}]^+$: 328.1827, found

328.1829.



1Z-1-(4-Methoxyphenyl)-1,2-diphenylhex-1-en-3-ol (2f).

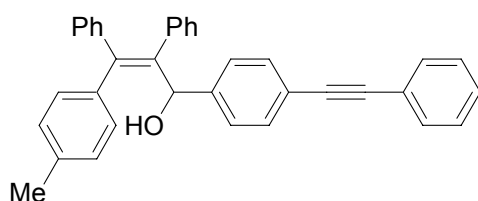
The reaction mixture was quenched by NH_4Cl solution. Column chromatography on silica-gel (petroleum ether / ethyl acetate = 8:1~ 5:1) afforded the title product as yellow oil in 70% isolated yield. ^1H NMR (CDCl_3 , Me_4Si) δ 0.81 (t, $J = 7.2$ Hz, 3H), 1.29-1.50 (m, 4H), 1.66 (s, 1H), 3.77 (s, 3H), 4.68-4.70 (m, 1H), 6.84-7.01 (m, 7H), 7.10-7.23 (m, 7H); ^{13}C NMR (CDCl_3 , Me_4Si) δ 13.92, 19.08, 38.06, 55.10, 71.68, 113.50, 125.93, 126.37, 127.22, 127.49, 130.07, 130.67, 130.88, 133.95, 138.51, 141.43, 141.53, 142.41, 158.43. HRMS (EI) calcd for $\text{C}_{25}\text{H}_{26}\text{O}_2$ $[\text{M}]^+$: 358.1933, found 358.1937.



2Z-1-(4-Chlorophenyl)-2,3-diphenyl-3-p-tolylprop-2-en-1-ol (2g).

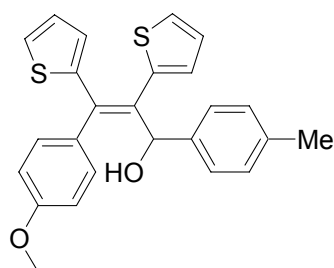
Column chromatography on silica-gel (petroleum ether / ethyl acetate = 8:1~ 5:1) afforded the title product as yellow foam in 61% isolated yield. ^1H NMR (CDCl_3 , Me_4Si) δ 2.24 (s, 1H), 2.32 (s, 3H), 5.91 (d, $J = 5.1$ Hz, 1H), 6.79-7.01 (m, 10H), 7.13-7.30 (m, 8H); ^{13}C NMR (CDCl_3 , Me_4Si) δ 21.14, 72.98, 126.28, 126.79, 127.25,

127.37, 127.49, 128.05, 129.24, 129.33, 130.11, 131.05, 132.45, 136.94, 137.21,
138.76, 140.15, 141.17, 141.88, 143.08. HRMS (EI) calcd for C₂₈H₂₁Cl [M-H₂O]⁺:
392.1332, found 392.1323.



2Z-2,3-Diphenyl-1-(4-(phenylethynyl)phenyl)-3-p-tolylprop-2-en-1-ol (2h).

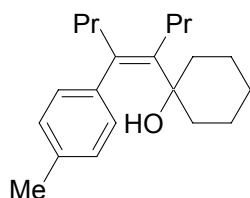
Column chromatography on silica-gel (petroleum ether / ethyl acetate = 8:1~ 5:1) afforded the title product as yellow foam in 38% isolated yield. ¹H NMR (CDCl₃, Me₄Si) δ 2.10 (s, 1H), 2.35 (s, 3H), 5.98 (s, 1H), 6.80-6.83 (m, 2H), 6.92-7.07 (m, 9H), 7.18-7.33 (m, 9H), 7.43-7.53 (m, 3H); ¹³C NMR (CDCl₃, Me₄Si) δ 21.17, 73.38, 89.23, 89.39, 121.53, 123.15, 125.86, 126.29, 126.80, 127.38, 127.51, 128.15, 128.27, 129.26, 129.41, 130.15, 131.08, 131.29, 131.48, 136.96, 137.25, 138.84, 140.24, 141.95, 143.02, 143.08. HRMS (EI) calcd for C₃₆H₂₈O [M]⁺: 476.2140, found 476.2124.



2Z-3-(4-Methoxyphenyl)-2,3-di(thien-2-yl)-1-p-tolylprop-2-en-1-ol (2i).

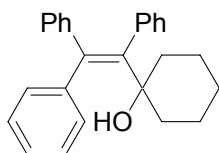
The reaction mixture was quenched by NH₄Cl solution. Column chromatography on

silica-gel (petroleum ether / ethyl acetate = 8:1~ 5:1) afforded the title product as brown oil in 68% isolated yield. ^1H NMR (CDCl_3 , Me_4Si) δ 2.20 (s, 4H), 3.70 (s, 3H), 5.53 (s, 1H), 6.38-7.28 (m, 14H); ^{13}C NMR (CDCl_3 , Me_4Si) δ 21.03, 55.14, 73.21, 113.78, 125.73, 125.78, 126.97, 127.44, 128.64, 129.85, 130.16, 130.73, 132.23, 133.01, 136.57, 136.98, 137.87, 138.79, 144.43, 158.99. HRMS (EI) calcd for $\text{C}_{25}\text{H}_{22}\text{O}_2\text{S}_2$ $[\text{M}]^+$: 418.1061, found 418.1068.



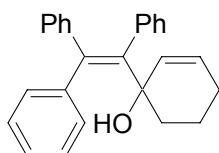
1-(1Z-1-Propyl-2-p-tolyl-pent-1-enyl)cyclohexanol (4b).

Column chromatography on silica-gel (petroleum ether / ethyl acetate = 100:1 ~ 50:1) afforded the title product as light yellow oil in 62 % isolated yield. ^1H NMR (CDCl_3 , Me_4Si) δ 0.85 (t, $J = 7.2$ Hz, 3H), 0.98 (t, $J = 7.5$ Hz, 3H), 1.13 (s, 1H), 1.20-1.28 (m, 2H), 1.38-1.66 (m, 12H), 2.05-2.10 (m, 2H), 2.15-2.20 (m, 2H), 2.31 (s, 3H), 6.99 (d, $J = 8.1$ Hz, 2H), 7.10 (d, $J = 7.8$ Hz, 2H); ^{13}C NMR (CDCl_3 , Me_4Si) δ 14.00, 14.79, 20.78, 21.02, 21.44, 24.14, 25.30, 33.20, 37.07, 39.02, 76.45, 128.48, 128.76, 135.25, 135.65, 141.19, 142.12. HRMS (EI) calcd for $\text{C}_{21}\text{H}_{32}\text{O}$ $[\text{M}]^+$: 300.2453, found 300.2462.



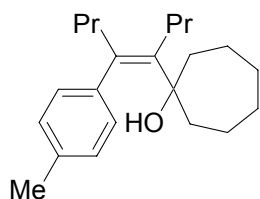
1-Triphenylvinyl-cyclohexanol (4c).

Column chromatography on silica-gel (petroleum ether / ethyl acetate = 30:1 ~ 25:1) afforded the title product as yellow solid in 61% isolated yield. Mp: 162-163 °C. ¹H NMR (CDCl₃, Me₄Si) δ 0.86-0.90 (m, 1H), 1.39-1.62 (m, 8H), 1.81 (d, *J* = 8.7 Hz, 2H), 6.81-7.13 (m, 10H), 7.19-7.24 (m, 1H), 7.31-7.36 (m, 2H), 7.40-7.43 (m, 2H); ¹³C NMR (CDCl₃, Me₄Si) δ 21.34, 24.98, 37.80, 75.56, 125.35, 125.93, 126.79, 126.98, 127.35, 128.37, 128.56, 128.84, 130.86, 140.24, 140.63, 143.05, 143.97, 148.40. Anal. calcd for C₂₆H₂₆O: C, 88.09; H, 7.39 found C, 88.24; H, 7.38. LRMS (EI) [M]⁺: 354.



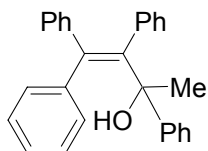
1-Triphenylvinyl-cyclohex-2-enol (4d).

Column chromatography on silica-gel (petroleum ether / ethyl acetate = 20:1) afforded the title product as brown oil in 49% isolated yield. ¹H NMR (CDCl₃, Me₄Si) δ 1.48-1.70 (m, 4H), 1.77-2.02 (m, 3H), 5.35-5.40 (m, 1H), 5.64 (d, *J* = 11.7 Hz, 1H), 6.83-6.86 (m, 1H), 6.90-7.26 (m, 12H), 7.30-7.34 (m, 2H); ¹³C NMR (CDCl₃, Me₄Si) δ 18.34, 24.41, 37.20, 72.55, 125.41, 126.12, 126.52, 127.03, 12.25, 127.71, 128.25, 128.90, 129.10, 131.25, 132.33, 139.91, 140.79, 142.81, 143.66, 146.43. HRMS (EI) calcd for C₂₆H₂₄O [M]⁺: 352.1827, found 352.1829.



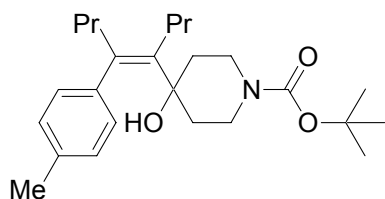
1-(1Z-1-Propyl-2-p-tolyl-pent-1-enyl)-cycloheptanol (4e).

Column chromatography on silica-gel (petroleum ether / ethyl acetate = 40:1) afforded the title product as light yellow oil in 23% isolated yield. ^1H NMR (CDCl_3 , Me_4Si) δ 0.84 (t, $J = 6.9$ Hz, 3H), 0.99 (t, $J = 7.2$ Hz, 3H), 1.17-1.27 (m, 3H), 1.37-1.41 (m, 4H), 1.50-1.66 (m, 8H), 1.81-1.89 (m, 2H), 2.06-2.18 (m, 4H), 2.31 (s, 3H), 6.98 (d, $J = 8.1$ Hz, 2H), 7.10 (d, $J = 7.8$ Hz, 2H); ^{13}C NMR (CDCl_3 , Me_4Si) δ 14.06, 14.95, 20.82, 21.06, 22.08, 24.39, 28.17, 33.25, 38.95, 41.74, 79.60, 128.57, 128.76, 133.97, 135.61, 141.24, 143.48. HRMS (EI) calcd for $\text{C}_{22}\text{H}_{32}$ $[\text{M}-\text{H}_2\text{O}]^+$: 296.2504, found 296.2513.



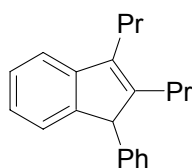
2,3,4,4-Tetraphenylbut-3-en-2-ol (4f).

Column chromatography on silica-gel (petroleum ether / ethyl acetate = 25:1) afforded the title product as light yellow oil in 45% isolated yield. ^1H NMR (CDCl_3 , Me_4Si) δ 1.53 (s, 3H), 2.30 (s, 1H), 6.83-6.93 (m, 5H), 7.00-7.24 (m, 13H), 7.31-7.35 (m, 2H); ^{13}C NMR (CDCl_3 , Me_4Si) δ 31.49, 77.34, 125.51, 126.22, 126.31, 126.39, 127.12, 127.30, 127.70, 127.99, 128.55, 128.99, 131.12, 140.18, 141.82, 142.01, 143.53, 147.01, 148.56. HRMS (EI) calcd for $\text{C}_{28}\text{H}_{24}\text{O}$ $[\text{M}]^+$: 376.1827, found 376.1831.



4-Hydroxy-4-(1Z-1-propyl-2-*p*-tolyl-pent-1-enyl)-piperidine-1-carboxylic acid *tert*-butyl ester (8).

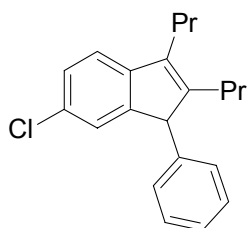
Column chromatography on silica-gel (petroleum ether / ethyl acetate = 10:1) afforded the title product as yellow oil in 58% isolated yield. ^1H NMR (CDCl_3 , Me_4Si) δ 0.85 (t, $J = 7.5$ Hz, 3H), 0.98 (t, $J = 6.9$ Hz, 3H), 1.24 (sex, $J = 7.2$ Hz, 2H), 1.39-1.56 (m, 14H), 1.82-1.85 (m, 2H), 2.02-2.08 (m, 2H), 2.16-2.21 (m, 2H), 2.33 (s, 3H), 2.93 (m, 2H), 3.82 (bs, 2H), 6.99 (d, $J = 7.8$ Hz, 2H), 7.13 (d, $J = 7.8$ Hz, 2H); ^{13}C NMR (CDCl_3 , Me_4Si) δ 13.97, 14.69, 20.68, 21.02, 24.01, 28.34, 32.88, 36.60, 39.01, 74.59, 79.05, 128.42, 129.00, 136.14, 136.57, 140.43, 140.48, 154.78. HRMS (EI) calcd for $\text{C}_{25}\text{H}_{39}\text{NO}_3$ $[\text{M}]^+$: 401.2930, found 401.2946.



1-Phenyl-2,3-dipropyl-1H-indene (5b).

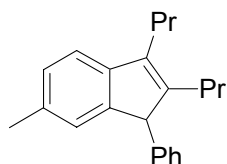
Column chromatography on silica-gel (eluent: n-hexane) afforded the title product as colorless oil in 86% isolated yield. ^1H NMR (CDCl_3 , Me_4Si) δ 0.86 (t, $J = 7.2$ Hz, 3H), 1.00 (t, $J = 7.2$ Hz, 3H), 1.26-1.57 (m, 2H), 1.67 (sex, $J = 7.5$ Hz, 2H), 1.94-2.03 (m, 1H), 2.34-2.45 (m, 1H), 2.56 (t, $J = 7.2$ Hz, 2H), 4.39 (s, 1H), 6.98-7.06 (m, 4H), 7.10-7.30 (m, 5H); ^{13}C NMR (CDCl_3 , Me_4Si) δ 14.15, 14.30, 22.20, 23.08, 27.35,

28.70, 56.74, 118.52, 123.57, 124.20, 126.42, 126.48, 128.20, 128.54, 137.70, 140.50, 145.73, 147.04, 148.35. HRMS (EI) calcd for $C_{21}H_{24}$ $[M]^+$: 276.1878, found 276.1879.



6-Chloro-1-phenyl-2,3-dipropyl-1H-indene (5c).

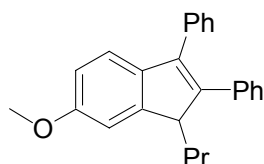
Column chromatography on silica-gel (eluent: petroleum ether) afforded the title product as colorless oil in 80% isolated yield. 1H NMR ($CDCl_3$, Me_4Si) δ 0.86 (t, J = 7.2 Hz, 3H), 0.99 (t, J = 7.2 Hz, 3H), 1.28-1.53 (m, 2H), 1.57-1.67 (m, 2H), 1.93-2.02 (m, 1H), 2.33-2.43 (m, 1H), 2.53 (t, J = 7.2 Hz, 2H), 4.37 (s, 1H), 6.97 (d, J = 6.6 Hz, 2H), 7.07 (s, 1H), 7.16-7.29 (m, 5H); ^{13}C NMR ($CDCl_3$, Me_4Si) δ 14.15, 14.24, 22.14, 22.98, 27.30, 28.74, 56.66, 119.32, 124.03, 126.58, 126.80, 128.15, 128.71, 130.07, 137.17, 139.55, 144.21, 147.57, 149.98. HRMS (EI) calcd for $C_{21}H_{23}Cl$ $[M]^+$: 310.1488, found 310.1489.



6-Methyl-1-phenyl-2,3-dipropyl-1H-indene (5d).

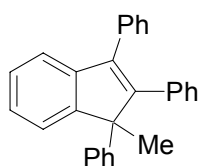
Column chromatography on silica-gel (eluent: petroleum ether) afforded the title product as colorless oil in 99% isolated yield. 1H NMR ($CDCl_3$, Me_4Si) δ 0.86 (t, J =

7.5 Hz, 3H), 0.99 (t, $J = 7.2$ Hz, 3H), 1.26-1.55 (m, 2H), 1.60-1.72 (m, 2H), 1.92-2.01 (m, 1H), 2.27 (s, 3H), 2.33-2.43 (m, 1H), 2.54 (t, $J = 7.2$ Hz, 2H), 4.36 (s, 1H), 6.94-7.06 (m, 4H), 7.16-7.27 (m, 4H); ^{13}C NMR (CDCl_3 , Me_4Si) δ 14.12, 14.28, 21.30, 22.21, 23.07, 27.41, 28.67, 56.58, 118.21, 124.51, 126.42, 127.06, 128.24, 128.53, 133.80, 137.54, 140.77, 143.09, 145.95, 148.63. HRMS (EI) calcd for $\text{C}_{22}\text{H}_{26}$ $[\text{M}]^+$: 290.2035, found 290.2027.



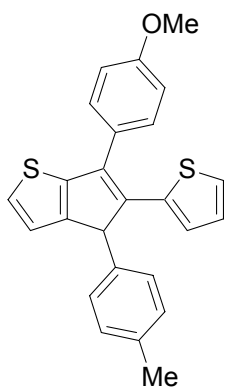
6-Methoxy-2,3-diphenyl-1-propyl-1H-indene (5e).

Column chromatography on silica-gel (petroleum ether / dichloromethane = 10:1 ~ 5:1) afforded the title product as colorless oil in 97% isolated yield. ^1H NMR (CDCl_3 , Me_4Si) δ 0.71 (t, $J = 7.2$ Hz, 3H), 0.86-1.20 (m, 2H), 1.61-1.73 (m, 1H), 1.84-1.96 (m, 1H), 3.85 (s, 3H), 4.06-4.09 (m, 1H), 6.82 (dd, $J = 2.1, 8.4$ Hz, 1H), 7.12-7.37 (m, 12H); ^{13}C NMR (CDCl_3 , Me_4Si) δ 14.31, 17.63, 32.85, 50.58, 55.56, 109.99, 111.49, 120.62, 126.37, 127.04, 127.99, 128.45, 129.20, 129.47, 135.81, 135.99, 138.73, 138.90, 144.17, 148.79, 158.01. HRMS (EI) calcd for $\text{C}_{25}\text{H}_{24}\text{O}$ $[\text{M}]^+$: 340.1827, found 340.1824.



1-Methyl-1,2,3-triphenyl-1H-indene (5f).

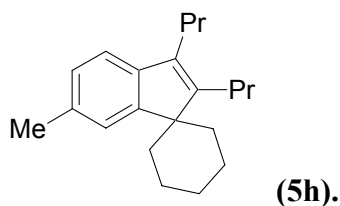
Column chromatography on silica-gel (eluent: petroleum ether) afforded the title product as colorless oil in 94% isolated yield. ^1H NMR (CDCl_3 , Me_4Si) δ 1.71 (s, 3H), 6.72-6.75 (m, 2H), 6.96-7.40 (m, 17H); ^{13}C NMR (CDCl_3 , Me_4Si) δ 21.27, 58.42, 120.74, 122.77, 126.06, 126.47, 126.60, 126.82, 127.18, 127.60, 128.39, 128.49, 129.51, 129.54, 135.33, 135.57, 139.24, 142.50, 143.28, 151.95, 154.78. HRMS (EI) calcd for $\text{C}_{28}\text{H}_{22}[\text{M}]^+$: 358.1722, found 358.1726.



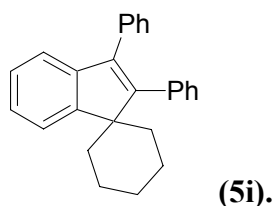
6-(4-Methoxy-phenyl)-5-thien-2-yl-4-*p*-tolyl-4*H*-cyclopenta[*b*]thiophene (5g).

Recrystallization from ethyl acetate / CHCl_3 to afford the title product in 85% yield.

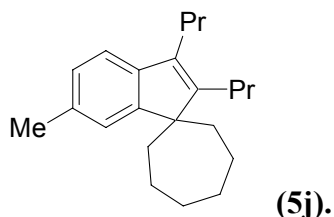
^1H NMR (CDCl_3 , Me_4Si) δ 2.29 (s, 3H), 3.86 (s, 3H), 4.82 (s, 1H), 6.74-6.77 (m, 2H), 6.85 (d, $J = 4.8$ Hz, 1H), 6.98 (d, $J = 8.7$ Hz, 3H), 7.05-7.13 (m, 5H), 7.55 (d, $J = 8.7$ Hz, 2H); ^{13}C NMR (CDCl_3 , Me_4Si) δ 21.14, 55.22, 55.82, 114.22, 122.03, 124.43, 125.75, 125.90, 126.56, 127.22, 127.84, 129.47, 130.06, 136.05, 136.35, 136.38, 138.67, 138.74, 146.72, 151.24, 159.58. HRMS (EI) calcd for $\text{C}_{25}\text{H}_{20}\text{OS}_2$ $[\text{M}]^+$: 400.0956, found 400.0956.



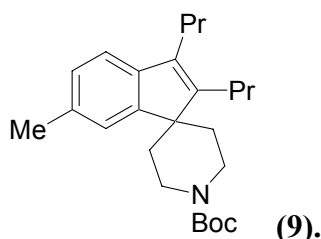
Column chromatography on silica-gel (eluent: n-hexane) afforded the title product as colorless oil in 89% isolated yield. ^1H NMR (CDCl_3 , Me_4Si) δ 0.94-1.02 (m, 6H), 1.13-1.17 (m, 2H), 1.36-1.62 (m, 5H), 1.71-1.80 (m, 4H), 1.92-2.04 (m, 3H), 2.19-2.24 (m, 2H), 2.39-2.45 (m, 5H), 7.04-7.19 (m, 2H), 7.56 (s, 1H); ^{13}C NMR (CDCl_3 , Me_4Si) δ 14.36, 15.04, 21.72, 22.04, 22.58, 24.05, 25.53, 27.82, 27.91, 31.75, 53.45, 118.19, 125.36, 126.60, 132.25, 134.70, 142.12, 151.19, 152.30. HRMS (EI) calcd for $\text{C}_{21}\text{H}_{30}$ $[\text{M}]^+$: 282.2348, found 282.2352.



Column chromatography on silica-gel (eluent: petroleum ether) afforded the title product as white solid in 89% isolated yield. Mp: 172-173 °C. ^1H NMR (CDCl_3 , Me_4Si) δ 1.15-1.29 (m, 1H), 1.46-1.51 (m, 2H), 1.70-1.74 (m, 2H), 1.80-1.90 (m, 3H), 1.96-2.09 (m, 2H), 7.09-7.36 (m, 13H), 7.91 (d, $J = 7.2$ Hz, 1H); ^{13}C NMR (CDCl_3 , Me_4Si) δ 22.23, 25.04, 31.48, 54.56, 120.58, 124.37, 124.85, 126.35, 126.69, 126.75, 127.70, 127.85, 129.41, 130.63, 135.02, 136.78, 138.30, 143.70, 151.66, 154.27. Anal. calcd for $\text{C}_{26}\text{H}_{24}$: C, 92.81; H, 7.19 found C, 92.91; H, 7.20. LRMS (EI) $[\text{M}]^+$: 336.



Column chromatography on silica-gel (eluent: n-hexane) afforded the title product as colorless oil in 85% isolated yield. ^1H NMR (CDCl_3 , Me_4Si) δ 0.92-1.02 (m, 6H), 1.47-1.63 (m, 12H), 1.81-1.87 (m, 4H), 2.29-2.42 (m, 7H), 7.00-7.09 (m, 2H), 7.30 (s, 1H); ^{13}C NMR (CDCl_3 , Me_4Si) δ 14.32, 15.01, 21.62, 22.06, 23.89, 25.56, 27.42, 28.71, 32.27, 36.32, 55.86, 118.23, 122.93, 126.61, 133.14, 134.03, 141.21, 152.27, 154.91. HRMS (EI) calcd for $\text{C}_{22}\text{H}_{32}$ $[\text{M}]^+$: 296.2504, found 296.2505.



Column chromatography on silica-gel (petroleum ether / ethyl acetate = 30:1 ~ 20:1) afforded the title product as colorless oil in 85% isolated yield. ^1H NMR (CDCl_3 , Me_4Si) δ 0.97-1.05 (m, 6H), 1.16-1.21 (m, 2H), 1.45-1.65 (m, 13H), 1.97-2.07 (m, 2H), 2.20-2.26 (m, 2H), 2.41-2.49 (m, 5H), 3.48 (t, $J = 12.3$ Hz, 2H), 4.18 (bs, 2H), 7.11 (d, $J = 7.5$ Hz, 1H), 7.18 (d, $J = 7.8$ Hz, 1H), 7.55 (s, 1H); ^{13}C NMR (CDCl_3 , Me_4Si) δ 14.30, 14.89, 21.60, 21.93, 23.93, 27.65, 27.75, 28.45, 30.98(bs), 40.78(bs), 51.25, 79.48, 118.59, 124.85, 127.09, 132.73, 135.84, 142.02, 149.26, 150.54, 155.33. HRMS (EI) calcd for $\text{C}_{25}\text{H}_{37}\text{NO}_2$ $[\text{M}]^+$: 383.2824, found 383.2821.

