



Supporting Information

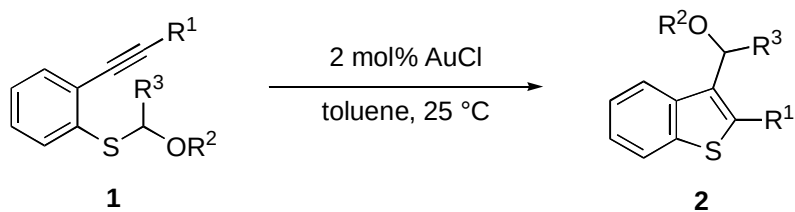
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Gold-Catalyzed Intramolecular Carbothiolation of Alkynes. Synthesis of 2,3-Disubstituted Benzothiophenes from α -Alkoxyalkyl (*ortho*-Alkynyl)phenyl Sulfides

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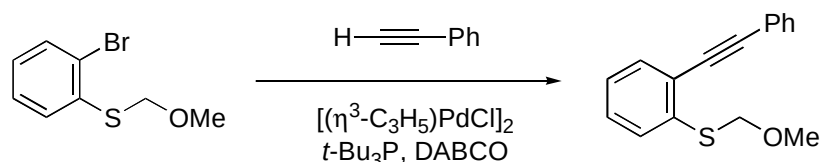
General. Spectroscopic measurements were carried out with following instruments: JEOL JNM AL 400 (^1H and ^{13}C NMR), JASCO FT/IR-460*Plus* (FT-IR), HITACHI M-2500s (HRMS). AuCl was purchased from Aldrich or STREM. The starting materials **1** were prepared from 2-benzenethiol as mentioned below. Chromatography was performed with Kanto Chemical silica gel 60N (spherical, neutral, 100-210 μm) or Fuji Silysia silica gel BW-300 (200-400 mesh).

Preparation of the starting material 1a



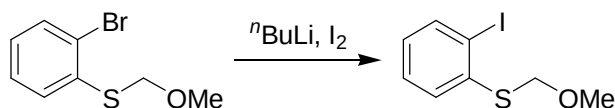
(a) To a suspension of sodium *tert*-butoxide (3.84 g, 40 mmol) in THF (100 ml) at room temperature was added o-bromobenzenethiol (4.8 ml, 40 mmol) and the mixture was stirred for 15 min. Chloromethyl methyl ether (3.3 ml, 44 mmol) was added and the reaction mixture was stirred for an additional 15 min. The mixture was diluted with ether, washed with water and brine, and dried over Na_2SO_4 . The crude product was purified by silica gel column chromatography using hexane / ethyl acetate as eluent to obtain 2-bromophenyl methoxymethyl sulfide in quantitative yield.

(b)

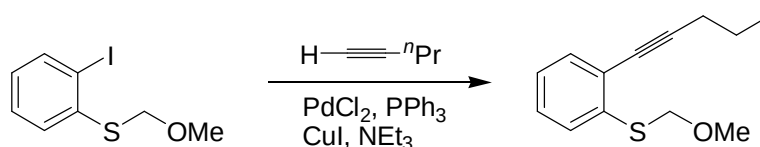


(b) To a mixture of 2-bromophenyl methoxymethyl sulfide (233 mg, 1.00 mmol) and $[\text{PdCl}(\eta^3\text{-C}_3\text{H}_5)]_2$ (9.2 mg, 0.025 mmol) in acetonitrile (1.0 ml) was added tri-*tert*-butylphosphine (0.30 ml, 10 wt% in hexanes, 0.10 mmol) and phenylacetylene (0.18 ml, 1.6 mmol) under argon atmosphere. Then DABCO (0.22 g, 2.0 mmol) was added immediately. The reaction mixture was left stirring overnight at 25 °C. The mixture was diluted with ether, filtered through a short silica gel column using ether as eluent and concentrated *in vacuo*. The crude product was purified by silica gel column chromatography using hexane / ethyl acetate as eluent to obtain methoxymethyl 2-(phenylethynyl)phenyl sulfide in 82 % yield.

In some cases, we converted 2-bromophenyl methoxymethyl sulfide to 2-iodophenyl methoxymethyl sulfide prior to Sonogashira coupling.



(c) To a solution of 2-bromophenyl methoxymethyl sulfide (8.48 g, 36.4 mmol) in THF (200 ml) under argon at -78 °C was added dropwise *n*-BuLi (1.58 M in hexane, 23.0 ml, 36.4 mmol) and the reaction mixture was stirred at -78 °C for 30 min. A solution of I_2 (9.24 g, 36.4 mmol) in THF (50 ml) was added slowly, and the reaction mixture was allowed to warm gradually to room temperature. The mixture was diluted with ether, washed with diluted aqueous $\text{Na}_2\text{S}_2\text{O}_3$, water and brine, and dried over Na_2SO_4 . The crude product was purified by silica gel column chromatography using hexane / ethyl acetate as eluent to obtain 2-iodophenyl methoxymethyl sulfide in 73 % yield.



(d) To a mixture of 2-iodophenyl methoxymethyl sulfide (3.09 g, 11.0 mmol), PdCl₂ (39 mg, 0.22 mmol), PPh₃ (144 mg, 0.55 mmol) and CuI (84 mg, 0.44 mmol) in triethylamine (20 ml) under argon was added 1-pentyne (1.5 ml, 15.4 mmol). The reaction mixture was left stirring overnight at room temperature. The mixture was diluted with ether, washed with saturated aqueous ammonium chloride (× 2), water and brine and dried over Na₂SO₄. The crude product was purified by silica gel column chromatography using hexane / ethyl acetate as eluent to obtain 2-(phenylethynyl)phenyl methoxymethyl sulfide **1a** quantitative yield.

Methoxymethyl 2-(pent-1-ynyl)phenyl sulfane. IR (neat) 3060, 2962, 2932, 2820, 2231, 1466, 1182, 1087, 898, 753 cm⁻¹. ¹H NMR (400 MHz, CDCl₃) δ 1.08 (t, *J* = 7.2 Hz, 3H), 1.67 (tq, *J* = 7.2, 7.2 Hz, 2H), 2.46 (t, *J* = 7.2 Hz, 2H), 3.43 (s, 3H), 5.04 (s, 2H), 7.11 (ddd, *J* = 1.2, 7.6, 7.6 Hz, 1H), 7.21 (ddd, *J* = 1.6, 7.6, 7.6 Hz, 1H), 7.37 (dd, *J* = 1.6, 7.6, 7.6 Hz, 1H), 7.54 (dd, *J* = 1.2, 7.6, 7.6 Hz, 1H). ¹³C NMR (100 MHz, CDCl₃) δ 13.67, 21.70, 22.25, 56.12, 76.26, 78.67, 69, 47, 123.95, 125.66, 128.05, 128.11, 132.44, 138.47. HRMS (ESI) Calcd for C₁₃H₁₆OS (M+Na)⁺: *m/z* 243.0814. Found: *m/z* 243.0814.

General Procedure of the gold-catalyzed cyclization of **1**.

To AuCl (0.005 mmol) in toluene (0.75 ml) was added the substrate **1** (0.25 mmol) in toluene (0.5 ml) under argon atmosphere in a pressure vial. After stirring at 25 °C for 2 h, the reaction mixture was filtered through a short silica gel column using ethyl acetate as eluent. The crude product was purified by silica gel column chromatography using hexane / ethyl acetate as eluent to give **2**.

3-(Methoxymethyl)-2-propylbenzo[*b*]thiophene (2a). IR (neat) 3060, 2959, 2929, 2871, 2817, 1573, 1460, 1436, 1093, 760, 732 cm⁻¹. ¹H NMR (600 MHz, CDCl₃) δ 1.01 (t, *J* = 7.2 Hz, 3H), 1.75 (m, 2H), 2.93 (t, *J* = 7.8 Hz, 2H), 3.38 (s, 3H), 4.46 (s, 2H), 7.27 (ddd, *J* = 8.4, 7.2, 1.2 Hz, 1H), 7.35 (ddd, *J* = 8.4, 7.2, 1.2 Hz, 1H), 7.76 (m, 1H), 7.79 (m, 1H). ¹³C NMR (150 MHz, CDCl₃) δ 13.82, 24.99, 30.47, 57.76, 65.62, 121.75, 121.99, 123.71, 124.07, 127.60, 138.18, 140.10, 145.28. HRMS (ESI) Calcd for C₁₃H₁₆OS (M+Na)⁺: *m/z* 243.0814. Found: *m/z* 243.0815.

2-Cyclohexyl-3-(methoxymethyl)benzo[*b*]thiophene (2b). IR (neat) 3059, 2925, 2850, 1447, 1186, 1098, 761, 733 cm⁻¹. ¹H NMR (400 MHz, CDCl₃) δ 1.27-1.58 (m, 5H), 1.77 (d, *J* = 13.6, 1H), 1.86 (m, 2H), 1.98 (d, *J* = 13.6 Hz, 2H), 3.14 (tt, *J* = 3.6, 11.6 Hz, 1H), 3.38 (s, 3H), 4.65 (s, 2H), 7.25 (ddd, *J* = 1.2, 7.2, 7.6 Hz, 1H), 7.33 (ddd, *J* = 1.2, 6.8, 7.6 Hz, 1H), 7.77 (m, 2H). ¹³C NMR (100 MHz, CDCl₃) δ 25.86, 26.72, 35.65, 38.50, 57.80, 65.64, 121.65, 122.07, 123.51, 123.96, 125.95, 137.78, 139.98, 151.93. HRMS (ESI) Calcd for C₁₆H₂₀OS (M+Na)⁺: *m/z* 283.1127. Found: *m/z* 283.1126.

2-*tert*-Butyl-3-(methoxymethyl)benzo[*b*]thiophene (2c). IR (neat) 3060, 2963-2871, 2817, 1564, 1530, 1461, 1435, 1364, 1228, 1189, 1114, 1091, 952, 763, 733 cm⁻¹. ¹H NMR (400 MHz, CDCl₃) δ 1.54 (s, 9H), 3.46 (s, 3H), 4.77 (s, 2H), 7.24 (m, 1H), 7.33 (m, 1H), 7.75 (m, 2H). ¹³C NMR (100 MHz, CDCl₃) δ 32.20, 35.50, 58.21, 66.38, 121.51, 121.60, 123.57, 123.93, 126.43, 136.61, 141.56, 154.64. HRMS (ESI) Calcd for C₁₄H₁₈OS (M+Na)⁺: *m/z* 257.0971. Found: *m/z* 257.0971.

3-(Methoxymethyl)-2-phenylbenzo[*b*]thiophene (2d). IR (neat) 3057, 2968, 2910, 2810, 1946, 1601, 1461, 1435, 1385, 1222, 1189, 1099, 909, 746, 726 cm⁻¹. ¹H NMR (400 MHz, CDCl₃) δ 3.43 (s, 3H), 4.63 (s, 2H), 7.35 (m, 1H), 7.42 (m, 2H), 7.47 (m, 2H), 7.59 (m, 2H), 7.83 (d, *J* = 8.4 Hz, 1H), 7.90 (d, *J* = 8.8 Hz, 1H). ¹³C NMR (100 MHz, CDCl₃) δ 58.16, 66.31, 122.00, 122.52, 124.43, 124.46, 128.11, 128.35, 128.58, 129.72, 133.81, 140.34, 143.52. HRMS (ESI) Calcd for C₁₆H₁₄OS (M+Na)⁺: *m/z* 277.0658. Found: *m/z* 277.0658.

3-(Methoxymethyl)-2-{4-(trifluoromethyl)phenyl}benzo[*b*]thiophene (2e). IR (neat) 3062, 2981, 2930, 2902, 2872, 2813, 2359, 2341, 2025, 1938, 1615, 1322, 1174, 1099, 1067, 1017, 942, 842, 723 cm⁻¹. ¹H NMR (400 MHz, CDCl₃) δ 3.46 (s, 3H), 4.61 (s, 2H), 7.38 (ddd, *J* = 1.2, 7.6, 7.6 Hz, 1H), 7.44 (m, 1H), 7.73 (m, 4H), 7.84 (d, *J* = 8.0, 1H), 7.92 (d, *J* = 8.0 Hz, 1H). ¹³C NMR (100 MHz, CDCl₃) δ 58.25, 65.99, 122.03, 122.60, 124.66, 124.87, 125.41, 125.45, 125.49, 125.52, 129.19, 129.88, 130.06, 137.36, 138.96, 140.08, 141.55. HRMS (ESI)

Calcd for $C_{17}H_{13}F_3OS$ ($M+Na$)⁺: m/z 345.0531. Found: m/z 345.0530.

3-(Methoxymethyl)-2-(4-methoxyphenyl)benzo[*b*]thiophene (2f). IR (neat) 3060, 2926, 2835, 1608, 1504, 1435, 1251, 1180, 1100, 836, 735 cm^{-1} . 1H NMR (400 MHz, $CDCl_3$) δ 3.42 (s, 3H), 3.85 (s, 3H), 4.60 (s, 2H), 6.98 (m, 2H), 7.32 (ddd, $J = 1.2, 7.6, 7.6$ Hz, 1H), 7.40 (m, 1H), 7.52 (m, 2H), 7.80 (d, $J = 7.6$ Hz, 1H), 7.87 (d, $J = 8.0$ Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 55.36, 58.12, 66.29, 114.05, 121.92, 122.27, 124.19, 124.38, 126.17, 127.40, 130.87, 138.62, 140.43, 143.56, 159.74. HRMS (ESI) Calcd for $C_{17}H_{16}O_2S$ ($M+Na$)⁺: m/z 307.0763. Found: m/z 307.0763.

Ethyl 3-(methoxymethyl)benzo[*b*]thiophene-2-carboxylate (2g). IR (neat) 3060, 2981, 2929, 2820, 1714, 1531, 1233, 1109, 1094, 760 cm^{-1} . 1H NMR (400 MHz, $CDCl_3$) δ 1.42 (t, $J = 7.2$ Hz, 3H), 3.42 (s, 3H), 4.40 (q, $J = 7.2$ Hz, 2H), 5.16 (s, 2H), 7.39-7.48 (m, 2H), 7.82 (m, 1H), 8.08 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 14.32, 58.19, 61.51, 65.53, 122.31, 124.65, 124.72, 127.07, 130.19, 139.37, 139.83, 140.28, 162.70. HRMS (ESI) Calcd for $C_{13}H_{14}O_3S$ ($M+Na$)⁺: m/z 273.0556. Found: m/z 273.0557.

***tert*-Butyldimethyl{(2-phenylbenzo[*b*]thiophene-3-yl)methoxy}silane (2h).** IR (neat) 3060, 2953, 2927, 2856, 1602, 1461, 1435, 1254, 1095, 1066, 837, 755 cm^{-1} . 1H NMR (400 MHz, $CDCl_3$) δ 0.07 (s, 6H), 0.91 (s, 9H), 4.86 (s, 2H), 7.34 (m, 1H), 7.38-7.47 (m, 4H), 7.61 (m, 2H), 7.82 (d, $J = 8.0$ Hz, 1H), 7.91 (d, $J = 7.6$ Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ -5.17, 18.46, 25.98, 57.53, 121.99, 122.74, 124.23, 128.25, 128.47, 129.73, 130.69, 133.98, 139.01, 140.42, 141.93. HRMS (ESI) Calcd for $C_{21}H_{26}OSSi$ ($M+Na$)⁺: m/z 377.1366. Found: m/z 377.1365.

3-((4-Methoxybenzyloxy)methyl)-2-phenylbenzo[*b*]thiophene (2i). IR (neat) 3056, 2936, 2910, 2856, 1608, 1584, 1508, 1454, 1249, 1237, 1047, 1033, 1017, 975, 903, 845, 816, 755, 735 cm^{-1} . 1H NMR (400 MHz, $CDCl_3$) δ 3.78 (s, 3H), 4.51 (s, 2H), 4.67 (s, 2H), 6.85 (d, $J = 8.4$ Hz, 2H), 7.24 (d, $J = 8.4$ Hz, 2H), 7.30-7.42 (m, 5H), 7.55 (m, 2H), 7.80 (d, $J = 8.0$ Hz, 1H), 7.84 (d, $J = 8.0$ Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 55.27, 63.41, 72.03, 113.72, 121.94, 122.60, 124.39, 128.11, 128.25, 129.65, 130.07, 133.77, 138.88, 140.41, 143.40, 159.16. HRMS (ESI) Calcd for $C_{23}H_{20}O_2S$ ($M+Na$)⁺: m/z 383.1076. Found: m/z 383.1075.

[2-((2-Phenylbenzo[*b*]thiophene-3-yl)methoxy)ethyl]trimethylsilane (2j). IR (neat) 3060, 2952, 2856, 1601, 1460, 1434, 1361, 1248, 1095, 1080, 859, 836, 755, 733 cm^{-1} . 1H NMR (400 MHz, $CDCl_3$) δ 0.00 (s, 9H), 1.00 (m, 2H), 3.61 (m, 2H), 4.64 (s, 2H), 7.33 (m, 1H), 7.40 (m, 2H), 7.45 (m, 2H), 7.60 (m, 2H), 7.81 (d, $J = 8.0$ Hz, 1H), 7.91 (d, $J = 8.0$ Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ -1.30, 18.37, 63.94, 67.71, 121.94, 122.65, 124.34, 128.26, 128.50, 128.52, 129.75, 133.94, 138.94, 140.46, 143.05. HRMS (ESI) Calcd for $C_{20}H_{24}OSSi$ ($M+Na$)⁺: m/z 363.1209. Found: m/z 363.1210.

3-(1-Ethoxyethyl)-2-propylbenzo[*b*]thiophene (2k). IR (neat) 3059, 2972, 2930, 2870, 1457, 1435, 1370, 1115, 1093, 763, 735 cm^{-1} . 1H NMR (400 MHz, $CDCl_3$) δ 1.02 (t, $J = 7.2$ Hz, 3H), 1.16 (t, $J = 7.2$ Hz, 3H), 1.59 (d, $J = 6.8$ Hz, 3H), 1.74 (tq, $J = 7.6, 7.6$ Hz, 2H), 2.88 (t, $J = 7.6$ Hz, 2H), 3.33 (m, 2H), 4.89 (q, $J = 6.8$ Hz, 1H), 7.23-7.31 (m, 2H), 7.75 (d, $J = 8.0$ Hz, 1H), 8.08 (d, $J = 8.0$ Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 14.02, 15.48, 22.04, 25.01, 30.51, 63.79, 72.20, 121.94, 123.04, 123.32, 123.58, 132.40, 138.38, 138.62, 141.78. HRMS (ESI) Calcd for $C_{15}H_{20}OS$ ($M+Na$)⁺: m/z 271.1127. Found: m/z 271.1127.

3-(1-Ethoxyethyl)-2-phenylbenzo[*b*]thiophene (2l). IR (neat) 3062, 3023, 2973, 2926, 2868, 1956, 1601, 1442, 1335, 1155, 1077, 751, 733 cm^{-1} . 1H NMR (400 MHz, $CDCl_3$) δ 1.06 (t, $J = 7.2$ Hz, 3H), 1.68 (d, $J = 6.8$ Hz, 3H), 3.25 (m, 2H), 4.83 (q, $J = 6.8$ Hz, 1H), 7.30-7.46 (m, 7H), 7.81 (m, 1H), 8.28 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 15.40, 22.18, 63.69, 72.26, 121.95, 123.96, 124.12, 124.32, 128.19, 128.40, 129.82, 133.60, 134.09, 138.30, 139.35, 140.00. HRMS (ESI) Calcd for $C_{18}H_{18}OS$ ($M+Na$)⁺: m/z 305.0971. Found: m/z 305.0970.

2-(2-Propylbenzo[*b*]thiophene-3-yl)-tetrahydro-2*H*-pyran (2m). IR (neat) 3058, 2934, 2852, 1458, 1436, 1203, 1083, 1037, 760, 733 cm^{-1} . 1H NMR (400 MHz, $CDCl_3$) δ 1.00 (t, $J = 7.6$ Hz, 3H), 1.61-1.83 (m, 6H), 1.97

(d, $J = 11.6$ Hz, 1H), 2.09 (m, 1H), 2.89 (t, $J = 7.6$ Hz, 2H), 3.57 (ddd, $J = 2.0, 12.0, 12.0$ Hz, 1H), 4.18 (m, 1H), 4.72 (dd, $J = 2.0, 12.0$ Hz, 1H), 7.20 (m, 1H), 7.28 (ddd, $J = 1.2, 7.6, 8.0$ Hz, 1H), 7.70 (d, $J = 8.0$ Hz, 1H), 8.08 (d, $J = 7.6$ Hz, 1H). ^{13}C NMR (100 MHz, CDCl_3) δ 13.97, 24.19, 25.00, 26.08, 30.82, 31.68, 69.30, 75.89, 121.84, 123.12, 123.29, 123.43, 131.88, 138.42, 138.71, 141.39. HRMS (ESI) Calcd for $\text{C}_{16}\text{H}_{20}\text{OS}$ ($\text{M}+\text{Na}$) $^+$: m/z 283.1127. Found: m/z 283.1127.

2-(2-Phenylbenzo[*b*]thiophene-3-yl)-tetrahydro-2H-pyran (2n). IR (neat) 3058, 2937, 2851, 1601, 1433, 1202, 1082, 1037, 903, 758, 735 cm^{-1} . ^1H NMR (400 MHz, CDCl_3) δ 1.59-1.84 (m, 4H), 1.96 (m, 1H), 2.30 (m, 1H), 3.51 (m, 1H), 4.14 (m, 1H), 4.71 (dd, $J = 2.4, 11.6$ Hz, 1H), 7.30 (m, 1H), 7.35 (m, 1H), 7.39-7.49 (m, 5H), 7.79 (d, $J = 8.0$ Hz, 1H), 8.31 (d, $J = 8.0$ Hz, 1H). ^{13}C NMR (100 MHz, CDCl_3) δ 23.93, 25.97, 31.42, 69.04, 75.78, 121.86, 123.80, 123.89, 124.68, 128.07, 128.34, 129.78, 132.61, 134.21, 138.59, 139.46, 139.71. HRMS (ESI) Calcd for CHOS ($\text{M}+\text{Na}$) $^+$: m/z 317.0971. Found: m/z 317.0970.

Bis(2-propylbenzo[*b*]thiophen-3-yl)methane (3). IR (neat) 3056, 2956, 2867, 1457, 1434, 755, 731 cm^{-1} . ^1H NMR (600 MHz, CDCl_3) δ 0.86 (t, $J = 7.2$ Hz, 6H), 1.60 (m, 4H), 2.77 (t, $J = 7.8$ Hz, 4H), 4.28 (s, 2H), 7.19-7.23 (m, 4H), 7.05 (m, 2H), 7.75 (m, 2H). ^{13}C NMR (150 MHz, CDCl_3) δ 13.87, 24.50, 24.55, 30.81, 121.49, 122.14, 123.39, 123.86, 128.09, 138.14, 140.48, 141.56. HRMS (ESI) Calcd for $\text{C}_{23}\text{H}_{24}\text{S}_2$ ($\text{M}+\text{Na}$) $^+$: m/z 387.1212. Found: m/z 387.1213.

3-(4-Methoxybenzyl)-2-phenylbenzo[*b*]thiophene (5a). IR (neat) 3065, 3026, 2994, 2957, 2928, 2899, 2830, 2545, 2476, 2058, 1948, 1911, 1610, 1507, 1434, 1241, 1174, 1034, 818, 759, 744 cm^{-1} . ^1H NMR (400 MHz, CDCl_3) δ 3.75 (s, 3H), 4.22 (s, 2H), 6.78 (d, $J = 8.8$ Hz, 2H), 7.05 (d, $J = 8.8$ Hz, 2H), 7.25-7.41 (m, 5H), 7.49-7.53 (m, 3H), 7.89 (m, 1H). ^{13}C NMR (100 MHz, CDCl_3) δ 31.75, 55.13, 113.80, 121.97, 122.76, 124.06, 124.11, 127.94, 128.48, 128.81, 129.29, 129.66, 131.88, 134.24, 138.98, 139.99, 140.42, 157.72. HRMS (ESI) Calcd for $\text{C}_{22}\text{H}_{18}\text{OS}$ ($\text{M}+\text{Na}$) $^+$: m/z 353.0971. Found: m/z 353.0971.

3-Allyl-2-phenylbenzo[*b*]thiophene (7). IR (neat) 3058, 3024, 3004, 2977, 2914, 1637, 1602, 1489, 1459, 1434, 914, 754, 733, 716 cm^{-1} . ^1H NMR (400 MHz, CDCl_3) δ 3.63 (ddd, $J = 5.2, 2.0, 1.6$ Hz, 2H), 5.03 (m, 1H), 5.12 (m, 1H), 6.09 (ddd, $J = 22.5, 10.5, 5.2$ Hz, 1H), 7.33 (ddd, $J = 7.7, 7.7, 2.2$ Hz, 1H), 7.37 (m, 2H), 7.41-7.45 (m, 2H), 7.55 (dd, $J = 8.2, 1.4$ Hz, 2H), 7.72 (m, 1H), 7.83 (m, 1H). ^{13}C NMR (100 MHz, CDCl_3) δ 31.26, 116.14, 122.09, 122.54, 124.07, 124.18, 127.98, 128.49, 128.93, 129.43, 134.38, 136.04, 139.01, 139.54, 140.41. HRMS (EI) Calcd for $\text{C}_{17}\text{H}_{14}\text{S}$: m/z 250.0816. Found: m/z 250.0814.

(2-Phenylbenzo[*b*]thiophene-3-yl)methanol (8). IR (neat) 3242, 3059, 1950, 1900, 1538, 1479, 1434, 1324, 1217, 1092, 1026, 986, 786, 751, 733 cm^{-1} . ^1H NMR (400 MHz, CDCl_3) δ 1.66 (t, $J = 4.8$ Hz, 1H), 4.96 (d, $J = 4.8$ Hz, 2H), 7.35-7.49 (m, 5H), 7.59-7.62 (m, 2H), 7.85 (d, $J = 7.6$ Hz, 1H), 7.94 (d, $J = 8.0$ Hz, 1H). ^{13}C NMR (100 MHz, CDCl_3) δ 57.00, 122.19, 122.23, 124.58, 128.49, 128.69, 129.63, 130.20, 133.59, 139.09, 139.85, 143.02. HRMS (ESI) Calcd for $\text{C}_{15}\text{H}_{12}\text{OS}$ ($\text{M}+\text{Na}$) $^+$: m/z 263.0501. Found: m/z 263.0500.

