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Supporting Information

$B(C_6F_5)_3$-Catalyzed Cyclization of alkynes: Direct Synthesis of 3-Silyl Hetero Cyclic Compounds

Mengxing Li,[a] Ting Wang, Zhenyu An, Rulong Yan*[a]

[a] State Key Laboratory of Applied Organic Chemistry, College of Chemistry and Chemical Engineering, Lanzhou University, Gansu, China.

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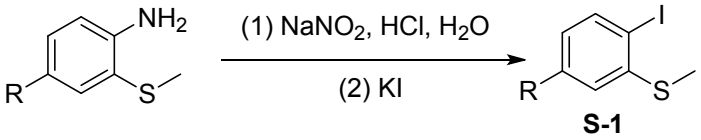
General remark

^{1}H NMR and ^{13}C NMR spectra were recorded on Bruker 400M and Mercury 300M in $CDCl_3$. All chemical shifts are given as δ value (ppm) with reference to tetramethylsilane (TMS) as an internal standard. All compounds were further characterized by HRMS; copies of ^{1}H NMR and ^{13}C NMR spectra were provided. Products were purified by flash chromatography on 200-300 mesh silica gels. All melting points were determined without correction. All reactions were carried out under argon atmosphere in oven-dried glassware, unless otherwise noted. All reagents were purchased commercially and used as received, unless otherwise noted.

Experimental section

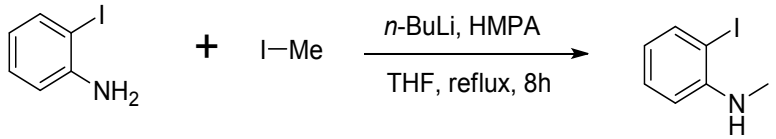
General Procedure for the Synthesis of S-1[1]



S-1

A mixture of 2-(methylthio)aniline (0.21 g, 1.5 mmol), aqueous HCl (37%, 0.3 mL) and water (1.3 mL) was cooled to 0 °C. A solution of $NaNO_2$ (0.11 g, 1.6 mmol) in water (0.3 mL) was added dropwise and stirred for 10 min. The resulting diazonium salt was treated with a solution of KI (0.29 g, 1.7 mmol) in water (0.3 mL). The resulting brown foamy mixture was stirred for 30 min at room temperature and heated at reflux for 15 min. After cooling to ambient temperature, the reaction was diluted with water (10 mL) and neutralized by slow addition of aquesou $Na_2S_2O_3$. The mixture was extracted with dichloromethane (10 mL × 2). The combined organic layer was dried over Na_2SO_4, filtered and evaporated in vacuo. The residue was purified by silica gel column chromatography to afford (2-iodopheny)(methyl)sulfane as colorless oil (0.3 g, 81%).

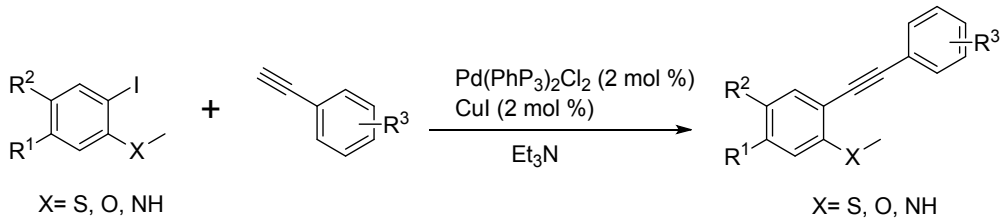
General Procedure for the Synthesis of S-2 [3]



S-2

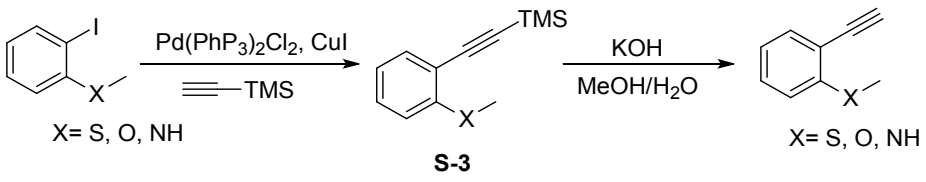
To a THF (30 mL) solution of 2-iodoaniline (1.09 g, 5 mmol) was added n-butyllithium (2.5 M, 9.4 mL, 23.5 mmol) at -40 °C. After stirring in this temperature for 30 min, HMPA (1 mL, 5.5 mmol) was added and the reaction was allowed to warm up to room temperature in 20 min. Then iodomethane (1.07 g, 7.5 mmol) was added to the solution and the resulting solution was heated to reflux for 8 h. The reaction was then quenched with a saturated aqueous NH_4Cl solution. The aqueous solution was extracted with ether, and the organic phase was dried over $MgSO_4$, and evaporated to dryness. The residues were eluted through a silica gel column to afford substrate **S-2** (0.87 g, 75%).

General procedure for the synthesis of 1a-1m, 1s-1u, 3a-3g, 3i-3m



To a solution of (2-iodophenyl)(methyl)sulfane (5 mmol), CuI (2 mol %), and $Pd(Ph_3P)_2Cl_2$ (2 mol %) in triethylamine (100 mL) was added drop-wise an alkyne (6 mmol) under N_2. The reaction mixture was stirred for 5-10 h at room temperature. Upon completion, the mixture was diluted with diethyl ether and then washed with water and brine successively. The organic phase was dried with anhydrous Na_2SO_4, filtered, and concentrated under vacuum. The residue was purified through silica gel flash chromatography to give the desired product in mostly > 90% yield.

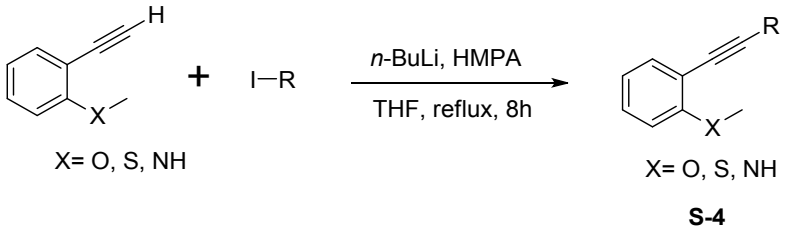
General Procedure for the Synthesis of 1n-1r, 3h, 3o[2] [3]



S-3 was synthesized using a literature procedure[2].

A solution of KOH (0.45 g, 8.0 mmol, 2 equiv) in 2 mL of water was added dropwise to o-(trimethylsilylethynyl)thioanisole (0.88 g, 4.0 mmol) in 20 mL of CH_3OH under an argon atmosphere at 25 °C. The mixture was stirred for another 0.5

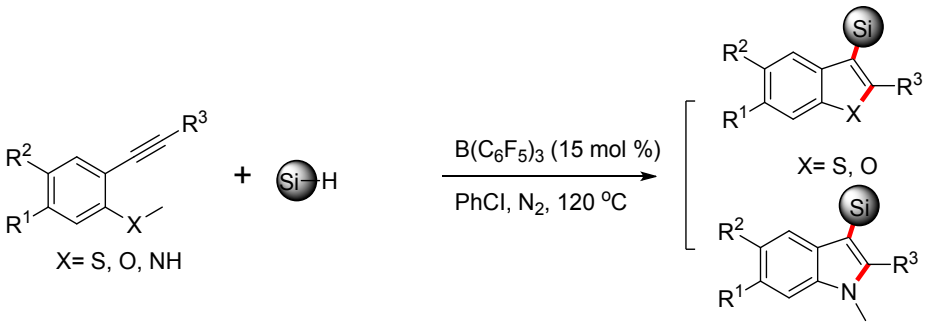
h at 25 °C, and the CH_3OH was removed under vacuum. The residue was added to 20 mL of brine, and the mixture was extracted with EtOAc (3 × 20 mL), dried (Na_2SO_4), filtered, and the solvent removed under vacuum. Purification by flash chromatography afforded the **1p** (yield = 96%) as a yellow oil.



S-4

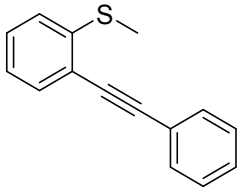
S-4 was synthesized using a literature procedure[3].

General procedure for the synthesis of silylated heteroaromatic compounds



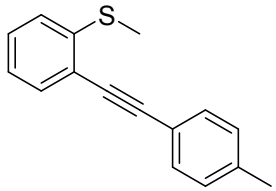
To a flame dried transparent Schlenk tube equipped with a stirring bar was added methyl(2-(phenylethynyl)phenyl)sulfane (0.2 mmol), chlorobenzene (2 mL), $B(C_6F_5)_3$ (15 mol %), Diphenylsilane (0.4 mmol, 2 equiv). The reaction mixture was stirred under N_2 at 120 °C for 24 h. Upon completion, the reaction mixture was concentrated under vacuum. The residue was purified by silicagel column chromatography using a petroleum ether to afford the corresponding products.

The data of substrates:



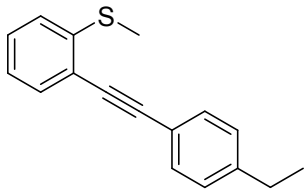
methyl(2-(phenylethynyl)phenyl)sulfane (1a)

Yellow solid(1.06 g, 95% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.59-7.56 (m, 2 H), 7.49-7.47 (m, 1 H), 7.37-7.27 (m, 4 H), 7.17-7.15 (d, *J* = 7.6 Hz, 1 H), 7.12-7.08 (m, 1 H), 2.50 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 141.7, 132.2, 131.5, 128.7, 128.3, 128.2, 124.2, 124.1, 123.1, 121.3, 95.8, 86.9, 15.0.



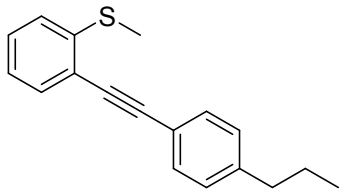
methyl(2-(*p*-tolylethynyl)phenyl)sulfane (1b)

Yellow solid (0.96 g, 81% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.50-7.48 (d, *J* = 7.2 Hz, 3 H), 7.31-7.25 (m, 1 H), 7.18-7.16 (d, *J* = 8.0 Hz, 3 H), 7.13-7.09 (m, 1 H), 2.51 (s, 3 H), 2.37 (s, 3 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 141.5, 138.5, 132.1, 131.5, 129.1, 128.6, 124.2, 124.0, 121.5, 120.1, 96.1, 86.2, 21.5, 15.1.



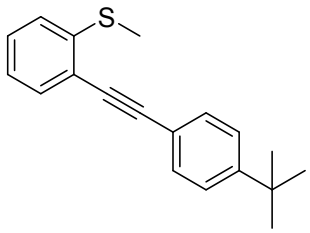
(2-((4-ethylphenyl)ethynyl)phenyl)(methyl)sulfane (1c)

Yellow oil (1.059 g, 83% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.50-7.45 (m, 3 H), 7.28-7.24 (m, 1 H), 7.17-7.13 (m, 3 H), 7.10-7.06 (m, 1 H), 2.67-2.61 (m, 2 H), 2.47 (s, 3 H), 1.24-1.20 (m, 3 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 144.8, 141.5, 132.0, 131.5, 128.5, 127.8, 124.1, 123.9, 121.4, 120.3, 96.1, 86.2, 28.8, 15.3, 15.0



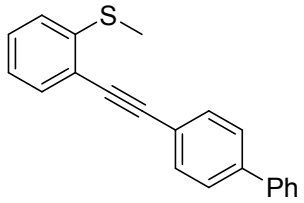
methyl(2-((4-propylphenyl)ethynyl)phenyl)sulfane (1d)

Yellow solid (1.13 g, 85% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.50-7.45 (m, 3 H), 7.29-7.25 (m, 1 H), 7.16-7.14 (d, *J* = 8.0 Hz, 3 H), 7.10-7.06 (m, 1 H), 2.60-2.56 (m, 2 H), 2.48 (s, 3 H), 1.68-1.58 (m, 2 H), 0.95-0.91 (m, 3 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 143.3, 141.5, 132.1, 131.4, 128.5, 128.4, 124.2, 124.0, 121.5, 120.3, 96.1, 86.2, 37.9, 24.3, 15.0, 13.7.



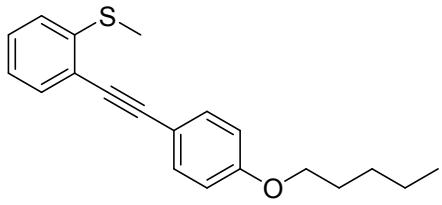
(2-((4-(tert-butyl)phenyl)ethynyl)phenyl)(methyl)sulfane (1e)

Yellow solid (1.01 g, 76% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.54-7.46 (m, 3 H), 7.39-7.33 (m, 2 H), 7.31-7.25 (m, 1 H), 7.17-7.06 (m, 2 H), 2.50-2.49 (d, *J* = 2.8 Hz, 3 H), 1.32 (s, 9 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 151.6, 141.6, 132.1, 131.3, 128.5, 125.3, 124.1, 124.0, 121.5, 120.1, 96.0, 86.2, 34.8, 31.1, 15.0.



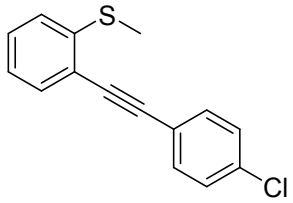
(2-([1,1'-biphenyl]-4-ylethynyl)phenyl)(methyl)sulfane (1f)

Yellow solid (1.35 g, 90% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.65-7.63 (m, 2 H), 7.61-7.57 (m, 4 H), 7.50-7.48 (m, 1 H), 7.45-7.42 (m, 2 H), 7.37-7.32 (m, 1 H), 7.31-7.27 (m, 1 H), 7.18-7.16 (d, *J* = 8.0 Hz, 1 H), 7.13-7.09 (m, 1 H), 2.50 (s, 3 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 141.7, 141.1, 140.3, 132.2, 132.0, 128.8, 128.7, 127.6, 127.0, 124.2, 124.1, 122.0, 121.3, 95.8, 87.6, 15.0.



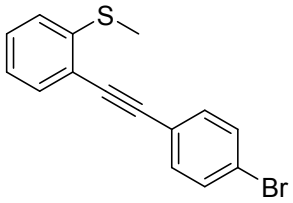
methyl(2-((4-(pentyloxy)phenyl)ethynyl)phenyl)sulfane (1g)

Yellow solid (1.24 g, 80% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.51-7.42 (m, 3 H), 7.29-7.24 (m, 1 H), 7.16-7.07 (m, 2 H), 6.87-6.81 (m, 2 H), 3.96-3.93 (m, 2 H), 2.49 (s, 3 H), 1.80-1.76 (m, 2 H), 1.45-1.37 (m, 4 H), 0.95-0.91 (m, 3 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 159.3, 141.3, 133.9, 133.0, 131.9, 128.3, 124.1, 123.9, 121.6, 114.4, 96.0, 85.5, 68.0, 28.8, 28.1, 22.4, 15.0, 14.0.



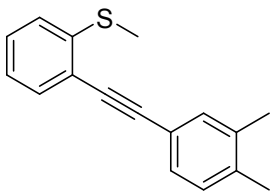
(2-((4-chlorophenyl)ethynyl)phenyl)(methyl)sulfane (1h)

Yellow solid(1.09 g, 85% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.50-7.45 (m, 3 H), 7.32-7.27 (m, 3 H), 7.17-7.15 (d, *J* = 8.0 Hz, 1 H), 7.12-7.08 (m, 1 H), 2.49 (s, 3 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 141.7, 134.3, 132.7, 132.2, 128.9, 128.6, 124.2, 123.9, 121.6, 120.8, 94.6, 87.8, 15.0.



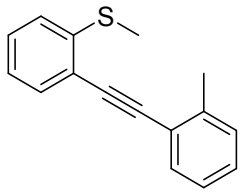
(2-((4-bromophenyl)ethynyl)phenyl)(methyl)sulfane (1i)

yellow oil (1.18 g, 86% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.49-7.45 (m, 3 H), 7.43-7.41 (m, 2 H), 7.33-7.29 (m, 1 H), 7.18-7.16 (d, J = 7.6 Hz, 1 H), 7.12-7.09 (m, 1 H), 2.50 (s, 3 H); ^{13}C NMR (100 MHz, CDCl3, ppm): δ = 141.8, 133.0, 132.2 131.6, 129.0, 124.2, 124.0, 122.6, 122.1, 120.9, 94.7, 88.0, 15.0.



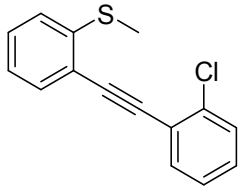
(2-((3,4-dimethylphenyl)ethynyl)phenyl)(methyl)sulfane (1j)

Yellow solid (1.1 g, 80% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.47-7.44 (m, 1 H), 7.35 (s, 1 H), 7.33-7.28 (m, 1 H), 7.26-7.23 (m, 1 H), 7.15-7.13 (d, *J* = 9.6 Hz, 1 H), 7.11-7.05 (m, 2 H), 2.48 (s, 3 H), 7.25-7.24 (d, *J* = 4.0 Hz, 6 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 141.5, 137.3, 136.6, 132.5, 132.0, 129.6, 129.0, 128.4, 124.1, 124.0, 121.5, 120.3, 96.2, 86.0, 19.7, 19.5, 15.0.



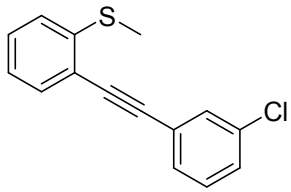
methyl(2-(*o*-tolylethynyl)phenyl)sulfane (1k)

Yellow oil (0.86 g, 72% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.48-7.46 (m, 1 H), 7.40-7.37 (m, 2 H), 7.30-7.21 (m, 2 H), 7.17-7.08 (m, 3 H), 2.50 (s, 3 H), 2.35 (s, 3 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 141.6, 138.0, 132.1, 132.0, 129.3, 128.6, 128.2, 124.2, 124.0, 122.9, 121.3, 96.0, 86.5, 21.2, 15.0.



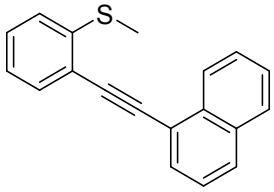
(2-((2-chlorophenyl)ethynyl)phenyl)(methyl)sulfane (1l)

Yellow solid (1.09 g, 84% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.62-7.60 (m, 1 H), 7.55-7.53 (m, 1 H), 7.44-7.42 (m, 1 H), 7.34-7.30 (m, 1 H), 7.27-7.24 (m, 2 H), 7.20-7.18 (d, *J* = 8.0 Hz, 1 H),7.14-7.10 (m, 1 H), 2.52 (s, 3 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 141.9, 135.8, 133.4, 132.6, 129.3, 129.2, 129.1, 126.4, 124.3, 124.2, 123.2, 121.0, 92.4, 91.9, 15.2.



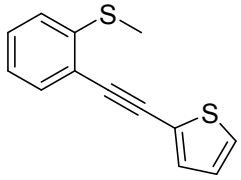
(2-((3-chlorophenyl)ethynyl)phenyl)(methyl)sulfane (1m)

Yellow solid (1.03 g, 80% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.56-7.55 (m, 1 H), 7.47-7.42 (m, 2 H), 7.31-7.27 (m, 2 H), 7.25-7.23 (d, *J* = 8.8 Hz, 1 H), 7.17-7.15 (d, *J* = 8.0 Hz, 1 H), 7.12-7.08 (m, 1 H), 2.49 (s, 3 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 141.9, 134.1, 132.2, 131.3, 129.6, 129.5, 129.1, 128.6, 124.8, 124.2, 124.0, 120.7, 94.2, 88.0, 15.0.



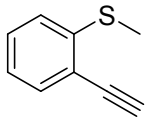
methyl(2-(naphthalen-1-ylethynyl)phenyl)sulfane (1n)

Yellow solid (1.10 g, 91% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.65-6.62 (d, *J* = 11.2 Hz, 1 H), 7.86-7.81 (m, 3 H), 7.61-6.59 (d, *J* = 8.8 Hz, 2 H), 7.54-7.42 (m, 2 H), 7.34-7.28 (m, 1 H), 7.21-7.12 (m, 2 H), 2.53 (s, 3 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 141.6, 133.2, 132.4, 130.5, 128.9, 128.8, 128.2, 126.8, 126.5, 126.4, 125.2, 124.3, 124.2, 121.5, 120.9, 94.0, 91.7, 15.2.



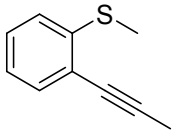
2-((2-(methylthio)phenyl)ethynyl)thiophene (1o)

Yellow solid (1.035 g, 90% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.47-7.45 (d, *J* = 7.6 Hz, 1 H), 7.32-7.27 (m, 3 H), 7.18-7.16 (d, *J* = 8.0 Hz, 1 H), 7.12-7.08 (m, 1 H), 7.02-7.00 (m, 1 H), 2.50 (s, 3 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 141.5, 132.1, 132.0, 128.9, 127.5, 127.1, 124.2, 124.1, 123.0, 121.0, 90.5, 88.9, 15.1.



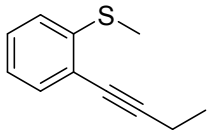
(2-ethynylphenyl)(methyl)sulfane (1p)

Yellow oil (1.14 g, 96% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.46-6.44 (m, 1 H), 7.33-7.28 (m, 1 H), 7.16-7.14 (d, *J* = 7.6 Hz, 1 H), 7.10-7.06 (m, 1 H), 3.47 (s, 1 H), 2.48 (s, 3 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 141.8, 133.1, 129.2, 124.2, 120.2, 83.5, 81.0, 15.1.



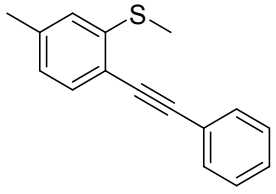
methyl(2-(prop-1-yn-1-yl)phenyl)sulfane (1q)

Yellow oil (0.61 g, 75% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.36-6.35 (d, *J* = 7.6 Hz, 1 H), 7.26-7.22 (m, 1 H), 7.13-7.11 (d, *J* = 8.0 Hz, 1 H), 7.07-7.03 (m, 1 H), 2.48-2.47 (d, *J* = 2.4 Hz, 3 H), 2.14-2.13 (d, *J* = 1.6 Hz, 3 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 140.9, 132.1, 127.9, 123.9, 123.6, 121.6, 92.5, 77.1, 14.8, 4.4.



(2-(but-1-yn-1-yl)phenyl)(methyl)sulfane(1r)

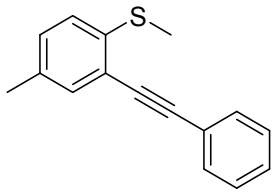
Yellow oil (0.66 g, 75% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.36-7.34 (m, 1 H), 7.25-7.21 (m, 1 H), 7.11-7.09 (d, *J* = 8.0 Hz, 1 H), 7.06-7.02 (m, 1 H), 2.52-2.48 (m, 2 H), 2.46 (s, 3 H), 1.29-1.25 (m, 3 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 141.0, 132.1, 128.0, 124.0, 123.7, 121.9, 98.5, 83.4, 14.9, 13.8, 13.3.



methyl(5-methyl-2-(phenylethynyl)phenyl)sulfane(1s)

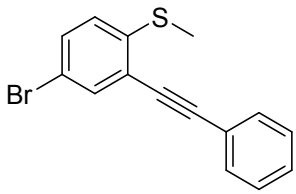
Yellow oil (0.95 g, 85% yield). ^{1}H NMR (400 MHz, CDCl3, ppm): δ = 7.57-7.55 (m,

2 H), 7.38-7.32 (m, 4 H), 6.98-6.90 (m, 2 H), 2.50 (s, 3 H), 2.36 (s, 3 H); ^{13}C NMR (100 MHz, CDCl3, ppm): δ = 141.3, 134.0, 132.1, 131.5, 128.3, 128.2, 125.3, 125.0, 123.4, 118.5, 95.1, 87.0, 21.7, 15.1.



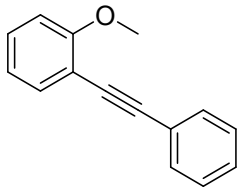
methyl(4-methyl-2-(phenylethynyl)phenyl)sulfane(1t)

Yellow oil (0.95 g, 85% yield). ^{1}H NMR (400 MHz, CDCl3, ppm): δ = 7.57-7.55 (m, 2 H), 7.36-7.30 (m, 4 H), 7.08 (s, 2 H), 2.48 (s, 3 H), 2.29 (s, 3 H); ^{13}C NMR (100 MHz, CDCl3, ppm): δ = 140.0, 134.2, 132.9, 131.5, 129.7, 128.3, 124.9, 123.3, 121.6, 95.2, 87.2, 21.6, 15.5.



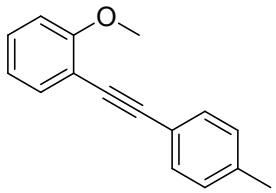
(4-bromo-2-(phenylethynyl)phenyl)(methyl)sulfane (1u)

Yellow oil (1.36 g, 90% yield). ^{1}H NMR (400 MHz, CDCl3, ppm): δ = 7.61-7.60 (d, *J* = 2.0 Hz, 1 H), 7.58-7.55 (m, 2 H), 7.41-7.38 (m, 1 H), 7.37-7.34 (m, 3 H), 7.03-7.01 (d, *J* = 8.4 Hz, 1 H), 2.48 (s, 3 H); ^{13}C NMR (100 MHz, CDCl3, ppm): δ = 141.0, 134.5, 132.7, 131.6, 128.7, 128.4, 125.6, 123.1, 122.7, 117.4, 97.0, 85.5, 15.2.



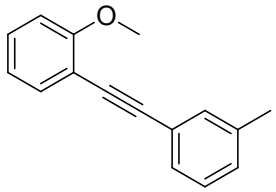
1-methoxy-2-(phenylethynyl)benzene (3a)

Yellow oil (0.88 g, 85% yield). ^{1}H NMR (400 MHz, CDCl3, ppm): δ = 7.57-7.55 (m, 2 H), 7.51-7.49 (m, 1 H), 7.35-7.27 (m, 4 H), 6.95-6.87 (m, 2 H), 3.89 (s, 3 H); ^{13}C NMR (100 MHz, CDCl3, ppm): δ = 159.8, 135.5, 131.6, 129.7, 128.2, 128.1, 123.5, 120.4, 112.3, 110.6, 93.4, 85.7, 55.8.



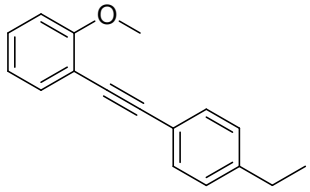
1-methoxy-2-(p-tolylethynyl)benzene (3b)

Yellow oil (0.94 g, 85% yield). ^{1}H NMR (400 MHz, CDCl3, ppm): δ = 7.50-7.44 (m, 3 H), 7.27-7.25 (m, 1 H), 7.14-7.12 (d, *J* = 8 Hz, 2 H), 6.94-6.86 (m, 2 H), 3.89 (s, 3 H), 2.34 (s, 3 H); ^{13}C NMR (100 MHz, CDCl3, ppm): δ = 159.8, 138.1, 133.5, 131.5, 129.5, 129.0, 120.4, 112.6, 110.6, 93.6, 85.0, 55.8, 21.5.



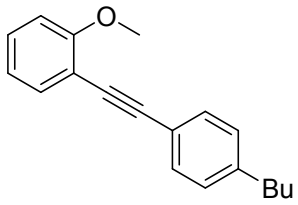
1-methoxy-2-(m-tolylethynyl)benzene (3c)

Yellow solid (0.99 g, 89% yield). ^{1}H NMR (400 MHz, CDCl3, ppm): δ = 7.50-7.48 (m, 1 H), 7.39-7.36 (m, 2 H), 7.31-7.20 (m, 2 H), 7.13-7.11 (d, J=7.6 Hz 1 H), 6.95-6.88 (m, 2 H), 3.90 (s, 3 H), 2.34 (s, 3 H); ^{13}C NMR (100 MHz, CDCl3, ppm): δ = 159.9, 137.8, 133.5, 132.2, 129.6, 129.0, 128.7, 128.1, 123.3, 120.4, 112.5, 110.6, 93.6, 85.3, 55.8, 21.2.



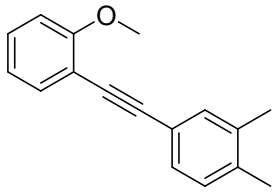
1-((4-ethylphenyl)ethynyl)-2-methoxybenzene (3d)

Yellow solid (1.04 g, 88% yield). ^{1}H NMR (400 MHz, CDCl3, ppm): δ = 7.50-7.47 (m, 3 H), 7.30-7.26 (m, 1 H), 7.17-7.15 (d, *J*=8 Hz, 2 H), 6.94-6.87 (m, 2 H), 3.90 (s, 3 H), 2.68-2.62 (m, 2 H), 1.25-1.21 (m, 3 H); ^{13}C NMR (100 MHz, CDCl3, ppm): δ = 159.8, 144.5, 133.5, 131.6, 129.5, 127.8, 120.7, 120.4, 112.6, 110.6, 93.6, 84.9, 55.8, 28.8, 15.3.



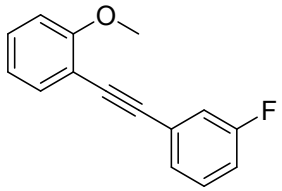
1-((4-butylphenyl)ethynyl)-2-methoxybenzene (3e)

Yellow oil (1.15 g, 87% yield). ^{1}H NMR (400 MHz, CDCl3, ppm): δ = 7.50-7.45 (m, 3 H), 7.30-7.26 (m, 1 H), 7.15-7.13 (d, *J* = 8 Hz, 2 H), 6.94-6.87 (m, 2 H), 3.89 (s, 3 H), 2.62-2.58 (m, 2 H), 1.62-1.55 (m, 2 H), 1.39-1.29 (m, 2 H), 0.94-0.90 (m, 3 H),; ^{13}C NMR (100 MHz, CDCl3, ppm): δ = 159.8, 143.1, 133.5, 131.5, 129.5, 128.3, 120.6, 120.4, 112.6, 110.6, 93.6, 85.0, 55.8, 35.6, 33.4, 22.3, 13.9.



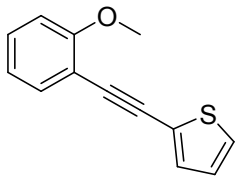
4-((2-methoxyphenyl)ethynyl)-1,2-dimethylbenzene (3f)

Yellow solid (0.99 g, 84% yield). ^{1}H NMR (400 MHz, CDCl3, ppm): δ = 7.50-7.47 (m, 1 H), 7.35-7.26 (m, 3 H), 7.10-7.08 (d, *J*=7.6 Hz, 1 H), 6.94-6.87 (m, 2 H), 3.90 (s, 3 H), 2.26-2.25 (d, *J*=5.6 Hz, 6 H); ^{13}C NMR (100 MHz, CDCl3, ppm): δ = 159.8, 137.0, 136.5, 133.5, 132.7, 129.5, 129.4, 129.1, 120.7, 120.4, 112.7, 110.6, 93.8, 84.7, 55.8, 19.7, 19.5.



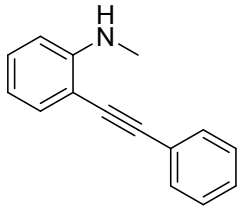
1-((3-fluorophenyl)ethynyl)-2-methoxybenzene (3g)

Yellow oil (0.90 g, 80% yield). ^{1}H NMR (400 MHz, CDCl3, ppm): δ = 7.50-7.48 (m, 1 H), 7.34-7.24 (m, 4 H), 7.04-7.00 (m, 1 H), 6.96-6.88 (m, 2 H), 3.90 (s, 3 H); ^{13}C NMR (100 MHz, CDCl3, ppm): δ = 163.5, 161.1, 159.9, 133.6, 130.1, 129.8, 129.7, 127.5, 127.4, 125.4, 125.3, 125.3, 120.5, 118.4, 118.2, 115.5, 115.3, 111.8, 110.6, 92.1, 92.0, 86.7, 55.8.



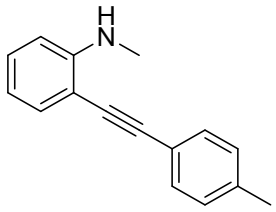
2-((2-methoxyphenyl)ethynyl)thiophene (3h)

Yellow oil (0.91 g, 85% yield). ^{1}H NMR (400 MHz, CDCl3, ppm): δ = 7.49-7.46 (m, 1 H), 7.32-7.24 (m, 3 H), 7.00-6.98 (m, 1 H), 6.95-6.88 (m, 2 H), 3.90 (s, 3 H); ^{13}C NMR (100 MHz, CDCl3, ppm): δ = 159.8, 133.4, 131.8, 130.0, 127.1, 127.0, 123.5, 120.4, 112.1, 110.6, 89.4, 86.4, 55.8.



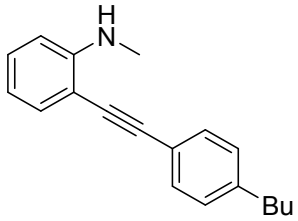
N-methyl-2-(phenylethynyl)aniline (3i)

Yellow solid (0.88 g, 85% yield). ^{1}H NMR (400 MHz, CDCl3, ppm): δ = 7.53-7.50 (m, 2 H), 7.38-7.30 (m, 4 H), 7.25-7.21 (m, 1 H), 6.67-6.59 (m, 2 H), 4.68 (s, 1 H), 2.90 (s, 3 H); ^{13}C NMR (100 MHz, CDCl3, ppm): δ = 149.8, 132.0, 131.4, 130.0, 128.3, 128.1, 123.3, 116.2, 109.0, 107.2, 94.9, 86.0, 30.3.



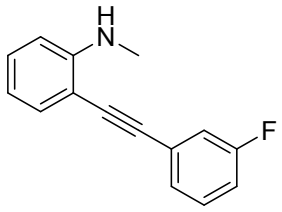
N-methyl-2-(p-tolylethynyl)aniline (3j)

Yellow solid (0.90 g, 81% yield). ^{1}H NMR (400 MHz, CDCl3, ppm): δ = 7.42-7.32 (m, 3 H), 7.24-7.20 (m, 1 H), 7.15-7.11 (m, 2H), 6.75-6.58 (m, 2 H), 4.68 (s, 1 H), 2.92-2.90 (m, 3 H), 2.35 (s, 3 H); ^{13}C NMR (100 MHz, CDCl3, ppm): δ = 149.7, 138.3, 132.0, 131.3, 129.8, 129.1, 120.2, 116.2, 108.9, 107.5, 95.0, 85.2, 30.3, 21.5.



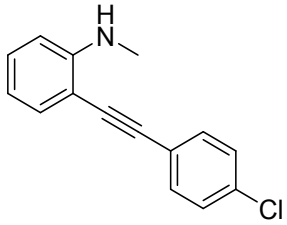
2-((4-butylphenyl)ethynyl)-N-methylaniline (3k)

Yellow oil (1.12 g, 85% yield). ^{1}H NMR (400 MHz, CDCl3, ppm): δ = 7.44-7.42 (d, *J* = 8 Hz, 2 H), 7.37-7.35 (m, 1 H), 7.24-7.20 (m, 1 H), 7.16-7.14 (d, *J* = 8 Hz, 2 H), 6.67-6.59 (m, 2 H), 4.68 (s, 1 H), 2.93-2.91 (d, *J* = 8 Hz, 3 H), 2.63-2.59 (m, 2 H), 1.63-1.55 (m, 2 H), 1.39-1.30 (m, 2 H), 0.94-0.91 (m, 3 H); ^{13}C NMR (100 MHz, CDCl3, ppm): δ = 149.7, 143.3, 132.0, 131.4, 129.8, 128.5, 120.4, 116.2, 108.9, 107.5, 95.1, 85.2, 35.6, 33.4, 30.3, 22.3, 13.9.



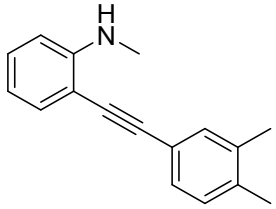
2-((3-fluorophenyl)ethynyl)-N-methylaniline (3l)

Yellow oil (0.89 g, 79% yield). ^{1}H NMR (400 MHz, CDCl3, ppm): δ = 7.37-7.19 (m, 5 H), 7.04-7.02 (m, 1 H), 6.75-6.59 (m, 2 H), 4.64 (s, 1 H), 2.92-2.91 (d, *J*=2.4 Hz, 4 H); ^{13}C NMR (100 MHz, CDCl3, ppm): δ = 163.6, 161.1, 149.8, 132.2, 130.4, 130.0, 129.9, 127.3, 125.2, 115.1, 118.2, 118.0, 116.0, 115.5, 115.3, 109.0, 106.6, 93.6, 30.3.



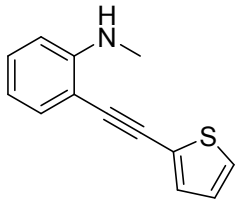
2-((4-chlorophenyl)ethynyl)-N-methylaniline (3m)

Yellow solid (0.94 g, 78% yield). ^{1}H NMR (400 MHz, CDCl3, ppm): δ = 7.45-7.43 (m, 2 H), 7.36-7.30 (m, 3 H), 7.27-7.23 (m, 1 H), 6.68-6.60 (m, 2 H), 4.64 (s, 1 H), 2.92 (s, 3 H); ^{13}C NMR (100 MHz, CDCl3, ppm): δ = 149.8, 134.1, 132.6, 132.1, 130.3, 128.7, 121.8, 116.3, 109.1, 106.9, 93.8, 87.0, 30.3.



2-((3,4-dimethylphenyl)ethynyl)-N-methylaniline (3n)

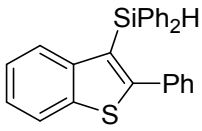
Yellow solid (0.92 g, 78% yield). ^{1}H NMR (400 MHz, CDCl3, ppm): δ = 7.37-7.20 (m, 4 H), 7.11-7.09 (d, *J*=7.6 Hz, 1 H), 6.67-6.59 (m, 2 H), 4.69 (s, 1 H), 2.92-2.91 (d, *J*=3.6 Hz, 3 H), 2.27-2.25 (d, *J*=5.6 Hz, 6 H); ^{13}C NMR (100 MHz, CDCl3, ppm): δ = 149.7, 137.1, 136.7, 132.5, 131.9, 129.8, 129.6, 128.9, 120.5, 116.1, 108.9, 107.6, 95.2, 85.0, 30.3, 19.8, 19.6.



N-methyl-2-(thiophen-2-ylethynyl)aniline (3o)

Yellow solid (0.91 g, 85% yield). ^{1}H NMR (400 MHz, CDCl3, ppm): δ = 7.35-7.34 (d, J=7.6 Hz, 1 H), 7.28-7.22 (m, 3 H), 7.01-6.99 (m, 1 H), 6.67-6.58 (m, 2 H), 4.63 (s, 1 H), 2.93-2.90 (m, 3 H); ^{13}C NMR (100 MHz, CDCl3, ppm): δ = 149.8, 132.1, 131.6, 130.3, 127.1, 127.0, 123.3, 116.2, 109.0, 106.8, 89.6, 87.8, 30.3.

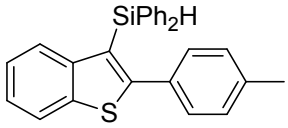
The data of products:



diphenyl(2-phenylbenzo[*b*]thiophen-3-yl)silane (2a)[4]

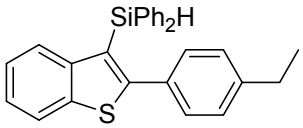
Yellow solid (68.99 mg, 88% yield). melting point: 97-98 ^{o}C. ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.88-7.86 (d, *J* = 8.0 Hz, 1 H), 7.63-7.61 (d, *J* = 8.0 Hz, 1 H), 7.55-7.52 (m, 4 H), 7.44-7.42 (m, 2 H), 7.39-7.34 (m, 2 H), 7.32-7.24 (m, 8 H), 7.18-7.14 (m, 1 H), 5.43 (s, 1 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 155.8, 145.1, 141.0, 135.7, 135.4, 132.8, 130.1, 129.7, 128.5, 128.0, 127.9, 125.7, 125.4, 124.2, 124.0,

121.8; HRMS calcd for $C_{26}H_{20}SSi$ $[M+H]^+$ 393.1128; found: 393.1113.



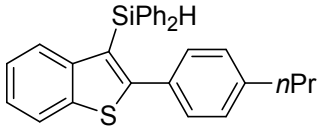
diphenyl(2-(*p*-tolyl)benzo[*b*]thiophen-3-yl)silane (2b)

White solid (73.08 mg, 90% yield). melting point: 133-135 °C. ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.86-7.83 (d, *J* = 8.4 Hz, 1 H), 7.61-7.59 (d, *J* = 8.0 Hz, 1 H), 7.54-7.52 (m, 4 H), 7.38-7.22 (m, 9 H), 7.16-7.14 (m, 1 H), 7.08-7.06 (d, *J* = 8.0 Hz, 2 H), 5.44 (s, 1 H), 2.32 (s, 3 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 156.0, 145.2, 140.9, 138.4, 135.7, 133.0, 132.5, 130.0, 129.7, 128.7, 128.0, 125.3, 124.1, 123.9, 121.7, 21.2; HRMS calcd for $C_{27}H_{22}SSi$ $[M+H]^+$ 407.1284; found: 407.1298.



(2-(4-ethylphenyl)benzo[*b*]thiophen-3-yl)diphenylsilane (2c)

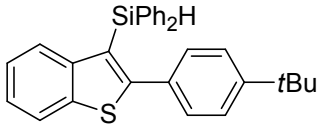
White solid (79.8 mg, 95% yield). melting point: 137-139 °C. ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.85-7.83 (d, *J* = 8.0 Hz, 1 H), 7.62-7.60 (d, *J* = 8.4 Hz, 1 H), 7.54-7.52 (m, 4 H), 7.36-7.32 (m, 4 H), 7.29-7.21 (m, 5 H), 7.16-7.12 (m, 1 H), 7.09-7.07 (d, *J* = 8.0 Hz, 2 H), 5.47 (s, 1 H), 2.64-2.59 (m, 2 H), 1.23-1.19 (m, 3 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 156.1, 145.2, 144.6, 140.9, 135.7, 132.9, 132.7, 130.0, 129.7, 128.0, 127.5, 125.3, 124.1, 123.9, 121.7, 28.6, 15.4; HRMS calcd for $C_{28}H_{24}SSi$ $[M+H]^+$ 421.1441; found: 421.1447.



diphenyl(2-(4-propylphenyl)benzo[*b*]thiophen-3-yl)silane (2d)

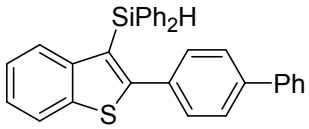
White solid (59.2 mg, 68% yield). melting point: 105-107 °C. ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.87-7.85 (d, *J* = 8.0 Hz, 1 H), 7.62-7.60 (d, *J* = 8.0 Hz, 1 H), 7.54-7.52 (m, 4 H), 7.38-7.24 (m, 9 H), 7.17-7.13 (m, 1 H), 7.08-7.06 (d, *J* = 8.0 Hz, 2 H), 5.46 (s, 1 H), 2.59-2.55 (m, 2 H), 1.66-1.60 (m, 2 H), 0.96-0.92 (m, 3 H); ^{13}C NMR

(100 MHz, $CDCl_3$, ppm): δ = 156.1, 145.2, 143.2, 141.0, 135.7, 132.9, 132.7, 130.0, 129.7, 128.1, 128.0, 125.3, 125.2, 124.1, 123.9, 121.7, 37.8, 24.4, 13.9; HRMS calcd for $C_{29}H_{26}SSi$ $[M+H]^+$ 435.1597; found: 435.1603.



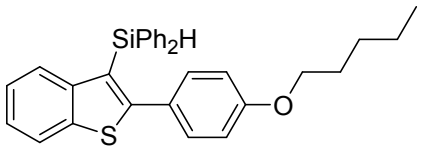
(2-(4-(*tert*-butyl)phenyl)benzo[*b*]thiophen-3-yl)diphenylsilane (2e)

White solid (58.24 mg, 65% yield). melting point: 131-133 °C. ^1H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.89-7.87 (d, *J* = 8.0 Hz, 1 H), 7.64-7.62 (d, *J* = 8.0 Hz, 1 H), 7.53-7.50 (m, 4 H), 7.38-7.23 (m, 11 H), 7.19-7.15 (m, 1 H), 5.50 (s, 1 H), 1.30 (s, 9 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 156.0, 151.5, 145.3, 140.9, 135.8, 132.9, 132.4, 129.8, 129.7, 128.1, 128.0, 125.3, 124.9, 124.1, 123.9, 121.7, 34.6, 31.3; HRMS calcd for $C_{30}H_{28}SSi$ $[M+H]^+$ 449.1754; found: 449.1760.



(2-([1,1'-biphenyl]-4-yl)benzo[*b*]thiophen-3-yl)diphenylsilane (2f)

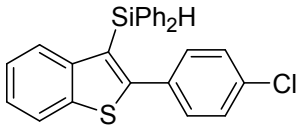
Yellow oil (53.35 mg, 57% yield). ^1H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.90-7.88 (d, *J* = 8.0 Hz, 1 H), 7.66-7.64 (d, *J* = 8.0 Hz, 1 H), 7.58-7.53 (m, 6 H), 7.47-7.42 (m, 6 H), 7.39-7.27 (m, 8 H), 7.22-7.17 (m, 1 H), 5.53 (s, 1 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 155.4, 145.2, 141.2, 141.0, 140.5, 135.8, 134.3, 132.8, 130.5, 129.7, 128.8, 128.1, 127.5, 127.1, 126.6, 125.8, 125.4, 124.2, 124.0, 121.8; HRMS calcd for $C_{32}H_{24}SSi$ $[M+H]^+$ 469.1441; found: 469.1450.



(2-(4-(pentyloxy)phenyl)benzo[*b*]thiophen-3-yl)diphenylsilane (2g)

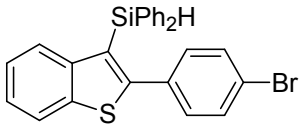
White oil (41.19 mg, 43% yield). ^1H NMR (300 MHz, $CDCl_3$, ppm): δ = 7.86-7.84 (d, *J* = 8.0 Hz, 1 H), 7.59-7.52 (m, 5 H), 7.39-7.23 (m, 9 H), 7.16-7.13 (m, 1 H), 6.80-6.77 (m, 2 H), 5.45 (s, 1 H), 3.95-3.92 (m, 2 H), 1.81-1.74 (m, 2 H), 1.46-1.35 (m, 4 H)

0.95-0.92 (m, 3 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 159.5, 155.9, 145.2, 140.9, 135.7, 133.0, 131.3, 129.7, 128.0, 127.6, 125.2, 125.0, 124.1, 123.8, 121.7, 113.9, 68.0, 28.9, 28.2, 22.4, 14.0; HRMS calcd for $C_{31}H_{30}SSi$ $[M+H]^+$ 479.1860; found: 479.1867.



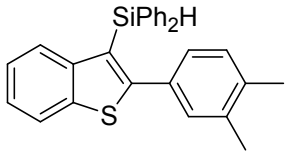
(2-(4-chlorophenyl)benzo[*b*]thiophen-3-yl)diphenylsilane (2h)

Yellow solid (65.76 mg, 77% yield). melting point: 154-156 °C. ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.89-7.87 (d, *J* = 7.6 Hz, 1 H), 7.64-7.62 (d, *J* = 8.4 Hz, 1 H), 7.51-7.49 (m, 4 H), 7.41-7.37 (m, 2 H), 7.32-7.28 (m, 7 H), 7.23-7.17 (m, 3 H), 5.44 (s, 1 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 154.1, 145.0, 140.9, 135.7, 134.6, 133.8, 132.5, 131.3, 129.8, 128.1, 126.4, 125.4, 124.4, 124.2, 121.8; HRMS calcd for $C_{27}H_{22}SSi$ $[M+H]^+$ 427.0738; found: 427.0742.



(2-(4-bromophenyl)benzo[*b*]thiophen-3-yl)diphenylsilane (2i)

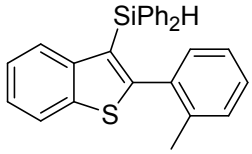
Yellow oil (48.98 mg, 52% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.89-7.87 (d, *J* = 8.0 Hz, 1 H), 7.64-7.62 (d, *J* = 8.2 Hz, 1H), 7.51-7.49 (m, 4 H), 7.41-7.35 (m, 4 H), 7.32-7.28 (m, 5 H), 7.26-7.22 (m, 2 H), 7.21-7.17 (m, 1 H), 5.45 (s, 1 H),; ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 154.1, 145.0, 140.9, 135.7, 134.3, 132.5, 131.6, 131.1, 129.8, 128.1, 126.5, 125.4, 124.4, 124.3, 122.9, 121.8; HRMS calcd for $C_{26}H_{19}BrSSi$ $[M+H]^+$ 471.0233; found: 471.0239.



(2-(3,4-dimethylphenyl)benzo[*b*]thiophen-3-yl)diphenylsilane (2j)

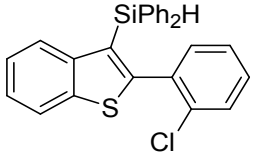
Yellow solid (67.2 mg, 80% yield). melting point: 135-137 °C. ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.86-7.84 (d, *J* = 8.0 Hz, 1 H), 7.61-7.59 (d, *J* = 8.0 Hz, 1 H), 7.54-

7.52 (d, J = 6.8 Hz, 4 H), 7.38-7.23 (m, 7 H), 7.19-7.13 (m, 3 H), 7.05-7.03 (m, 1 H), 5.44 (s, 1 H), 2.23 (s, 3 H), 2.15 (s, 3 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 156.2, 145.2, 140.9, 137.1, 136.1, 135.7, 133.1, 132.9, 131.3, 129.6, 129.2, 128.0, 127.5, 125.3, 125.2, 124.1, 123.8, 121.7, 19.6, 19.5; HRMS calcd for $C_{28}H_{24}SSi$ $[M+H]^+$ 421.1441; found: 421.1448.



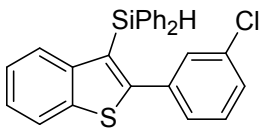
diphenyl(2-(*o*-tolyl)benzo[*b*]thiophen-3-yl)silane (2k)

Yellow oil (23.3 mg, 49% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.89-7.87 (d, J = 8.0 Hz, 1 H), 7.63-7.61 (d, J = 8.0 Hz, 1 H), 7.54-7.52 (d, J = 6.8 Hz, 4 H), 7.40-7.28 (m, 7 H), 7.23-7.10 (m, 5 H), 5.43 (s, 1 H), 2.26 (s, 3 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 156.0, 145.2, 141.0, 137.6, 135.7, 135.3, 133.1, 130.9, 129.7, 129.2, 128.0, 127.9, 127.2, 125.6, 125.4, 124.2, 123.9, 121.8, 21.3; HRMS calcd for $C_{27}H_{22}SSi$ $[M+H]^+$ 407.1084; found: 407.1298.



(2-(2-chlorophenyl)benzo[*b*]thiophen-3-yl)diphenylsilane (2l)

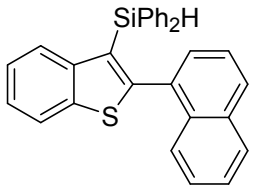
White solid (45.21 mg, 56% yield). melting point: 180-181 °C. ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.91-7.89 (d, J = 8.0 Hz, 1 H), 7.67-7.65 (d, J = 8.0 Hz, 1 H), 7.51-7.49 (m, 4 H), 7.37-7.27 (m, 8 H), 7.25-7.20 (m, 3 H), 7.16-7.12 (m, 1 H), 5.24 (s, 1 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 151.3, 144.1, 141.2, 135.8, 134.4, 134.3, 132.5, 132.2, 130.0, 129.7, 129.4, 128.6, 127.9, 126.1, 125.3, 124.3, 121.9; HRMS calcd for $C_{26}H_{19}SSi$ $[M+H]^+$ 427.0738; found: 427.0754.



(2-(3-chlorophenyl)benzo[*b*]thiophen-3-yl)diphenylsilane (2m)

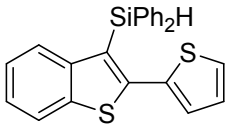
Yellow oil (66.54 mg, 78% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.89-7.87

(d, J = 8.0 Hz, 1 H), 7.67-7.65 (d, J = 8.4 Hz, 1 H), 7.53-7.51 (m, 4 H), 7.40-7.36 (m, 3 H), 7.33-7.24 (m, 7 H), 7.22-7.14 (m, 2 H), 5.46 (s, 1 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 153.6, 145.0, 140.9, 137.1, 135.7, 133.8, 132.4, 130.1, 129.9, 129.1, 128.5, 128.3, 128.1, 126.8, 125.5, 124.4, 124.3, 121.8; HRMS calcd for $C_{27}H_{22}SSi$ $[M+H]^+$ 427.0738; found: 427.0742.



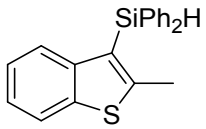
(2-(naphthalen-1-yl)benzo[*b*]thiophen-3-yl)diphenylsilane (2n)

Yellow oil (59.2 mg, 67% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.93-7.91 (m, 1 H), 7.80-7.73 (m, 4 H), 7.44-7.21 (m, 14 H), 7.15-7.11 (m, 2 H), 5.07 (s, 1 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 153.0, 144.5, 141.5, 135.7, 135.5, 133.1, 132.9, 132.5, 129.6, 129.1, 128.8, 127.9, 127.8, 127.6, 126.3, 126.2, 125.9, 125.1, 124.6, 124.3, 124.2, 121.8; HRMS calcd for $C_{30}H_{20}SSi$ $[M+H]^+$ 443.1284; found: 443.1292.



diphenyl(2-(thiophen-2-yl)benzo[b]thiophen-3-yl)silane (2o)

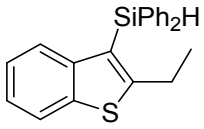
Yellow oil (44.58 mg, 56% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.85-7.83 (d, J = 8.0 Hz, 1 H), 7.60-7.55 (m, 5 H), 7.41-7.37 (m, 2 H), 7.34-7.25 (m, 6 H), 7.17-7.14 (m, 1 H), 7.05-7.04 (d, J = 3.2 Hz, 1 H), 6.93-6.91 (m, 1 H), 5.63 (s, 1 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 147.1, 145.1, 141.1, 136.5, 135.7, 132.6, 129.8, 129.0, 128.1, 127.5, 127.3, 127.2, 125.5, 124.3, 121.7; HRMS calcd for $C_{24}H_{18}S_2Si$ $[M+H]^+$ 399.0692; found: 399.0700.



(2-methylbenzo[*b*]thiophen-3-yl)diphenylsilane (2q)

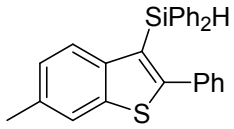
Yellow oil (33.0 mg, 50% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.80-7.78 (d,

J = 8.0 Hz, 1 H), 7.60-7.57 (m, 5 H), 7.43-7.33 (m, 6 H), 7.23-7.13 (m, 2 H), 5.80 (s, 1 H), 2.55 (s, 3 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 151.9, 145.3, 140.0, 135.8, 132.5, 129.9, 128.2, 124.3, 124.1, 123.9, 123.3, 121.6, 17.3; HRMS calcd for $C_{21}H_{18}SSi$ $[M+H]^+$ 331.0971; found: 331.0980.



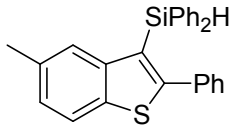
(2-ethylbenzo[*b*]thiophen-3-yl)diphenylsilane (2r)

Yellow oil (27.52 mg, 40% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.83-7.81 (d, *J* = 7.6 Hz, 1 H), 7.61-7.57 (m, 5 H), 7.44-7.39 (m, 2 H), 7.37-7.33 (m, 4 H), 7.22-7.20 (m, 1 H), 7.17-7.13 (m, 1 H), 5.79 (s, 1 H), 3.01-2.95 (m, 2 H), 1.24-1.20 (m, 3 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 160.0, 145.0, 139.9, 135.8, 132.6, 129.9, 128.1, 124.3, 123.9, 123.3, 123.2, 121.8, 25.1, 16.9; HRMS calcd for $C_{22}H_{20}SSi$ $[M+H]^+$ 345.1128; found: 345.1135.



(6-methyl-2-phenylbenzo[*b*]thiophen-3-yl)diphenylsilane (2s)

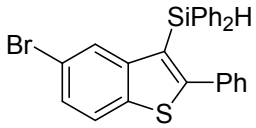
Yellow solid (60.9 mg, 75% yield). melting point: 139-140 °C ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.66 (s, 1 H), 7.54-7.52 (d, *J* = 7.2 Hz, 4 H), 7.49-7.47 (d, *J* = 8.4 Hz, 1 H), 7.43-7.41 (m, 2 H), 7.37-7.34 (m, 2 H), 7.30-7.25 (m, 7 H), 6.99-6.97 (m, *J* = 8.4 Hz, 1 H), 5.42 (s, 1 H), 2.40 (s, 3 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 154.7, 142.9, 141.3, 135.7, 135.5, 133.9, 133.0, 130.1, 129.7, 128.3, 128.0, 127.9, 125.9, 125.4, 125.0, 121.6, 21.4; HRMS calcd for $C_{27}H_{22}SSi$ $[M+H]^+$ 407.1284; found: 407.1288.



(5-methyl-2-phenylbenzo[*b*]thiophen-3-yl)diphenylsilane (2t)

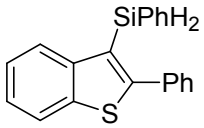
Yellow oil (47.9 mg, 59% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.76-7.34 (d,

J = 8 Hz, 1 H), 7.53-7.51 (m, 4 H), 7.41-7.35 (m, 5 H), 7.32-7.22 (m, 7 H), 7.12-7.10 (m, 1 H), 5.44 (s, 1 H), 2.25 (s, 3 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 155.9, 145.6, 138.2, 135.8, 135.6, 133.8, 133.0, 130.1, 129.7, 128.4, 128.0, 127.9, 125.7, 125.4, 125.3, 121.3, 21.5; HRMS calcd for $C_{27}H_{22}SSi$ $[M+H]^+$ 407.1284; found: 407.1288.



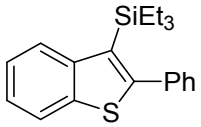
(5-bromo-2-phenylbenzo[*b*]thiophen-3-yl)diphenylsilane (2u)

Yellow oil (67.8 mg, 72% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.73 (m, 2 H), 7.51-7.49 (m, 4 H), 7.41-7.22 (m, 12 H), 5.44 (s, 1 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 157.4, 146.9, 139.6, 135.7, 134.9, 132.3, 130.0, 129.9, 128.7, 128.2, 128.0, 127.9, 127.1, 125.4, 123.0, 118.3; HRMS calcd for $C_{26}H_{19}SSi$ $[M+H]^+$ 471.0233; found: 471.0239.



phenyl(2-phenylbenzo[*b*]thiophen-3-yl)silane (5)

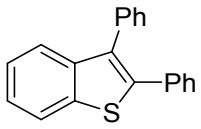
Yellow oil (43.11 mg, 68% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.91-7.88 (m, 2 H), 7.54-7.48 (m, 4 H), 7.38-7.28 (m, 8 H), 4.97 (s, 2 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 155.3, 145.4, 141.0, 135.4, 135.3, 131.4, 129.9, 129.8, 128.7, 128.3, 128.2, 124.7, 124.6, 124.3, 124.0, 121.9; HRMS calcd for $C_{20}H_{16}SSi$ $[M+H]^+$ 317.0815; found: 317.0820.



triethyl(2-phenylbenzo[*b*]thiophen-3-yl)silane (6)

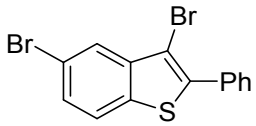
White oil (28.6 mg, 44% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.99-7.97 (d, *J* = 8.4 Hz, 1 H), 7.85-7.83 (d, *J* = 7.6 Hz, 1 H), 7.46-7.28 (m, 7 H), 0.84-0.80 (m, 9 H), 0.69-0.64 (m, 6 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 152.7, 145.6, 141.2,

136.9, 130.3, 130.0, 128.4, 127.6, 124.8, 123.9, 123.6, 121.7, 7.5, 4.5; HRMS calcd for $C_{20}H_{24}SSi$ $[M+H]^+$ 325.1441; found: 325.1445.



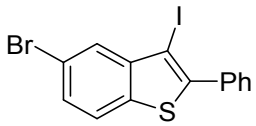
2,3-diphenylbenzo[b]thiophene (7)

White solid (32.03 mg, 56% yield). melting point: 113-114 °C. ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.87-7.85 (m, 1 H), 7.60-7.58 (m, 1 H), 7.41-7.31 (m, 9 H), 7.25-7.22 (m, 3 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 140.9, 139.6, 138.9, 135.5, 134.3, 133.3, 130.4, 129.6, 128.6, 128.3, 127.7, 127.4, 124.5, 124.4, 123.4, 122.1; HRMS calcd for $C_{20}H_{14}S$ $[M+H]^+$ 287.0898; found: 287.0901.



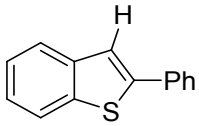
3,5-dibromo-2-phenylbenzo[*b*]thiophene (8)

White solid (67.34 mg, 92% yield). melting point: 131-133 °C. ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 8.01-8.00 (d, *J* = 2 Hz, 1 H), 7.74-7.72 (m, 2 H), 7.66-7.64 (m, 1 H), 7.49-7.41 (m, 4 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 140.8, 140.1, 136.3, 132.6, 129.6, 129.1, 128.7, 128.5, 126.4, 123.5, 119.4, 103.9; HRMS calcd for $C_{14}H_8Br_2S$ $[M+H]^+$ 366.8786; found: 366.8790.



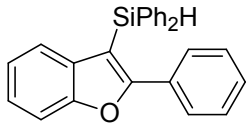
5-bromo-3-iodo-2-phenylbenzo[*b*]thiophene (9)

White solid (66.24 mg, 80% yield). melting point: 117-119 °C. ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.99-7.98 (d, *J* = 1.6 Hz, 1 H), 7.68-7.63 (m, 3 H), 7.51-7.45 (m, 4 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 144.1, 143.7, 137.6, 134.2, 129.9, 129.2, 129.0, 128.6, 123.4, 119.6, 78.0; HRMS calcd for $C_{14}H_8BrIS$ $[M+H]^+$ 414.8648; found: 414.8653.



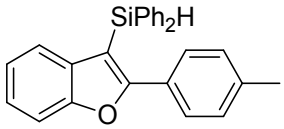
2-phenylbenzo[*b*]thiophene (10)

White solid (37.98 mg, 90% yield). melting point: 236-237 °C. ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.82-7.80 (d, *J* = 7.6 Hz, 1 H), 7.76-7.69 (m, 3 H), 7.52 (s, 1 H), 7.42-7.38 (m, 2 H), 7.35-7.27 (m, 3 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 144.2, 140.7, 139.5, 134.3, 128.9, 128.2, 126.5, 124.5, 124.3, 123.5, 122.2, 119.4; HRMS calcd for $C_{14}H_{10}S$ $[M+H]^+$ 211.0576; found: 211.0579.



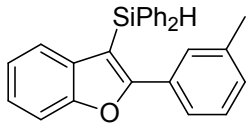
diphenyl(2-phenylbenzofuran-3-yl)silane (4a)

White oil (52.64 mg, 70% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.92 (s, 1 H), 7.73-7.66 (m, 5H), 7.46-7.33 (m, 8 H), 7.24-7.15 (m, 4 H), 7.02-6.98 (m, 2 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 159.7, 138.3, 137.8, 135.4, 131.7, 131.0, 130.9, 129.7, 128.4, 128.2, 128.1, 120.9, 120.8, 115.6; HRMS calcd for $C_{26}H_{20}OSi$ $[M+H]^+$ 377.1356; found: 377.1360.



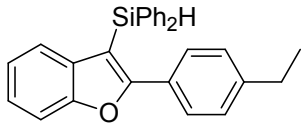
diphenyl(2-(p-tolyl)benzofuran-3-yl)silane (4b)

Yellow solid (60.08 mg, 77% yield). melting point: 139-140 °C. ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.90 (s, 1 H), 7.72-7.67 (m, 5 H), 7.46-7.42 (m, 2 H), 7.37-7.30 (m, 6 H), 7.21-7.17 (m, 1 H), 7.01-6.95 (m, 4 H), 2.24 (s, 3 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 159.6, 138.2, 137.8, 135.5, 134.3, 131.2, 131.0, 130.4, 130.0, 129.4, 129.1, 128.3, 128.2, 127.7, 120.8, 115.5, 21.2; HRMS calcd for $C_{27}H_{22}OSi$ $[M+H]^+$ 391.1513; found: 391.1517.



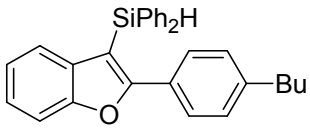
diphenyl(2-(m-tolyl)benzofuran-3-yl)silane (4c)

White oil (53.04 mg, 68% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.80 (s, 1 H), 7.72-7.66 (m,5H), 7.45-7.33 (m, 6 H), 7.23-7.18 (m, 3 H), 7.09-6.96 (m, 4 H), 2.08 (s, 3 H),; ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 159.7, 138.2, 138.0, 137.9, 135.4, 131.4, 131.1, 131.0, 130.9, 128.6, 128.3, 128.1, 125.7, 120.9, 120.8, 115.6, 21.0; HRMS calcd for $C_{27}H_{22}OSi$ $[M+H]^+$ 391.1513; found: 391.1517.



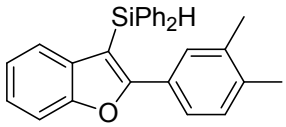
(2-(4-ethylphenyl)benzofuran-3-yl)diphenylsilane (4d)

Yellow oil (54.16 mg, 67% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.90 (s, 1 H), 7.72-7.67 (m, 5H), 7.45-7.41 (m, 2 H), 7.37-7.33 (m, 6 H), 7.21-7.16 (m, 1 H), 7.01-6.95 (m, 4 H), 2.57-2.51 (m, 2 H), 1.16-1.13 (m, 3 H),; ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 159.7, 144.8, 138.0, 135.8, 135.6, 134.5, 131.4, 131.1, 130.2, 129.6, 128.5, 128.3, 128.1, 121.0, 115.7, 28.7, 15.5; HRMS calcd for $C_{28}H_{24}OSi$ $[M+H]^+$ 405.1669; found: 405.1675.



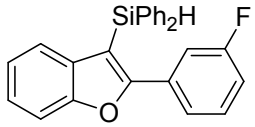
(2-(4-butylphenyl)benzofuran-3-yl)diphenylsilane (4e)

White oil (63.07 mg, 73% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.90 (s, 1 H), 7.72-7.66 (m, 5H), 7.46-7.42 (m, 2 H), 7.37-7.32 (m, 6 H), 7.21-7.17 (m, 1 H), 7.01-6.96 (m, 4 H), 2.53-2.49 (m, 2 H), 1.55-1.47 (m, 2 H), 1.32-1.22 (m, 2 H), 0.90-0.86 (m, 3 H),; ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 159.6, 143.3, 137.9, 135.7, 135.5, 131.3, 131.0, 130.9, 130.3, 129.4, 128.5, 128.2, 128.1, 120.8, 115.5, 35.3, 33.4, 22.2, 13.9; HRMS calcd for $C_{30}H_{28}OSi$ $[M+H]^+$ 433.1982; found: 433.1990.



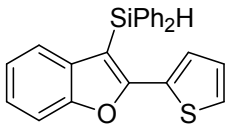
(2-(3,4-dimethylphenyl)benzofuran-3-yl)diphenylsilane (4f)

White oil (63.02 mg, 78% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.87 (s, 1 H), 7.70-7.68 (m, 5H), 7.61-7.59 (d, *J* = 6.8 Hz, 1 H), 7.45-7.41 (m, 2 H), 7.37-7.33 (m, 3 H), 7.30-7.26 (m, 1 H), 7.18-7.14 (m, 2 H), 7.02-6.92 (m, 3 H), 2.15 (s, 3 H), 1.99 (s, 3 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 159.6, 137.9, 137.0, 136.6, 135.8, 135.4, 134.3, 131.3, 131.1, 130.9, 130.4, 129.7, 129.3, 128.1, 127.7, 126.1, 120.8, 115.5, 19.5, 19.3; HRMS calcd for $C_{28}H_{24}OSi$ $[M+H]^+$ 405.1669; found: 405.1674



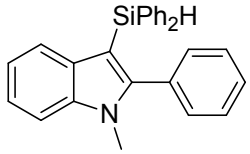
(2-(3-fluorophenyl)benzofuran-3-yl)diphenylsilane (4g)

White solid (42.55 mg, 54% yield). melting point: 162-163 °C. ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.67-7.62 (m, 5 H), 7.48-7.44 (m, 2H), 7.41-7.37 (m, 4 H), 7.30-7.28 (m, 1 H), 7.23-7.16 (m, 2 H), 7.08-6.98 (m, 4 H), 6.92-6.87 (m, 1 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 164.2, 161.8, 152.9, 143.8, 143.7, 143.1, 135.2, 133.3, 131.6, 131.3, 130.8, 130.1, 130.0, 128.2, 124.0, 122.9, 122.8, 121.4, 119.3, 114.0, 113.8, 113.4, 113.2; HRMS calcd for $C_{26}H_{19}FOSi$ $[M+H]^+$ 395.1262; found: 395.1268.



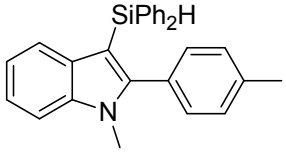
diphenyl(2-(thiophen-2-yl)benzofuran-3-yl)silane (4h)

White oil (51.18 mg, 67% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 8.02 (s, 1 H), 7.79-7.77 (d, *J* = 7.2 Hz, 4H), 7.67-7.66 (d, *J* = 7.6 Hz, 1 H), 7.48-7.36 (m, 6 H), 7.20-7.17 (m, 1 H), 7.08-7.07 (d, *J* = 4.4 Hz, 2 H), 7.00-6.95 (m, 2 H), 6.88-6.85 (m, 1 H),; ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 159.6, 143.2, 135.8, 134.3, 131.1, 130.9, 130.3, 129.5, 129.4, 128.5, 128.1, 127.5, 126.3, 120.9, 120.7, 115.6; HRMS calcd for $C_{24}H_{18}OSSi$ $[M+H]^+$ 383.0921; found: 383.0926.



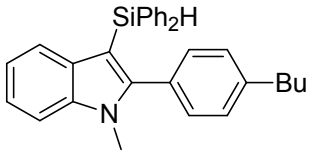
3-(diphenylsilyl)-1-methyl-2-phenyl-1H-indole (4i)

Yellow oil(48.23 mg, 62% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.93 (s, 1 H), 7.69-7.60 (m, 5H), 7.40-7.29 (m, 8 H), 7.23-7.17 (m, 1 H), 7.09-7.07 (m, 3 H), 6.78-6.73 (m, 1 H), 6.62-6.60 (d, *J* = 10.4 Hz, 1H), 2.78 (s, 3 H),; ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 152.8, 138.6, 137.4, 135.7, 131.5, 130.3, 130.1, 129.3, 128.4, 128.1, 128.0, 127.6, 120.3, 116.7, 108.6, 29.5; HRMS calcd for $C_{27}H_{23}NSi$ $[M+H]^+$ 390.1673; found: 390.1679



3-(diphenylsilyl)-1-methyl-2-(p-tolyl)-1H-indole (4j)

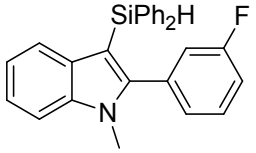
Yellow oil (54.00 mg, 67% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.91 (s, 1 H), 7.68-7.62 (m, 5 H), 7.44-7.39 (m, 2 H), 7.36-7.32 (m, 4 H), 7.28-7.26 (d, *J* = 8 Hz, 2 H), 7.20-7.16 (m, 1 H), 6.92-6.90 (d, *J* = 8 Hz, 2 H), 6.77-6.73 (m, 1 H), 6.61-6.59 (d, *J* = 8 Hz, 1 H), 2.78 (s, 3 H), 2.22 (s, 3 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 152.6, 137.6, 137.5, 135.8, 131.6, 131.0, 130.3, 130.2, 129.1, 128.8, 128.4, 128.0, 120.2, 116.7, 108.6, 29.5, 21.2; HRMS calcd for $C_{28}H_{25}NSi$ $[M+H]^+$ 404.1829; found: 404.1834.



2-(4-butylphenyl)-3-(diphenylsilyl)-1-methyl-1H-indole (4k)

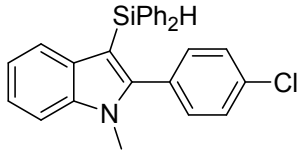
Yellow oil (51.62 mg, 58% yield). ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.91 (s, 1 H), 7.67-7.61 (m, 5H), 7.42-7.38 (m, 2 H), 7.35-7.27 (m, 6 H), 7.21-7.16 (m, 1 H), 6.92-6.90 (d, *J* = 8 Hz, 2 H), 6.77-6.73 (m, 1 H), 6.61-6.59 (d, *J* = 8 Hz, 1 H), 2.78 (s, 3 H), 2.50-2.46 (m, 2 H), 1.52-1.44 (m, 2 H), 1.29-1.20 (m, 2 H), 0.89-0.85 (m, 3 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 152.6, 142.7, 137.6, 136.1, 135.7, 131.6,

131.3, 130.3, 129.1, 128.4, 128.2, 128.0, 120.2, 116.7, 108.5, 35.3, 33.4, 29.5, 22.2, 13.9; HRMS calcd for $C_{31}H_{31}NSi$ $[M+H]^+$ 446.2309; found: 446.2315



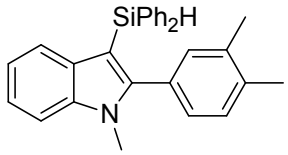
3-(diphenylsilyl)-2-(3-fluorophenyl)-1-methyl-1H-indole (4l)

Yellow oil (57.79 mg, 71% yield). ^1H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.86 (s, 1 H), 7.66-7.60 (m, 5H), 7.42-7.38 (m, 2 H), 7.35-7.32 (m, 4 H), 7.23-7.19 (m, 1 H), 7.12-7.10 (d, *J* = 7.6 Hz, 1 H), 7.06-7.02 (m, 2 H), 6.77-6.73 (m, 2 H), 6.62-6.60 (d, *J* = 8 Hz, 1 H), 2.77-2.76 (d, *J* = 2 Hz, 3 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 163.8, 161.3, 152.9, 141.1, 141.0, 135.8, 135.7, 134.7, 131.0, 130.5, 129.8, 129.6, 129.5, 128.1, 124.2, 120.5, 116.8, 114.8, 114.6, 114.4, 114.2, 108.8, 29.4; HRMS calcd for $C_{27}H_{22}FNSi$ $[M+H]^+$ 408.1579; found: 408.1584.



2-(4-chlorophenyl)-3-(diphenylsilyl)-1-methyl-1H-indole (4m)

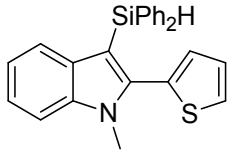
Yellow solid (60.91 mg, 72% yield). melting point: 128-129 °C. ^1H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.85 (s, 1 H), 7.66-7.59 (m, 5H), 7.42-7.40 (d, *J* = 7.2 Hz, 2 H), 7.36-7.33 (m, 4 H), 7.28-7.18 (m, 4 H), 7.06-7.04 (d, *J* = 8.2 Hz, 2 H), 6.77-6.73 (m, 1 H), 6.62-6.60 (d, *J* = 8 Hz, 1 H), 2.77 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 152.8, 137.2, 135.8, 135.7, 134.3, 133.7, 133.2, 131.1, 130.5, 129.8, 129.6, 128.3, 128.2, 120.4, 116.8, 108.8, 29.4; HRMS calcd for $C_{27}H_{22}ClNSi$ $[M+H]^+$ 424.1283; found: 424.1288



2-(3,4-dimethylphenyl)-3-(diphenylsilyl)-1-methyl-1H-indole (4n)

Yellow oil (50.87 mg, 61% yield). ^1H NMR (400 MHz, $CDCl_3$, ppm): δ = 7.89 (s, 1 H), 7.67-7.63 (m, 5 H), 7.42-7.39 (m, 2 H), 7.35-7.32 (m, 4 H), 7.23-7.22 (m, 1 H),

7.20-7.17 (m, 2 H), 7.12-7.10 (d, *J* = 7.6 Hz, 1 H), 6.90-6.88 (d, *J* = 8 Hz, 1 H), 6.77-6.73 (m, 1 H), 6.61-6.60 (d, *J* = 7.6 Hz, 1H), 2.79-2.78 (d, *J* = 1.6 Hz, 3H), 2.13 (s, 3 H), 1.97 (s, 3 H); ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 152.6, 137.6, 136.4, 136.2, 136.1, 135.7, 134.6, 131.7, 130.7, 130.2, 129.4, 129.0, 128.0, 126.3, 120.1, 116.7, 108.5, 29.5, 19.5, 19.3; HRMS calcd for $C_{29}H_{27}NSi$ $[M+H]^+$ 418.1986; found: 418.1990.



3-(diphenylsilyl)-1-methyl-2-(thiophen-2-yl)-1H-indole (4o)

Yellow solid (33.97 mg, 43% yield). melting point: 198-200 °C. ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ = 8.02 (s, 1 H), 7.74-7.72 (m, 4 H), 7.64-7.62 (m, 1 H), 7.46-7.42 (m, 2 H), 7.39-7.35 (m, 4 H), 7.20-7.16 (m, 1 H), 7.05-7.02 (m, 2 H), 6.83-6.81 (m, 1 H), 6.76-6.72 (m, 1 H), 6.60-6.58 (d, *J* = 7.6 Hz, 1 H), 2.76 (s, 3 H),; ^{13}C NMR (100 MHz, $CDCl_3$, ppm): δ = 152.8, 143.4, 136.0, 130.9, 130.7, 130.4, 129.8, 129.2, 128.9, 128.0, 127.2, 126.0, 120.1, 116.7, 108.6, 29.3; HRMS calcd for $C_{25}H_{21}NSi$ $[M+H]^+$ 396.1237; found: 396.1241.

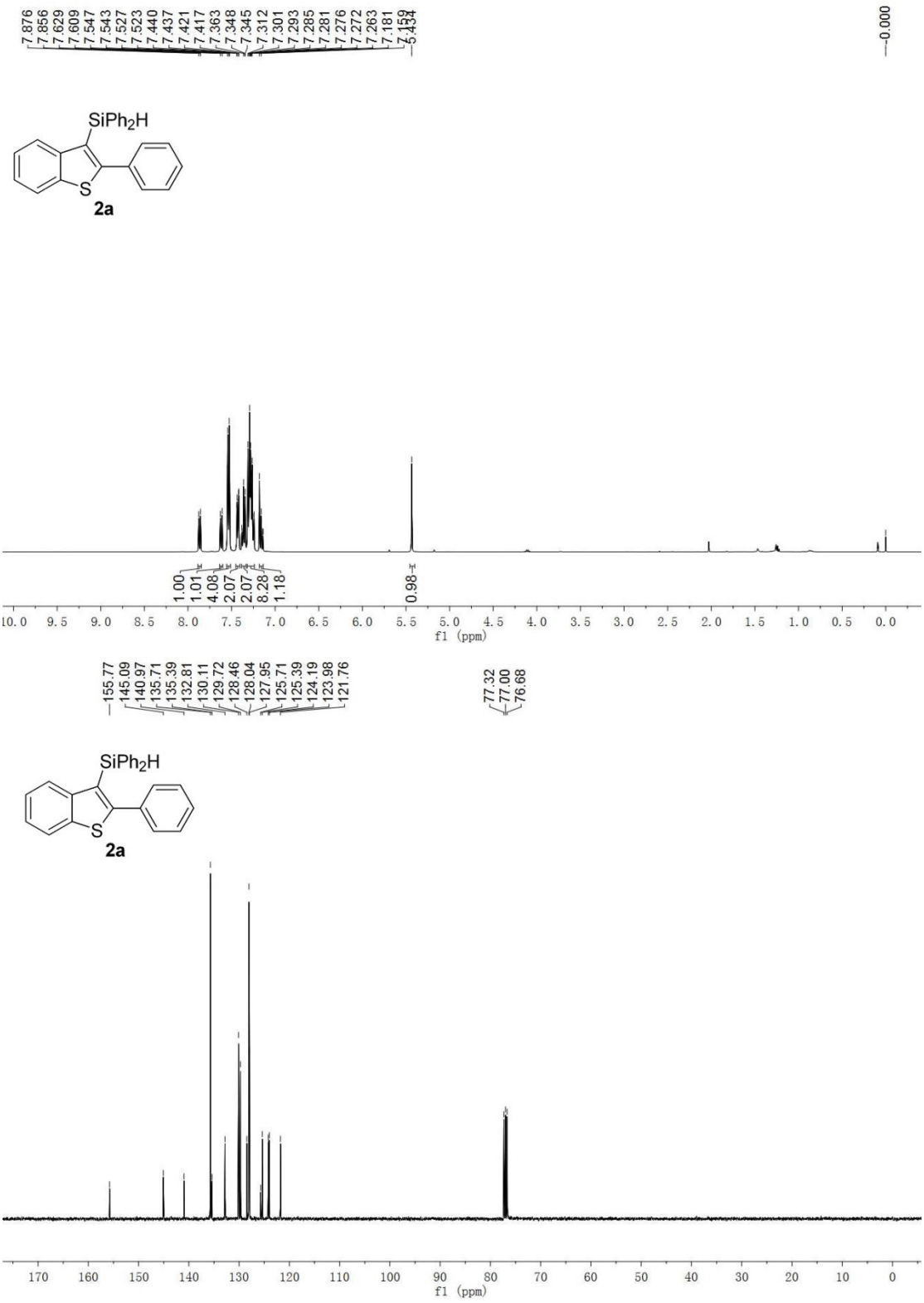
Reference:

(1) Yan, J. X.; Xu, J.; Zhou, Y.; Chen, J. L.; Song, Q. L. *Org. Chem. Fron*t. **2018**, *5*, 1483-1487.

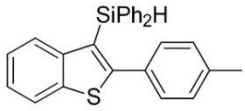
(2) Mehta, S.; Waldo, J. P.; Larock, R. C. *J. Org. Chem.* **2009**, *74*, 1141-1147.

(3) Ting, C.-M.; Hsu, Y.-L.; Liu, R.-S. *Chem. Commun*. **2012**, *48*, 6577-6579.

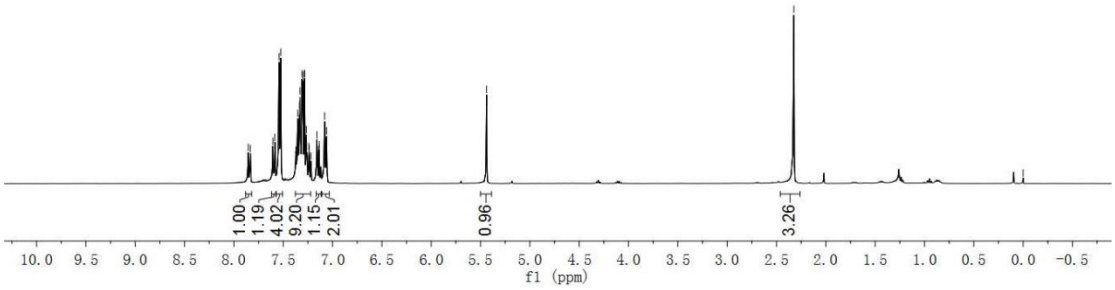
(4) Mitsudo, K.; Tanaka, S.; Isobuchi, R.; Inada, T.; Mandai, H.; Korenaga, T.; Wakamiya, A.; Murata, Y. ; Suga, S. *Org. Lett*. **2017**, *19*, 2564-2567.


7.876
7.856
7.629
7.609
7.547
7.543
7.527
7.523
7.440
7.437
7.421
7.417
7.363
7.348
7.345
7.312
7.301
7.293
7.285
7.281
7.276
7.272
7.263
7.181
7.159
7.154
5.434
0.000
SiPh2H
S
2a
1.00
1.01
4.08
2.07
2.07
8.28
1.18
0.98
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)
155.77
145.09
140.97
135.71
135.39
132.81
130.11
129.72
128.46
128.04
127.95
125.71
125.39
124.19
123.98
121.76
77.32
77.00
76.68
SiPh2H
S
2a
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

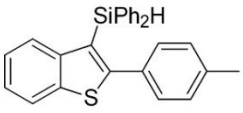

7.855
7.834
7.605
7.585
7.544
7.541
7.525
7.522
7.353
7.347
7.338
7.334
7.330
7.309
7.303
7.286
7.283
7.269
7.266
7.263
7.240
7.159
7.136
7.080
7.060
2.324
0.000


SiPh2H
S

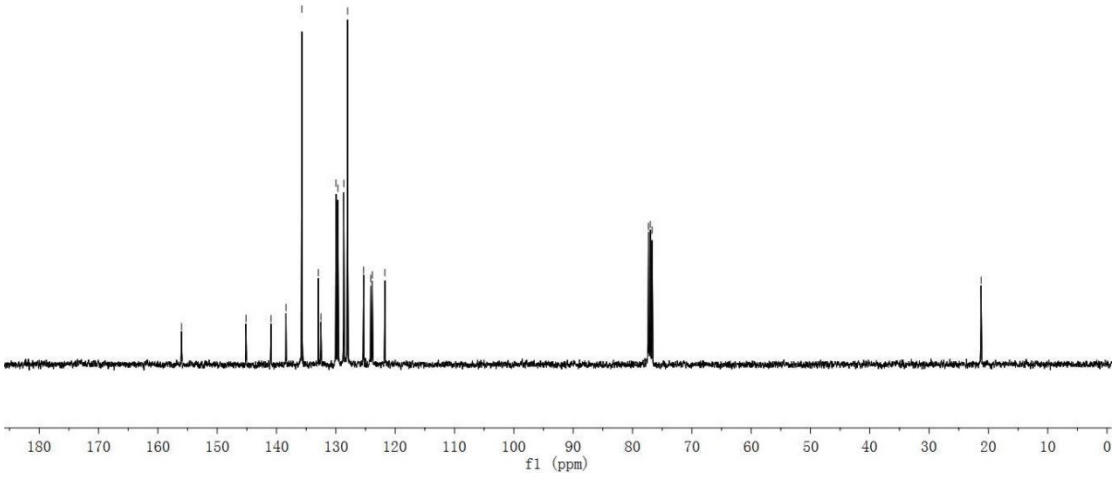
2b

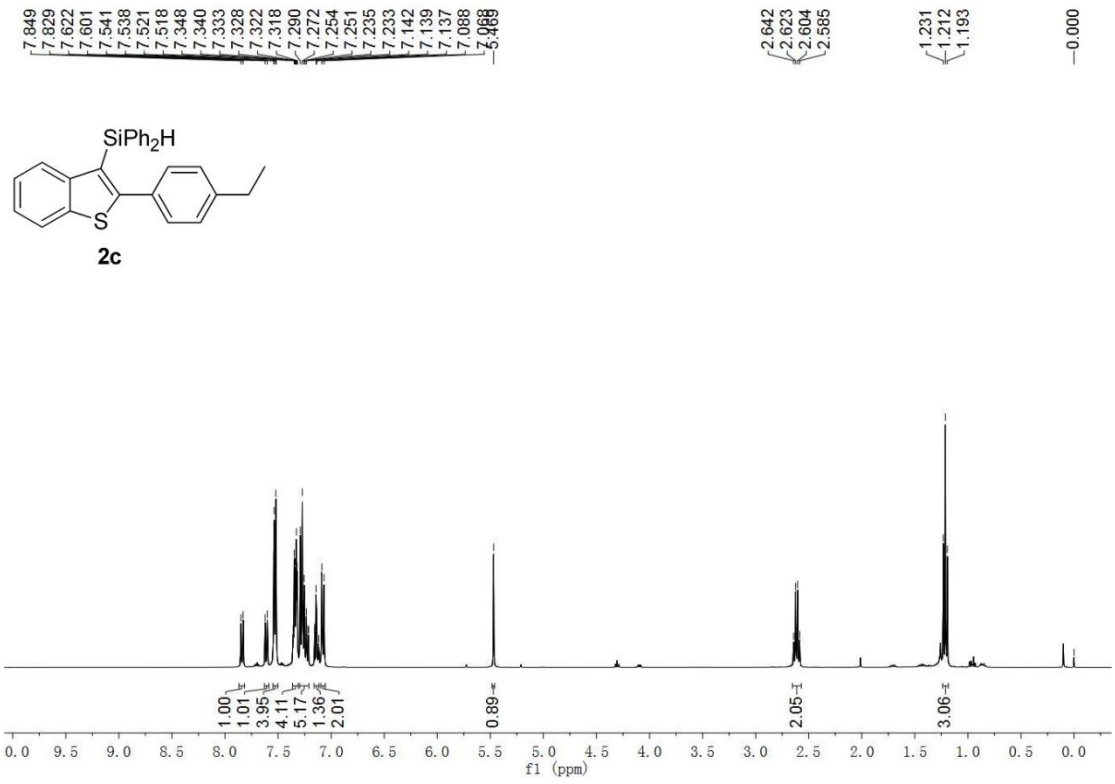

1.00
1.19
4.02
9.20
1.15
2.01
0.96
3.26
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)


156.01
145.15
140.94
138.40
135.73
132.96
132.52
129.98
129.65
128.66
128.02
125.32
124.12
123.85
121.73
77.32
77.00
76.68
21.24


SiPh2H
S

2b


180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)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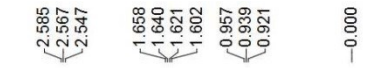
7.829
7.622
7.601
7.541
7.538
7.521
7.518
7.348
7.340
7.333
7.328
7.322
7.318
7.290
7.272
7.254
7.251
7.235
7.233
7.142
7.139
7.137
7.088
2.642
2.623
2.604
2.585
1.231
1.212
1.193
0.000
SiPh2H
S
2c
1.00
1.01
3.95
4.11
5.17
1.36
2.01
0.89
2.05
3.06
f1 (ppm)
156.06
145.19
144.64
140.94
135.72
132.93
132.70
130.04
129.65
128.00
127.45
125.29
124.12
123.85
121.73
77.32
77.00
76.68
28.59
15.38
SiPh2H
S
2c
f1 (ppm)


7.872
7.852
7.621
7.601
7.543
7.540
7.523
7.520
7.359
7.353
7.341
7.321
7.308
7.289
7.272
7.269
7.256
7.238
7.201
7.174
7.172
7.154
7.082
7.062
5.459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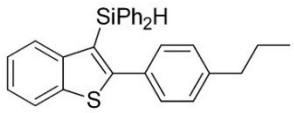
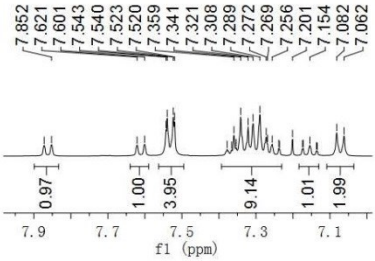
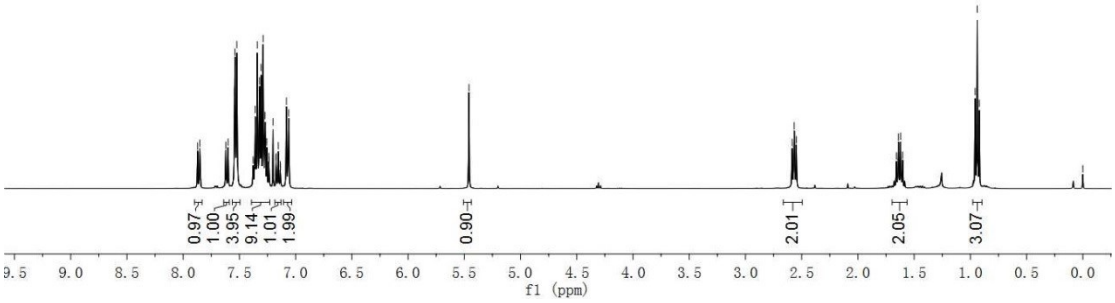
2.567
2.547
1.658
1.640
1.621
1.602
0.957
0.939
0.921
0.000


SiPh2H
S

2d

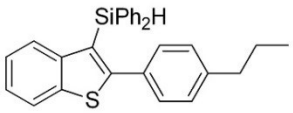

7.852
7.621
7.601
7.543
7.540
7.523
7.520
7.359
7.341
7.321
7.308
7.289
7.272
7.269
7.256
7.201
7.154
7.082
7.062
0.97
1.00
3.95
9.14
1.01
1.99
7.9
7.7
7.5
7.3
7.1
f1 (ppm)


0.97
1.00
3.95
9.14
1.01
1.99
0.90
2.01
2.05
3.07
f1 (ppm)

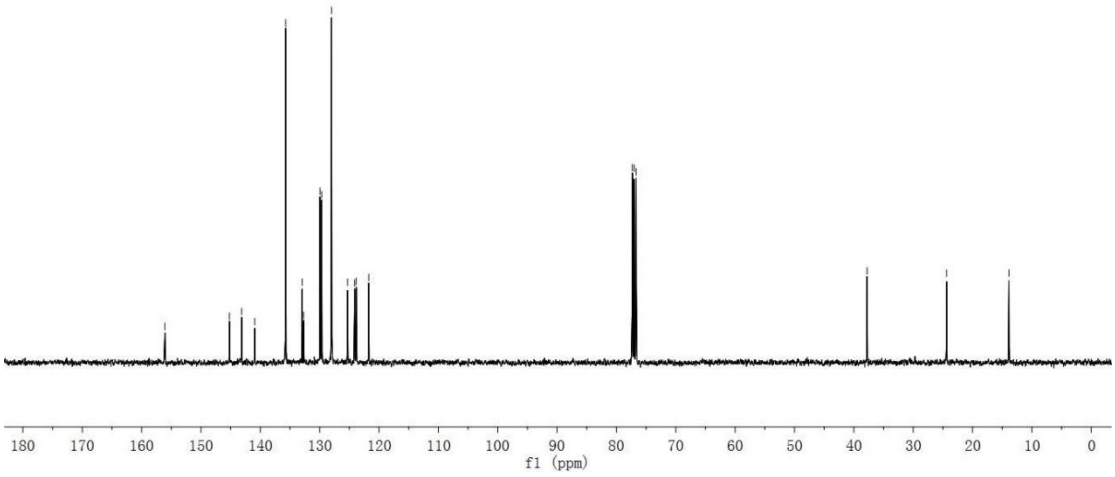

156.08
145.21
143.15
140.95
135.73
132.94
132.71
129.95
129.66
128.05
128.00
125.30
125.25
124.11
123.85
121.73

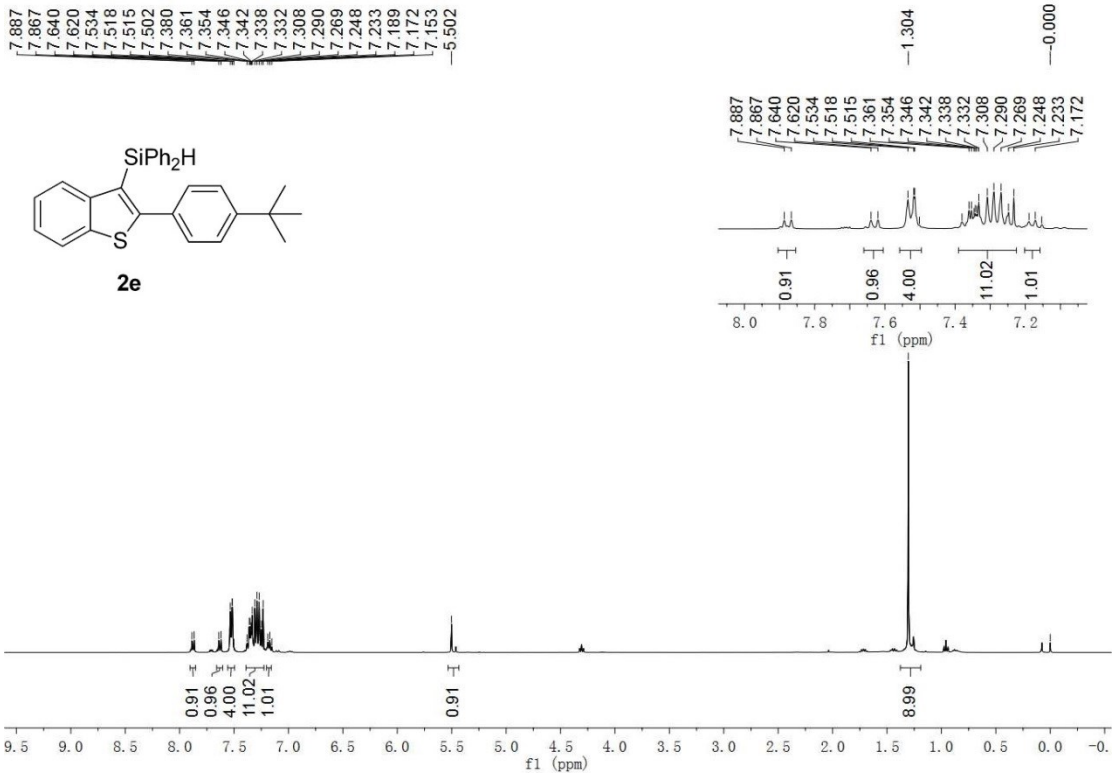

77.32
77.00
76.68


37.76
24.37
13.86


SiPh2H
S

2d


f1 (ppm)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7.534
7.518
7.515
7.502
7.380
7.361
7.354
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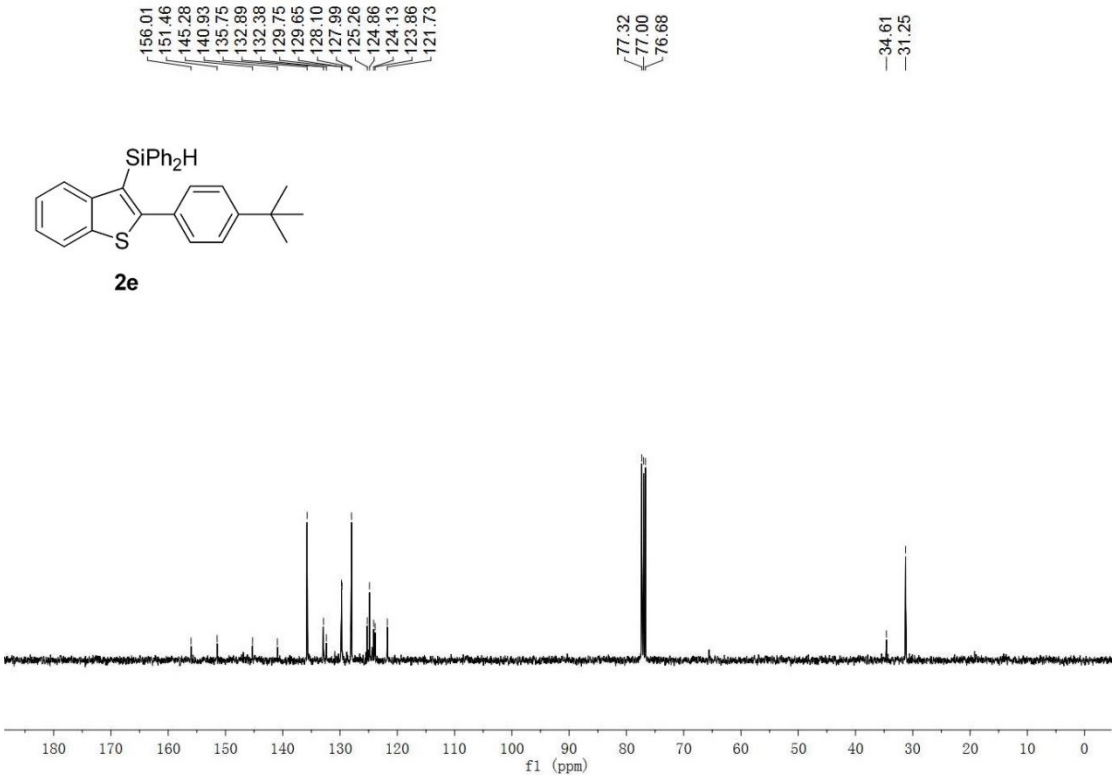
7.342
7.338
7.332
7.308
7.290
7.269
7.248
7.233
7.189
7.172
7.153
5.502
1.304
0.000
SiPh2H
S
2e
0.91
0.96
4.00
11.02
1.01
8.0
7.8
7.6
7.4
7.2
f1 (ppm)
0.91
0.96
4.00
11.02
1.01
0.91
8.99
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)


156.01
151.46
145.28
140.93
135.75
132.89
132.38
129.75
129.65
128.10
127.99
125.26
124.86
124.13
123.86
121.73
77.32
77.00
76.68
34.61
31.25
SiPh2H
S
2e
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


7.884
7.658
7.638
7.583
7.580
7.575
7.562
7.553
7.551
7.534
7.472
7.452
7.434
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7.370
7.363
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7.351
7.317
7.300
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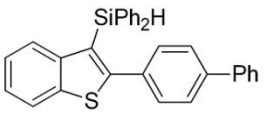
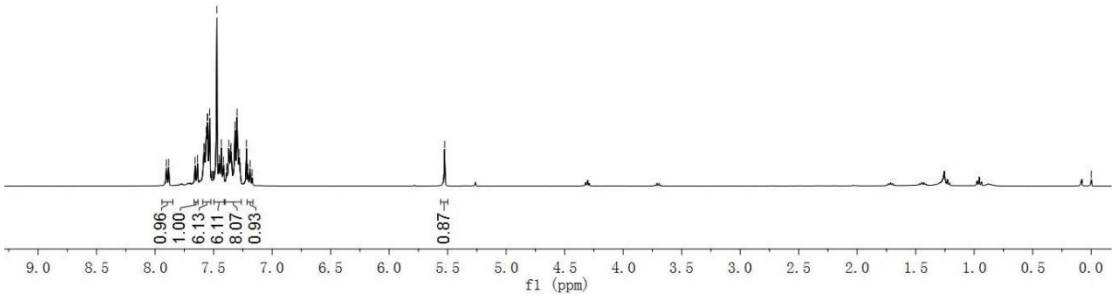
7.220
5.525
0.000


SiPh2H
Ph
S

2f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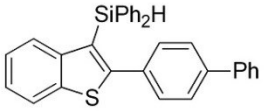
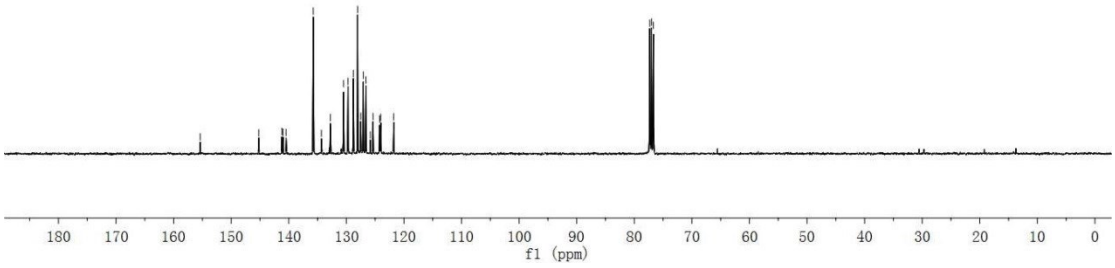
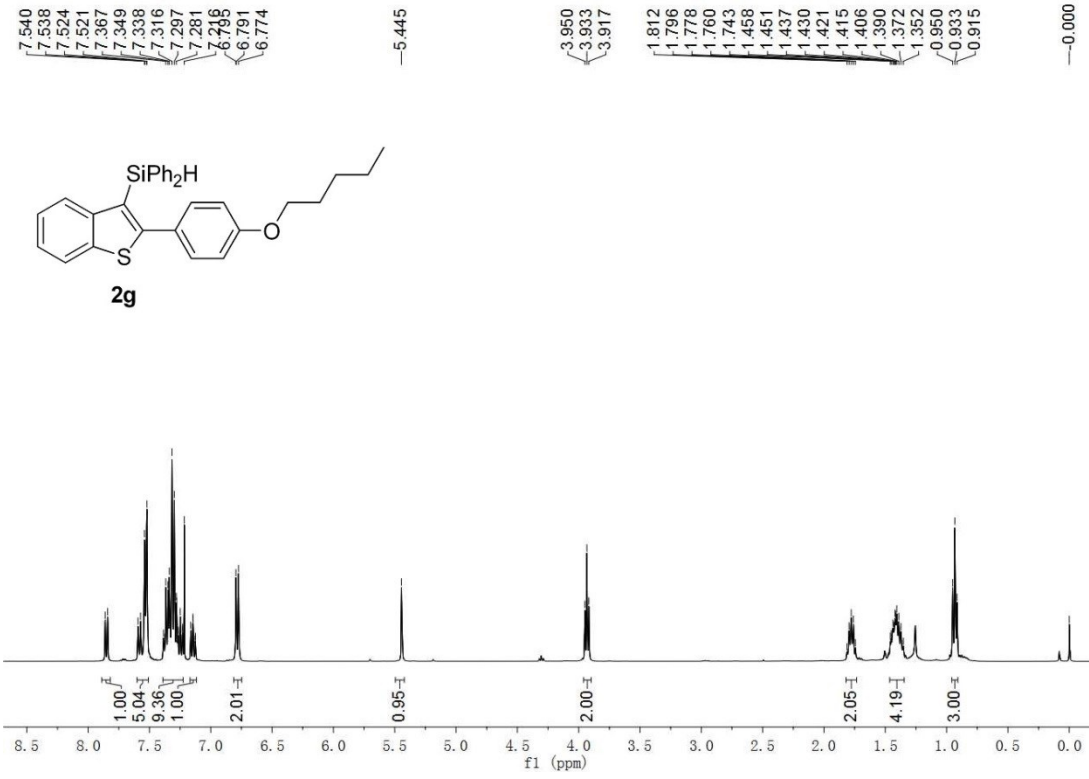
1.00
6.13
6.11
8.07
0.93
0.87
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


155.39
145.22
141.21
141.00
140.47
135.75
134.34
132.78
130.50
129.72
128.79
128.05
127.50
127.05
126.61
125.84
125.37
124.24
124.04
121.79
77.32
77.00
76.68


SiPh2H
Ph
S

2f


180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)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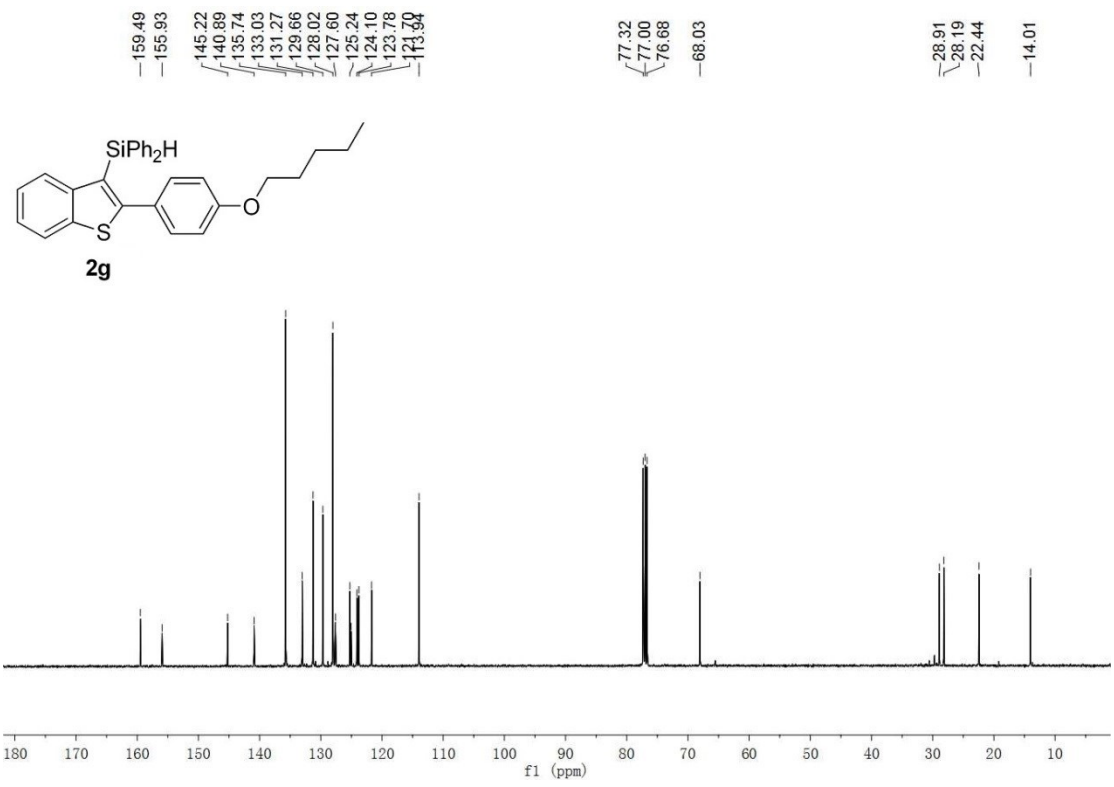
7.538
7.524
7.521
7.367
7.349
7.338
7.316
7.297
7.281
6.795
6.791
6.774
5.445
3.950
3.933
3.917
1.812
1.796
1.778
1.760
1.743
1.458
1.451
1.437
1.430
1.421
1.415
1.406
1.390
1.372
1.352
0.950
0.933
0.915
0.000
SiPh2H
O
S
2g
1.00
5.04
9.36
1.00
2.01
0.95
2.00
2.05
4.19
3.00
f1 (ppm)


159.49
155.93
145.22
140.89
135.74
133.03
131.27
129.66
128.02
127.60
125.24
124.10
123.78
77.32
77.00
76.68
68.03
28.91
28.19
22.44
14.01
SiPh2H
O
S
2g
f1 (ppm)


7.889
7.870
7.640
7.619
7.514
7.497
7.494
7.406
7.387
7.382
7.369
7.323
7.320
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7.305
7.299
7.288
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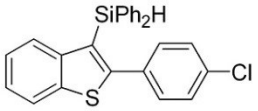
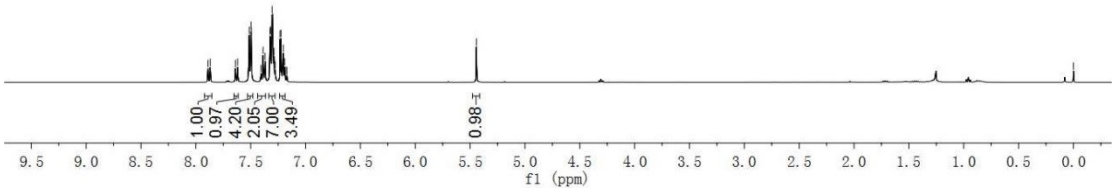
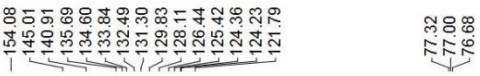
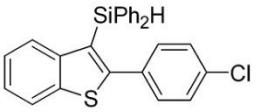
7.224
7.219
7.208
7.203
0.000


SiPh2H
Cl
S

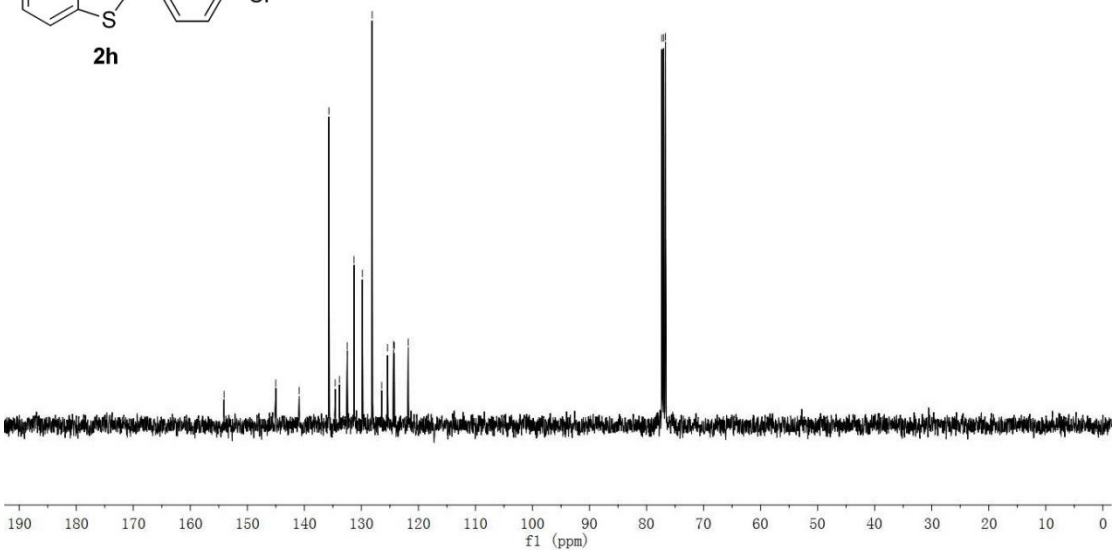
2h


1.00
0.97
4.20
2.05
7.00
3.49
0.98
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


154.08
145.01
140.91
135.69
134.60
133.84
132.49
131.30
129.83
128.11
126.44
125.42
124.36
124.23
121.79
77.32
77.00
76.68


SiPh2H
Cl
S

2h


190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


7.870
7.643
7.622
7.513
7.509
7.493
7.489
7.389
7.378
7.373
7.371
7.362
7.357
7.323
7.304
7.301
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7.287
7.284
7.252
7.247
7.238
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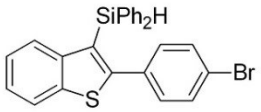
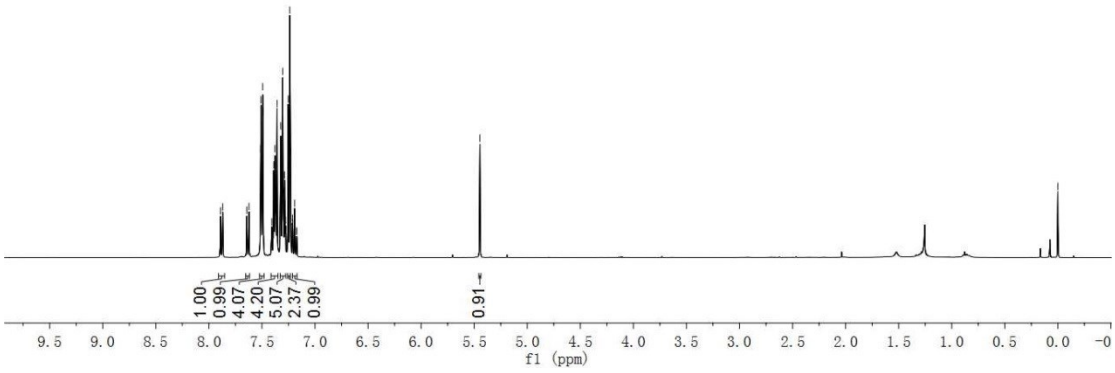
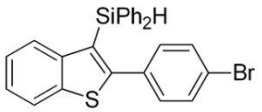

SiPh2H
Br
S

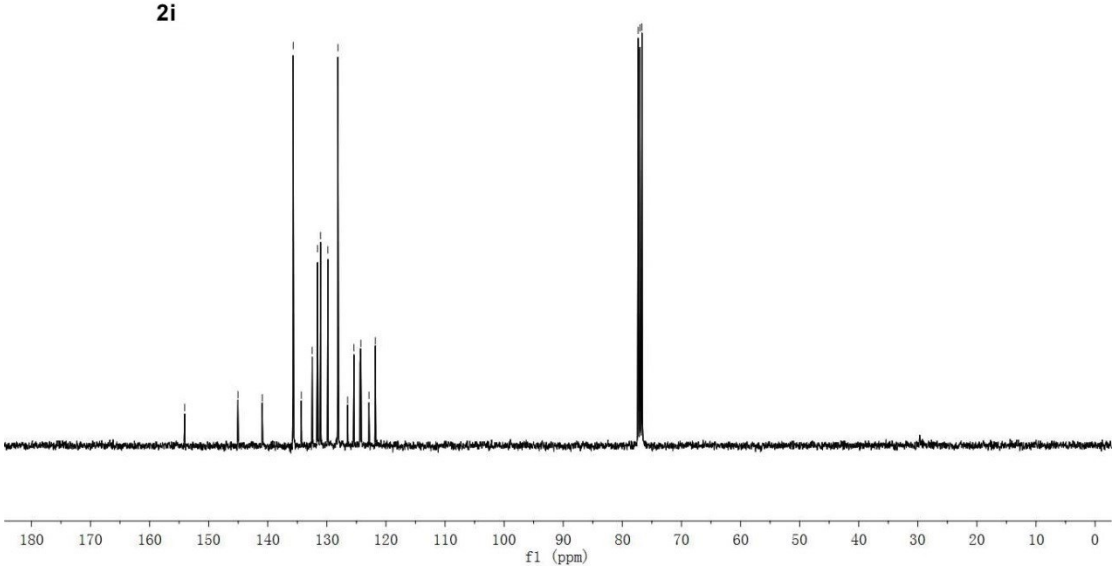
2i

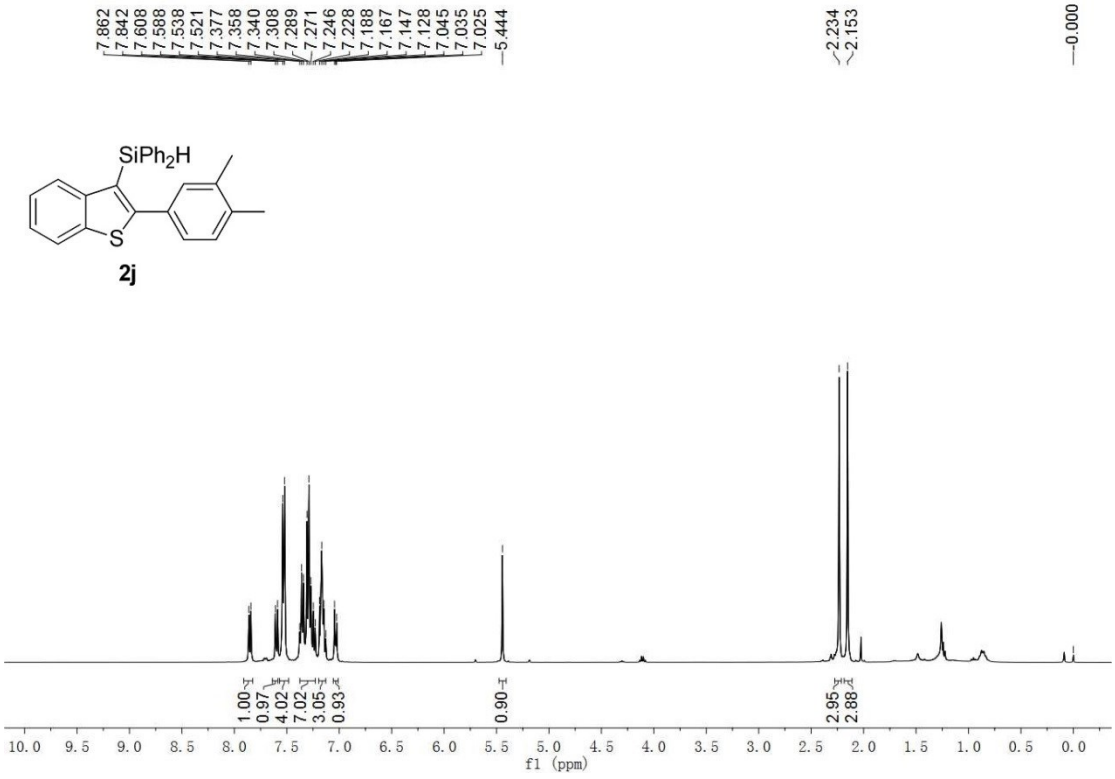

1.00
0.99
4.07
4.20
5.07
2.37
0.99
0.91
f1 (ppm)

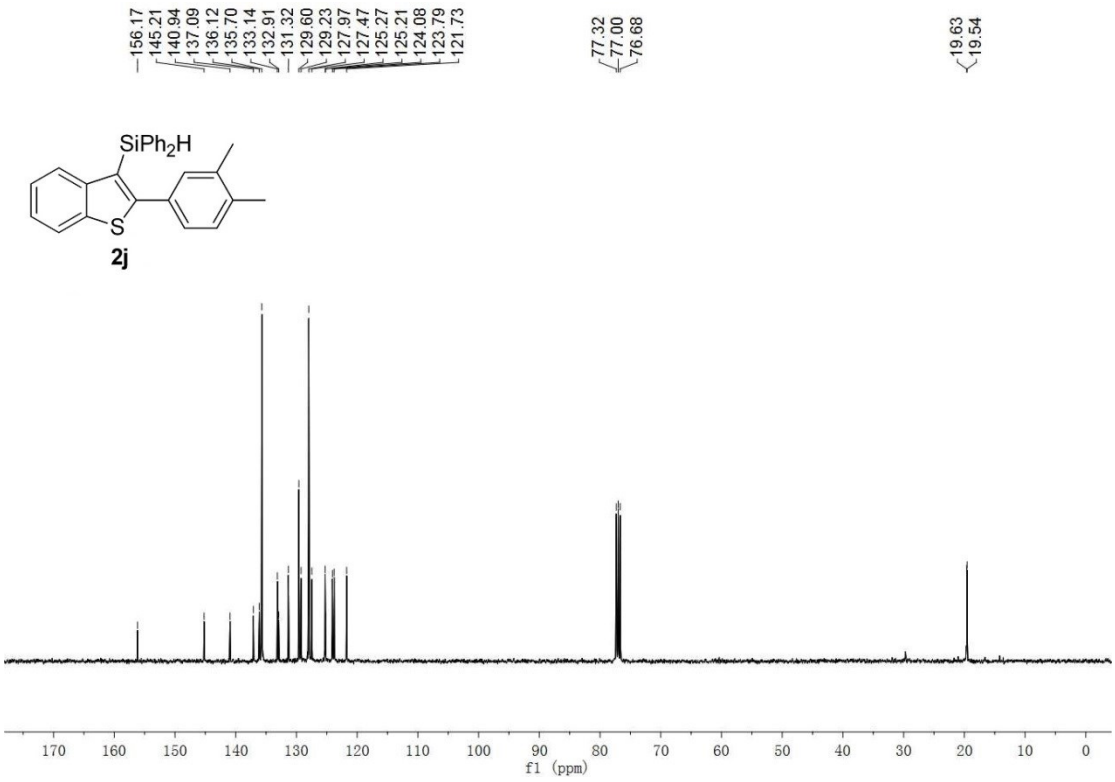

154.06
145.04
140.93
135.70
134.32
132.49
131.58
131.07
129.83
128.12
126.49
125.43
124.38
124.25
122.88
121.80
77.32
77.00
76.68


SiPh2H
Br
S

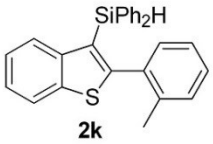
2i


f1 (ppm)

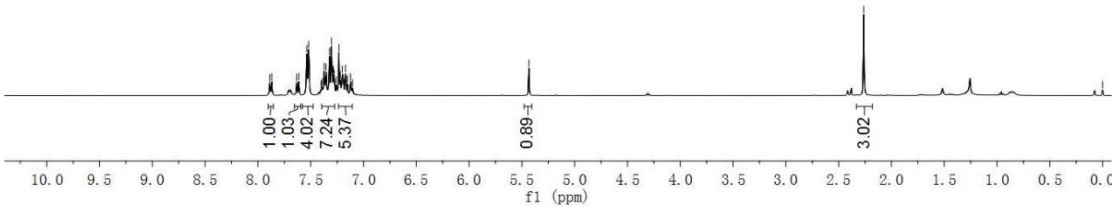

7.862
7.842
7.608
7.588
7.538
7.521
7.377
7.358
7.340
7.308
7.289
7.271
7.246
7.228
7.188
7.167
7.147
7.128
7.045
7.035
7.025
5.444
2.234
2.153
0.000
SiPh2H
S
2j
1.00
0.97
4.02
7.02
3.05
0.93
0.90
2.95
2.88
f1 (ppm)


156.17
145.21
140.94
137.09
136.12
135.70
133.14
132.91
131.32
129.60
129.23
127.97
127.47
125.27
125.21
124.08
123.79
121.73
77.32
77.00
76.68
19.63
19.54
SiPh2H
S
2j
f1 (ppm)

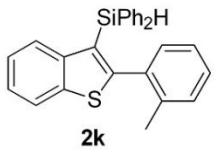

7.888
7.868
7.633
7.613
7.537
7.520
7.402
7.392
7.373
7.355
7.322
7.303
7.286
7.277
7.258
7.233
7.220
7.201
7.171
7.152
7.123
7.104
5.434
2.262
0.000


SiPh2H
S

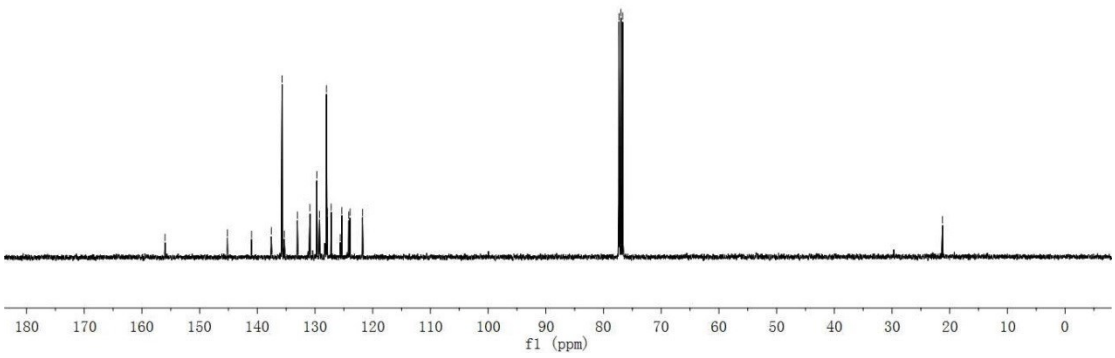
2k

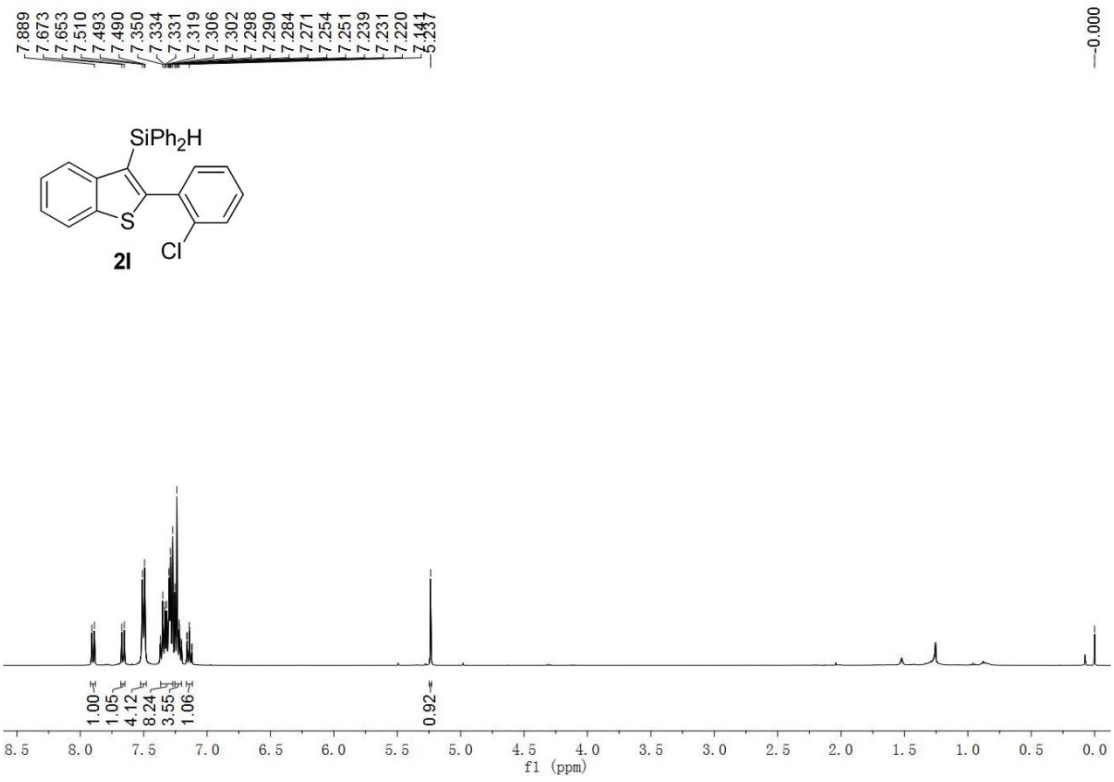

1.00
1.03
4.02
7.24
5.37
0.89
3.02
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


156.00
145.18
141.00
137.58
135.71
135.33
133.06
130.89
129.68
129.23
128.01
127.86
127.21
125.63
125.36
124.16
123.91
121.77
77.32
77.00
76.68
21.25

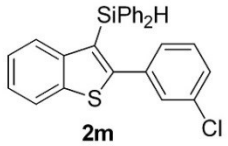

SiPh2H
S

2k

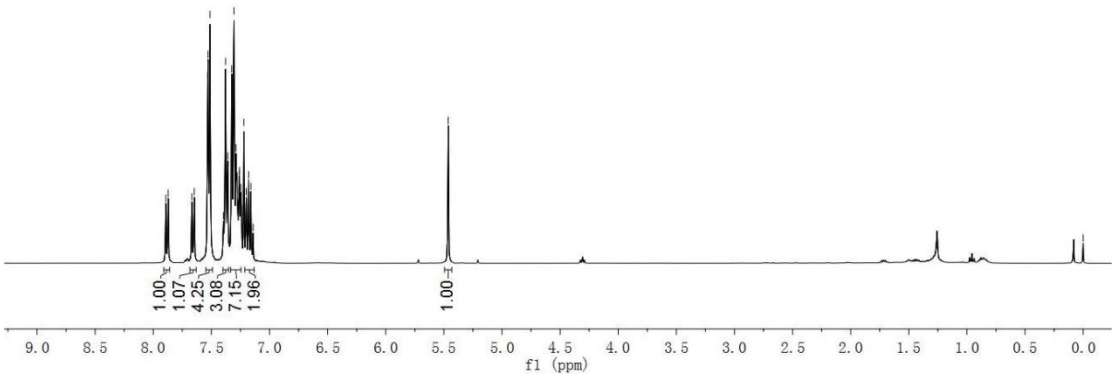

180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


7.889
7.673
7.653
7.510
7.493
7.490
7.350
7.334
7.331
7.319
7.306
7.302
7.298
7.290
7.284
7.271
7.254
7.251
7.239
7.231
7.220
7.141
7.137
0.000
SiPh2H
S
Cl
2l
1.00
1.05
4.12
8.24
3.55
1.06
0.92
f1 (ppm)
151.27
144.14
141.23
135.77
134.42
134.30
132.48
132.19
129.95
129.69
129.35
128.59
127.92
126.05
125.27
124.29
121.85
77.32
77.00
76.68
SiPh2H
S
Cl
2l
f1 (ppm)

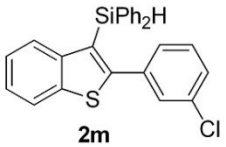

7.892
7.872
7.668
7.647
7.532
7.529
7.512
7.378
7.362
7.359
7.325
7.306
7.289
7.280
7.276
7.259
7.258
7.247
7.243
7.220
7.201
7.180
5.463
0.000


SiPh2H
S
Cl

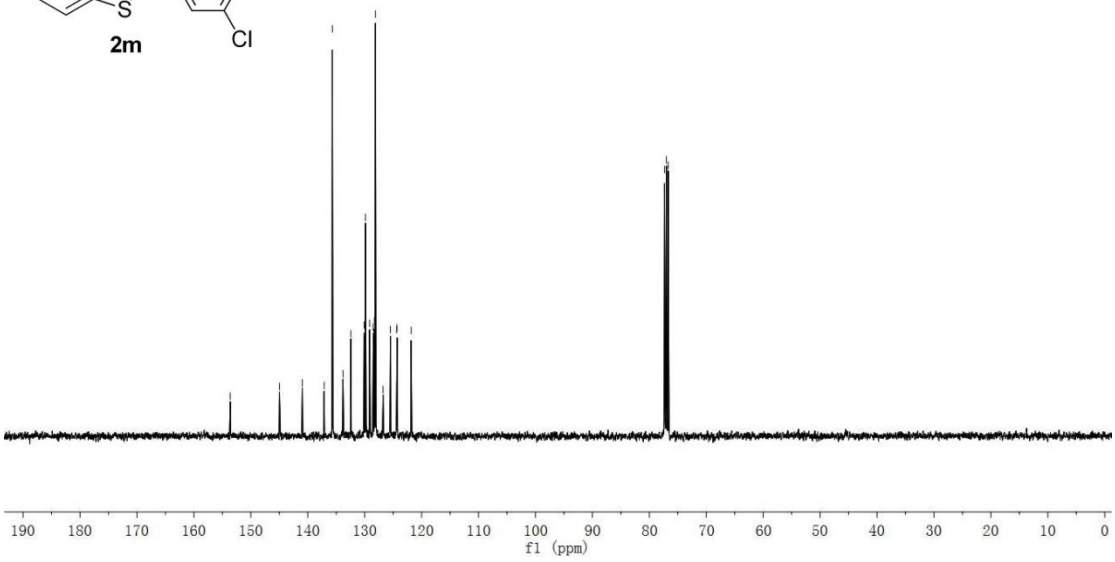
2m


1.00
1.07
4.25
3.08
7.15
1.96
1.00
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

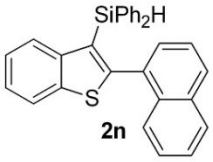

153.62
144.96
140.94
137.11
135.68
133.81
132.42
130.09
129.87
129.13
128.49
128.29
128.10
126.78
125.49
124.39
124.31
121.82
77.32
77.00
76.68


SiPh2H
S
Cl

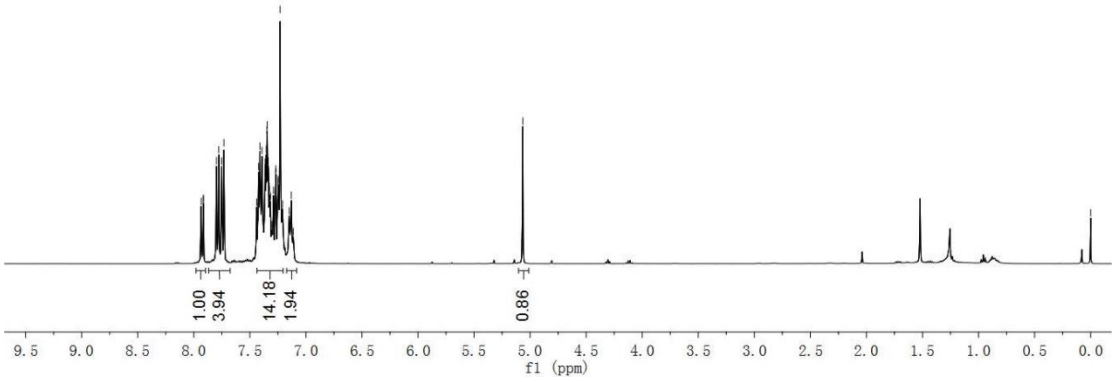
2m

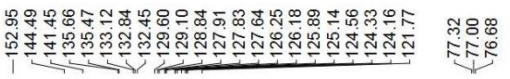

190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

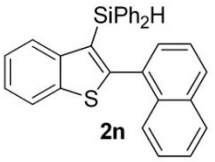

7.914
7.798
7.777
7.751
7.731
7.422
7.419
7.410
7.392
7.365
7.363
7.354
7.347
7.345
7.336
7.333
7.327
7.325
7.316
7.289
7.269
7.268
7.249
7.246
7.230
5.065
0.000


SiPh2H
S

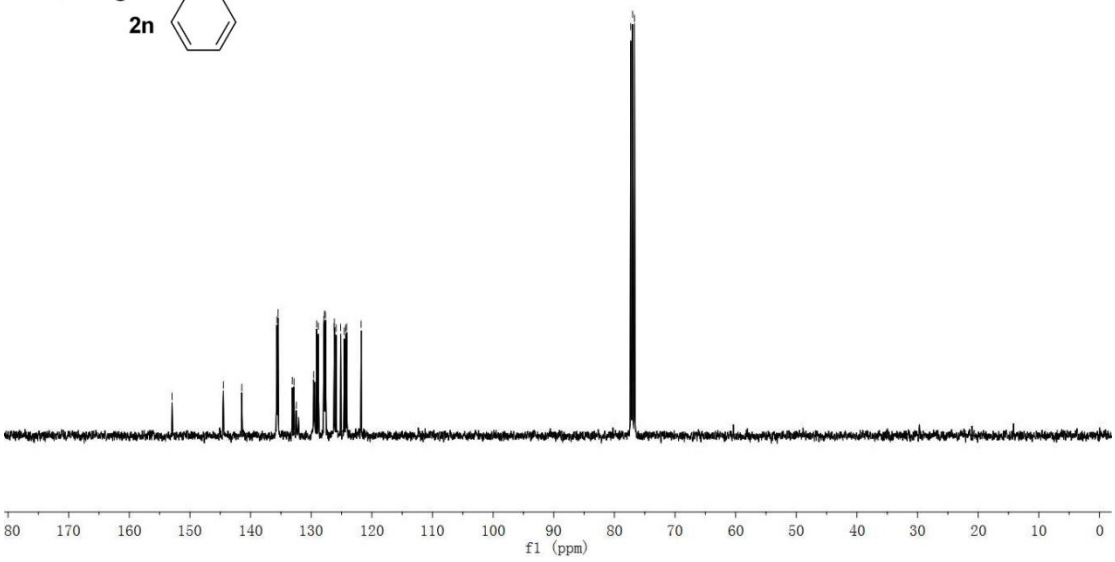
2n

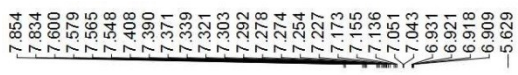

1.00
3.94
14.18
1.94
0.86
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


152.95
144.49
141.45
135.66
135.47
133.12
132.84
132.45
129.60
129.10
128.84
127.91
127.83
127.64
126.25
126.18
125.89
125.14
124.56
124.33
124.16
121.77
77.32
77.00
76.68


SiPh2H
S

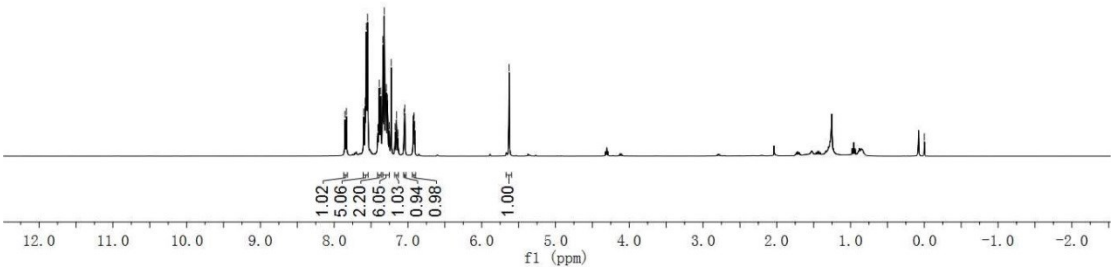
2n


80 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


7.854
7.834
7.600
7.579
7.565
7.548
7.408
7.390
7.371
7.339
7.321
7.303
7.292
7.278
7.274
7.254
7.227
7.173
7.155
7.136
7.051
7.043
6.931
6.921
6.918
6.909
5.629
0.000

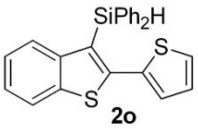

SiPh2H
S
S

2o

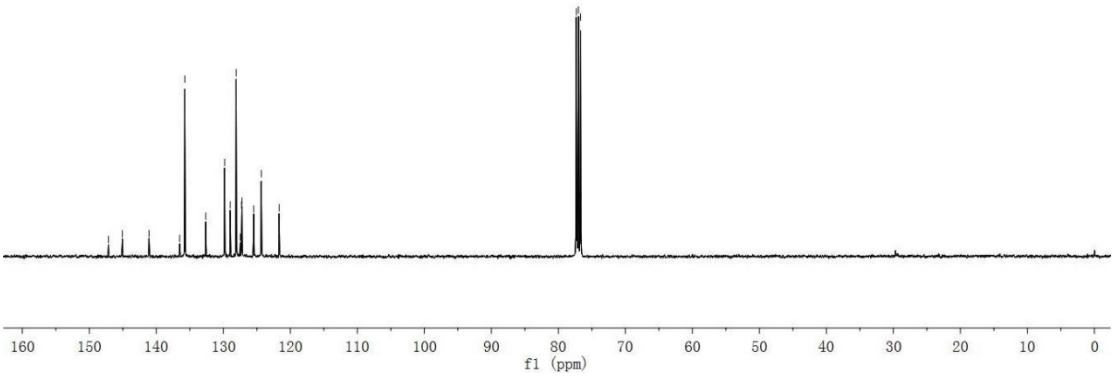

1.02
5.06
2.20
6.05
1.03
0.94
0.98
1.00
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
-1.0
-2.0
f1 (ppm)


147.14
145.07
141.09
136.52
135.74
132.62
129.80
128.97
128.08
127.46
127.28
127.22
125.46
124.33
121.67

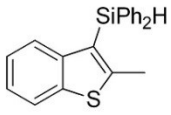

77.32
77.00
76.68


SiPh2H
S
S

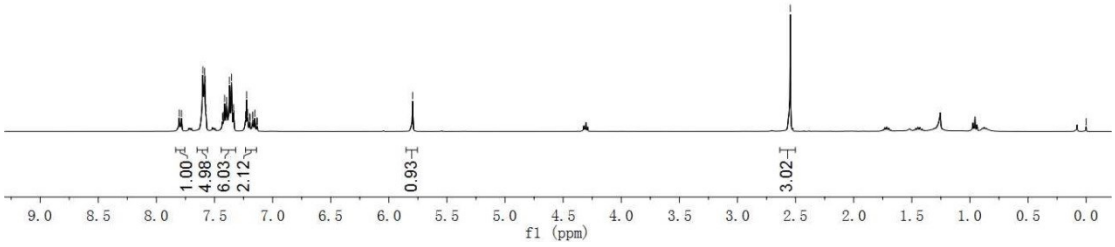
2o

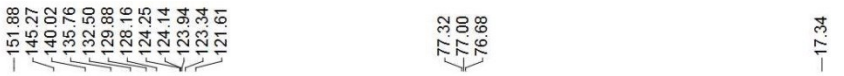

160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

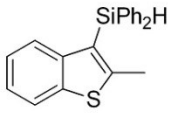

7.804
7.784
7.604
7.601
7.590
7.584
7.581
7.574
7.421
7.413
7.407
7.399
7.395
7.371
7.353
7.336
7.333
7.233
7.224
7.216
7.152
7.135
2.546
0.000


SiPh2H
S

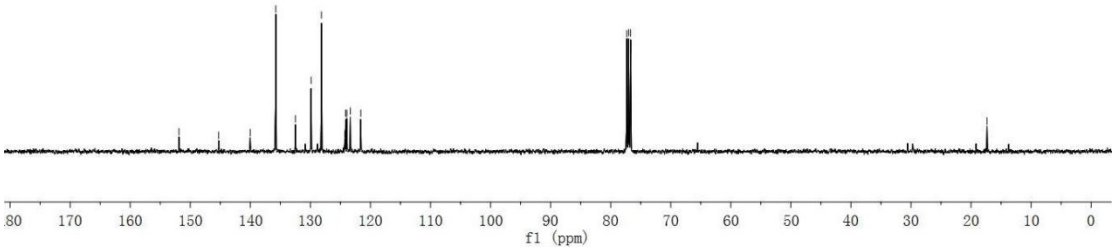
2q

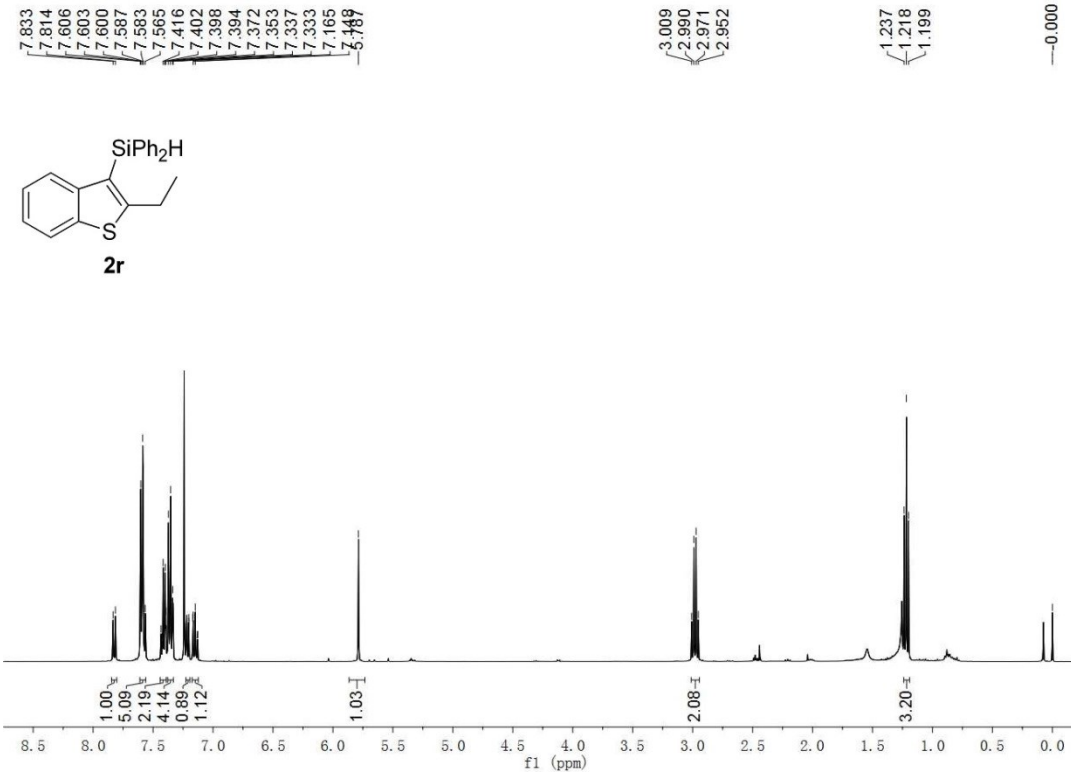

1.00
4.98
6.03
2.12
0.93
3.02
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

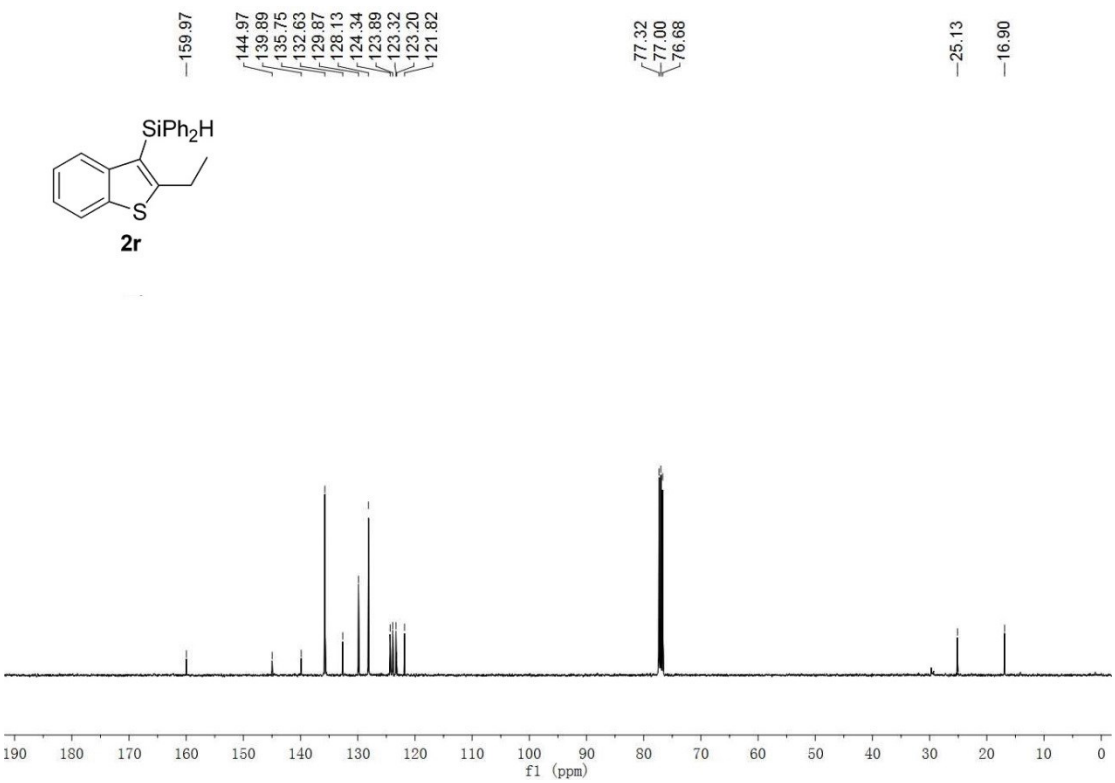

151.88
145.27
140.02
135.76
132.50
129.88
128.16
124.25
124.14
123.94
123.34
121.61
77.32
77.00
76.68
17.34

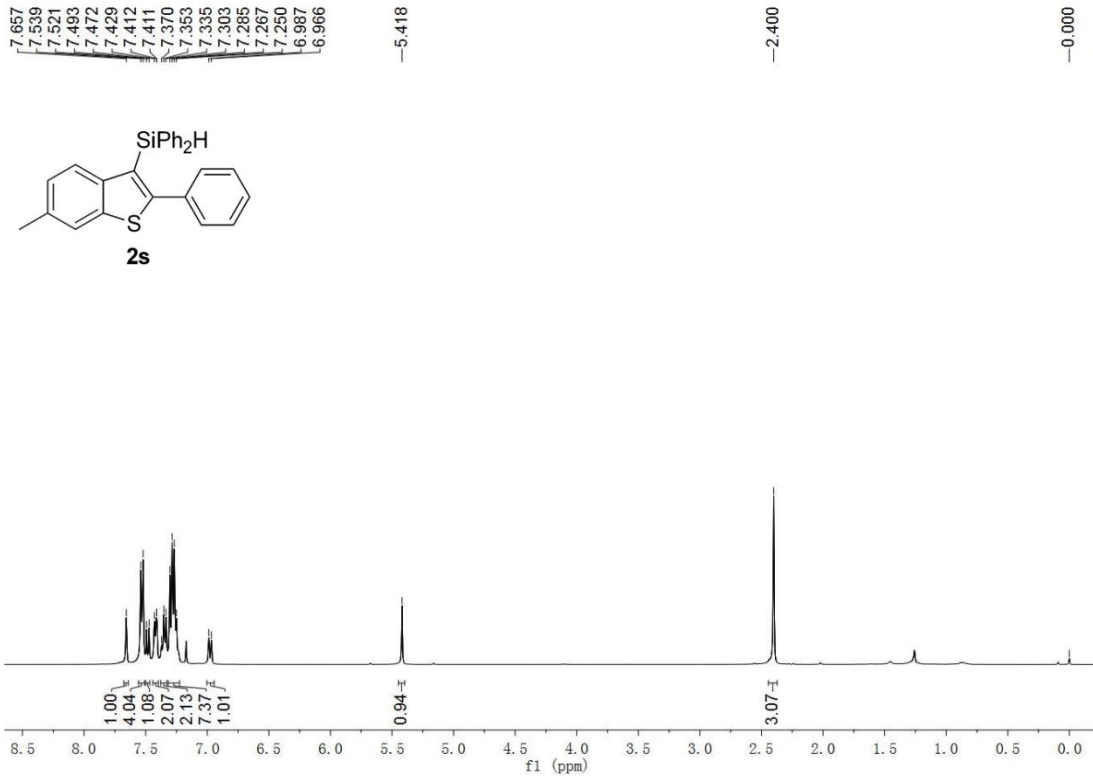

SiPh2H
S

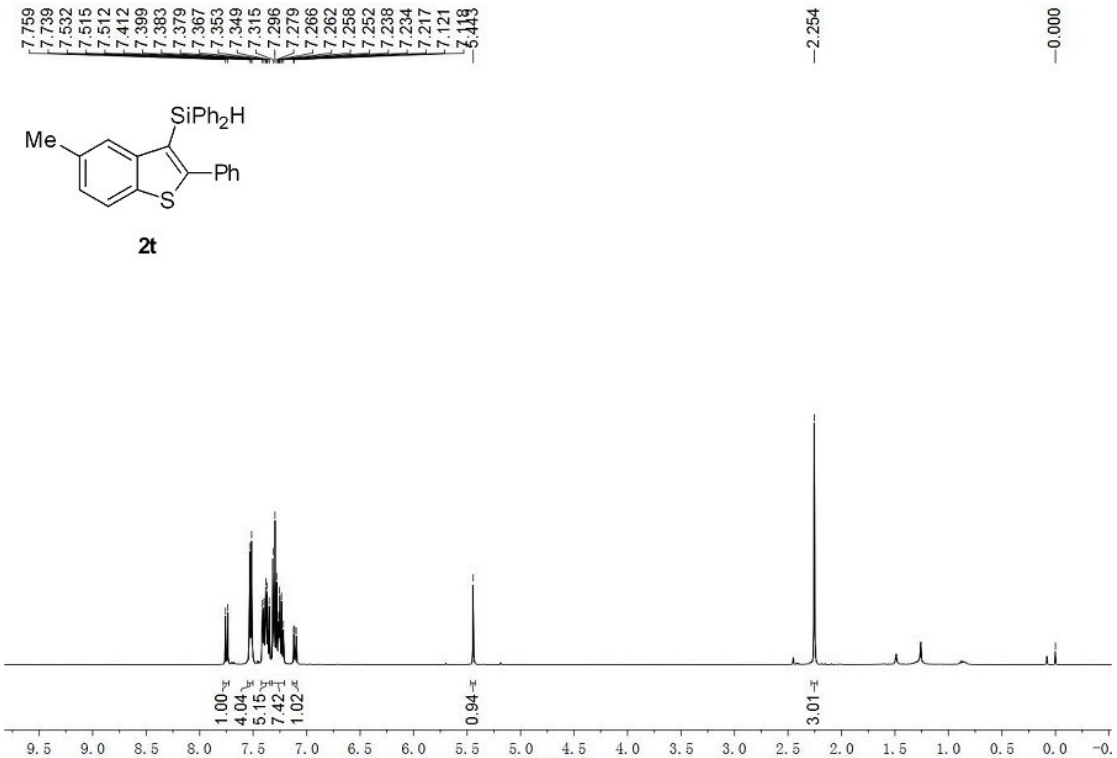
2q


180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


7.833
7.814
7.606
7.603
7.600
7.587
7.583
7.565
7.416
7.402
7.398
7.394
7.372
7.353
7.337
7.333
7.165
3.009
2.990
2.971
2.952
1.237
1.218
1.199
0.000
SiPh2H
S
2r
1.00
5.09
2.19
4.14
0.89
1.12
1.03
2.08
3.20
f1 (ppm)


159.97
144.97
139.89
135.75
132.63
129.87
128.13
124.34
123.89
123.32
123.20
121.82
77.32
77.00
76.68
25.13
16.90
SiPh2H
S
2r
f1 (ppm)


7.657
7.539
7.521
7.493
7.472
7.429
7.412
7.411
7.370
7.353
7.335
7.303
7.285
7.267
7.250
6.987
6.966
5.418
2.400
0.000
SiPh2H
S
2s
1.00
4.04
1.08
2.07
2.13
7.37
1.01
0.94
3.07
f1 (ppm)
154.66
142.92
141.32
135.71
135.54
133.92
132.96
130.11
129.68
128.33
128.02
127.92
125.89
125.35
125.00
121.60
77.32
77.00
76.68
21.39
SiPh2H
S
2s
f1 (ppm)

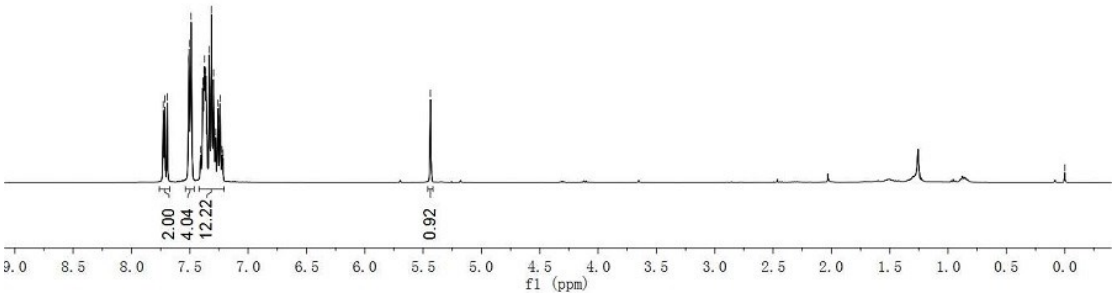

7.759
7.739
7.532
7.515
7.512
7.412
7.399
7.383
7.379
7.367
7.353
7.349
7.315
7.296
7.279
7.266
7.262
7.258
7.252
7.238
7.234
7.217
7.121
7.118
5.443
2.254
0.000
SiPh2H
Me
Ph
S
1.00
4.04
5.15
7.42
1.02
0.94
3.01
f1 (ppm)
155.90
145.58
138.15
135.77
135.58
133.81
132.99
130.07
129.66
128.36
128.00
127.90
125.70
125.43
125.29
121.32
77.32
77.00
76.68
21.48
SiPh2H
Me
Ph
S
f1 (ppm)

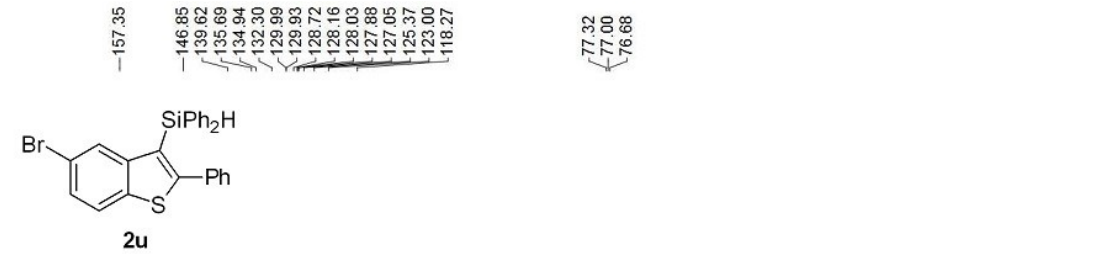
2t

2t

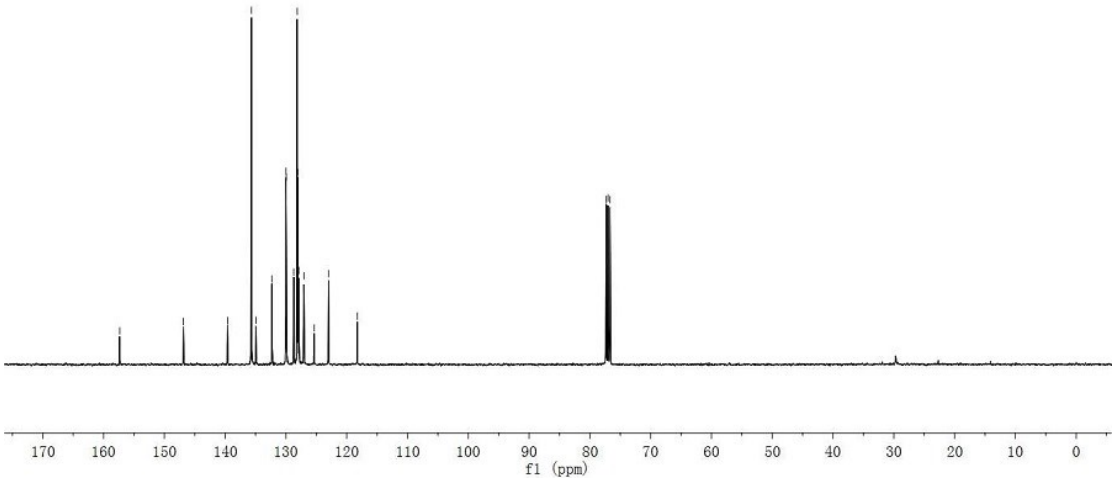

7.727
7.723
7.714
7.693
7.508
7.506
7.489
7.487
7.388
7.379
7.373
7.370
7.363
7.359
7.352
7.333
7.314
7.297
7.279
7.259
7.244
7.241
5.431
0.000
SiPh2H
Br
Ph
S

2u

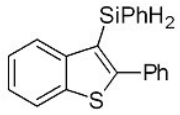

2.00
4.04
12.22
0.92
f1 (ppm)


157.35
146.85
139.62
135.69
134.94
132.30
129.99
129.93
128.72
128.16
128.03
127.88
127.05
125.37
123.00
118.27
77.32
77.00
76.68
SiPh2H
Br
Ph
S

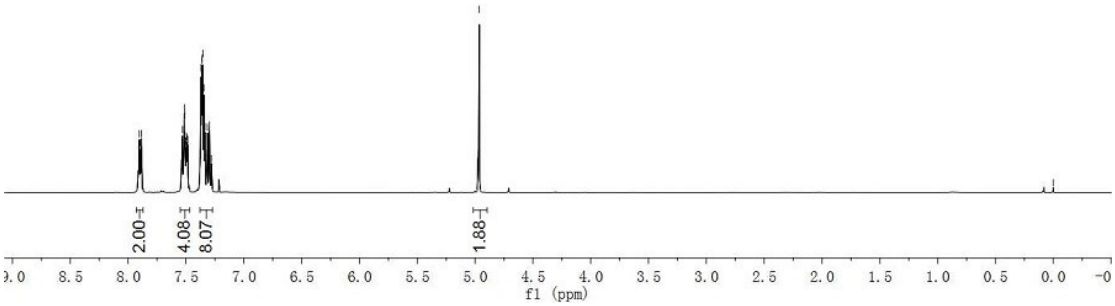
2u


f1 (ppm)

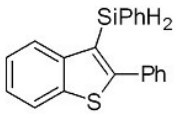

7.910
7.905
7.896
7.887
7.883
7.531
7.515
7.511
7.508
7.373
7.370
7.363
7.360
7.354
7.345
7.342
7.336
7.315
7.299
0.000


SiPhH2
Ph
S

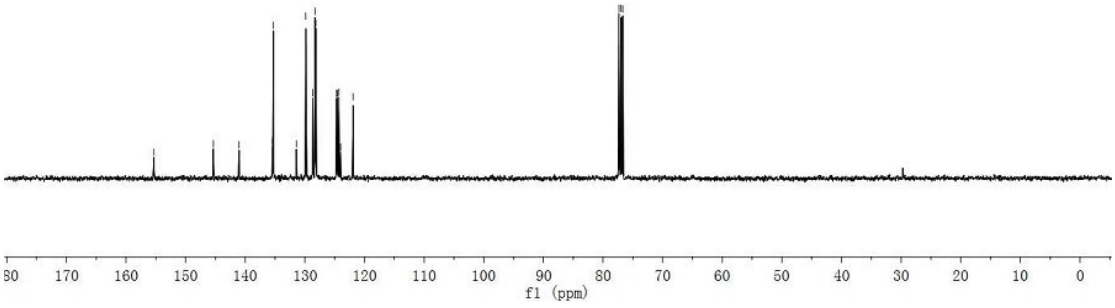
5

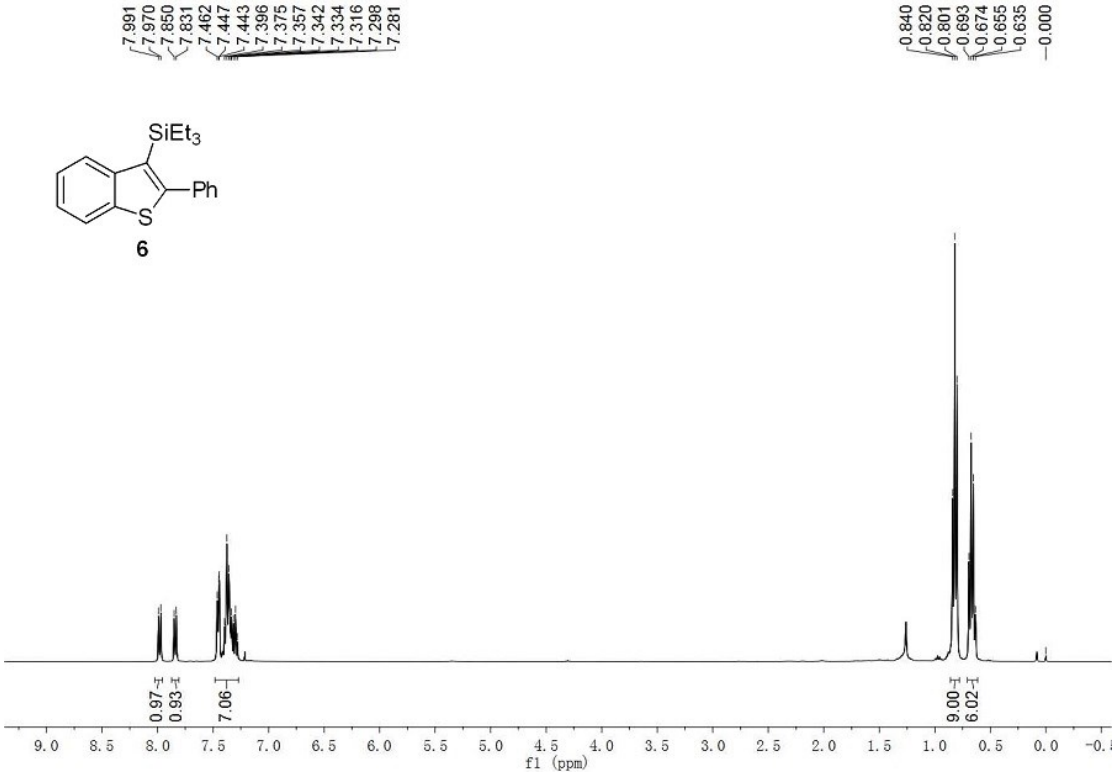

2.00
4.08
8.07
1.88
f1 (ppm)

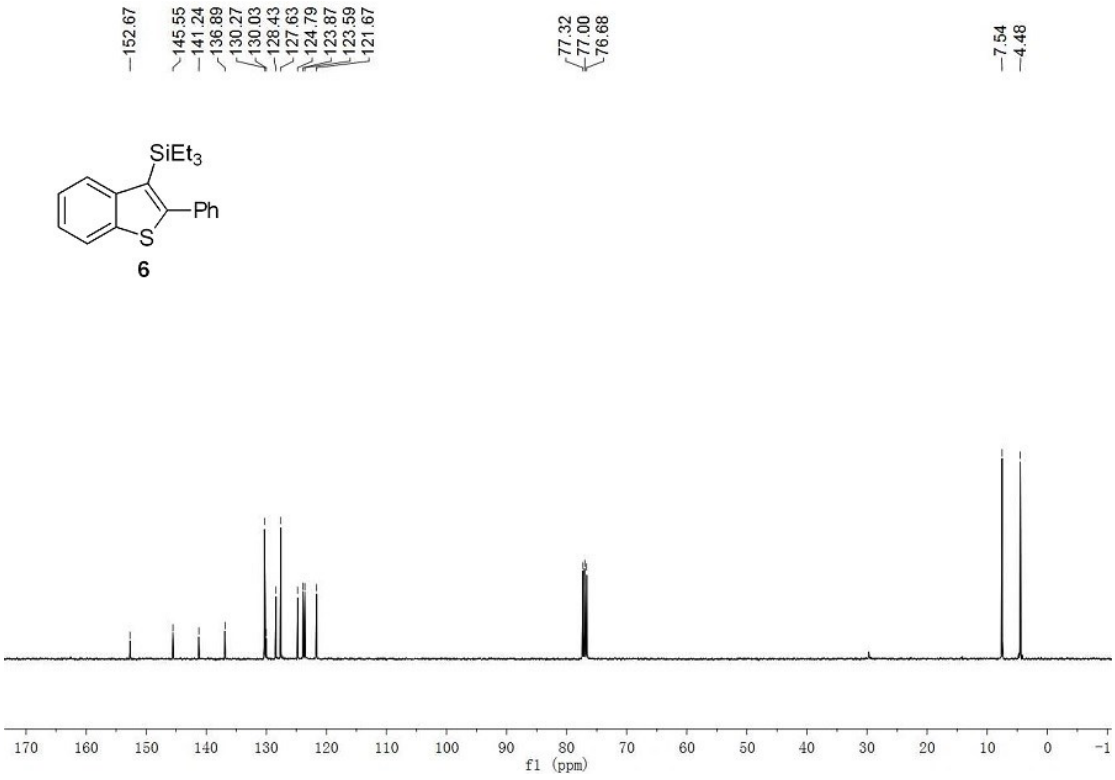

155.34
145.36
141.04
135.43
135.30
131.42
129.85
129.79
128.65
128.27
128.16
124.70
124.56
124.28
124.01
121.90
77.32
77.00
76.68


SiPhH2
Ph
S

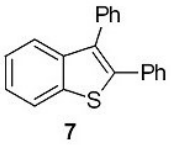
5


f1 (ppm)

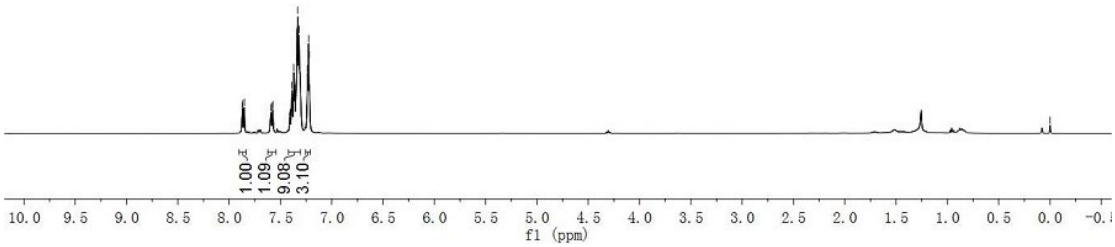

7.991
7.970
7.850
7.831
7.462
7.447
7.443
7.396
7.375
7.357
7.342
7.334
7.316
7.298
7.281
0.840
0.820
0.801
0.693
0.674
0.655
0.635
0.000
SiEt3
Ph
S
6
0.97
0.93
7.06
9.00
6.02
f1 (ppm)


152.67
145.55
141.24
136.89
130.27
130.03
128.43
127.63
124.79
123.87
123.59
121.67
77.32
77.00
76.68
7.54
4.48
SiEt3
Ph
S
6
f1 (ppm)

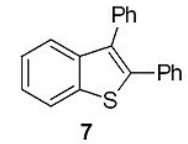

7.874
7.869
7.859
7.852
7.595
7.579
7.575
7.411
7.406
7.390
7.371
7.361
7.356
7.348
7.344
7.338
7.333
7.325
7.319
7.312
7.306
7.245
7.236
7.234
7.225
7.220
0.000


Ph
Ph
S

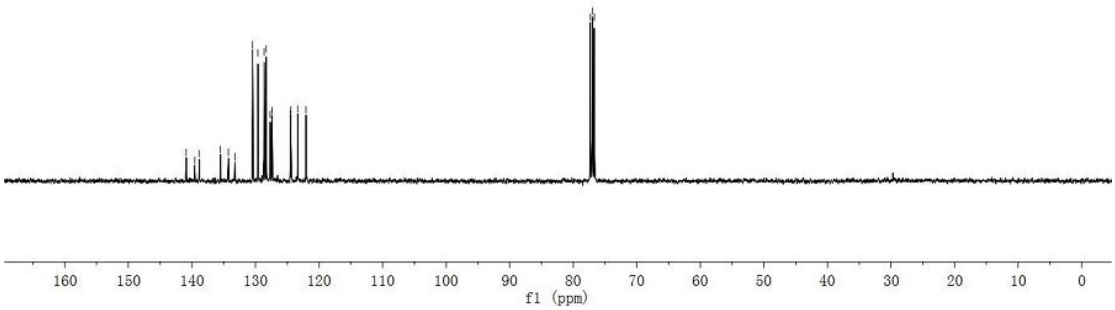
7


1.00
1.09
9.08
3.10
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

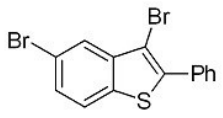

140.90
139.55
138.86
135.53
134.25
133.25
130.44
129.62
128.63
128.33
127.69
127.37
124.52
124.43
123.35
122.05
77.32
77.00
76.68


Ph
Ph
S

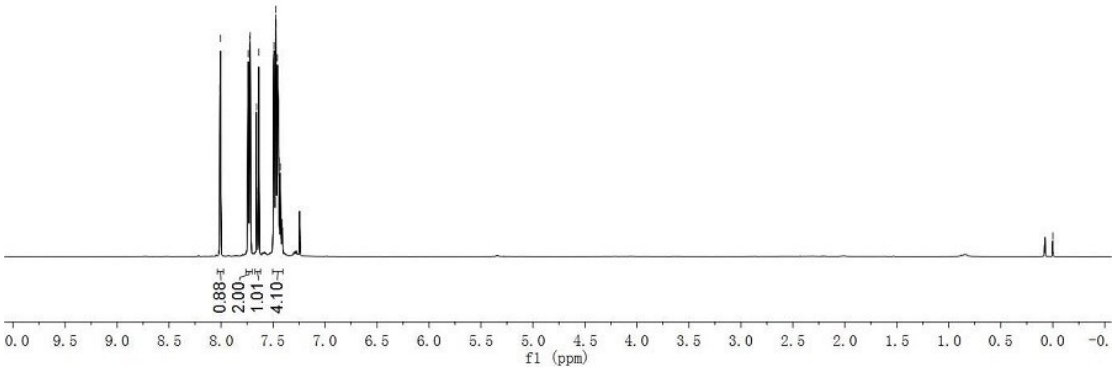
7

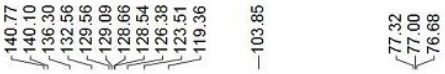

160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

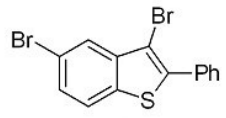

8.011
8.006
7.743
7.739
7.734
7.722
7.719
7.658
7.654
7.637
7.494
7.490
7.476
7.473
7.471
7.469
7.461
7.458
7.452
7.448
7.444
7.438
7.431
7.422
7.416
7.412
0.000


Br
Br
Ph
S

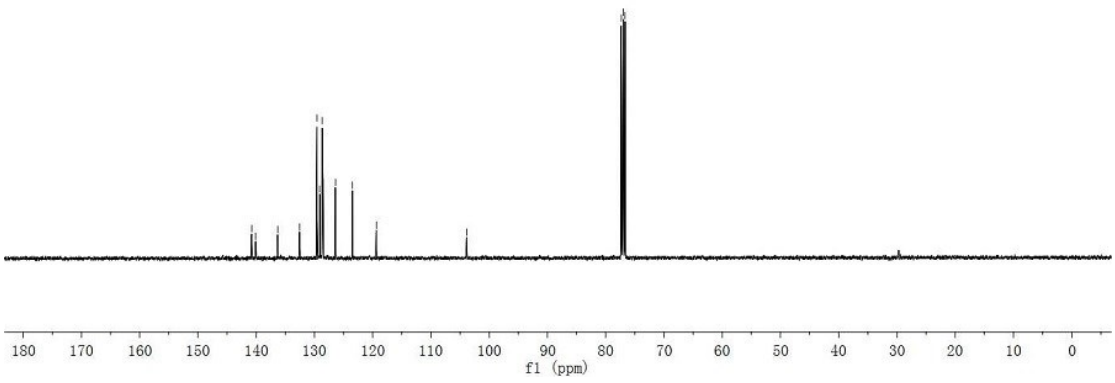
8


0.88
2.00
1.01
4.10
0.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.
f1 (ppm)


140.77
140.10
136.30
132.56
129.56
129.09
128.66
128.54
126.38
123.51
119.36
103.85
77.32
77.00
76.68

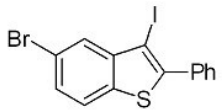

Br
Br
Ph
S

8

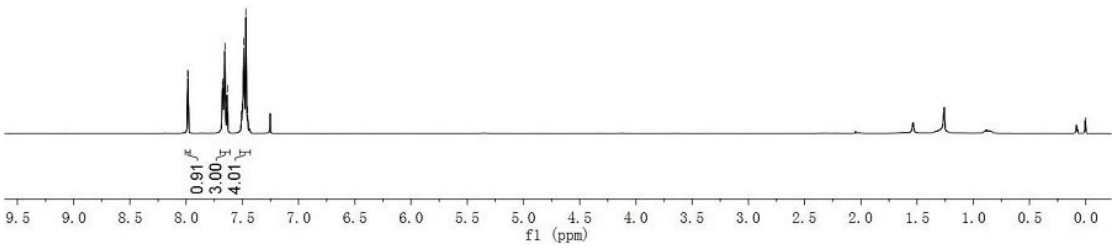

180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


7.986
7.982
7.678
7.674
7.659
7.655
7.639
7.633
7.508
7.500
7.492
7.487
7.468
7.454

0.000

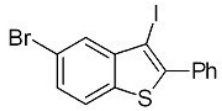

Br
I
Ph
S

9

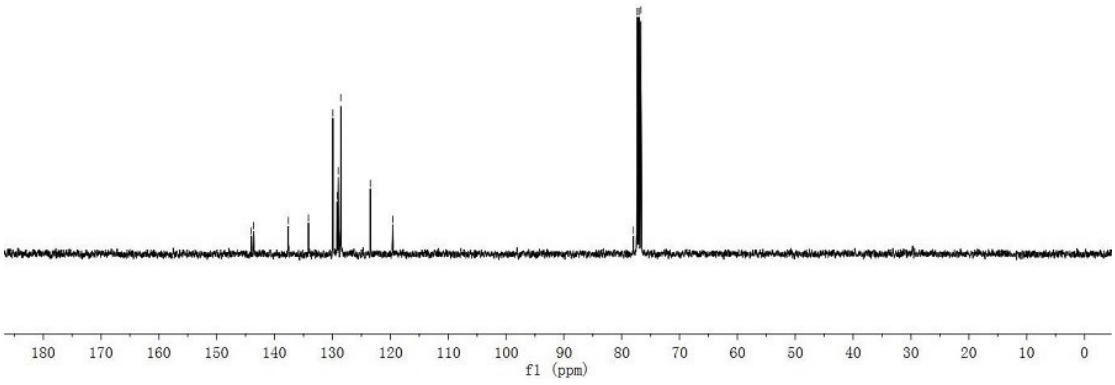

0.91
3.00
4.01
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


144.05
143.65
137.63
134.15
129.94
129.18
129.01
128.57
123.43
119.59

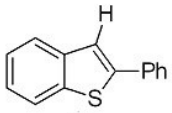
78.01
77.32
77.00
76.68


Br
I
Ph
S

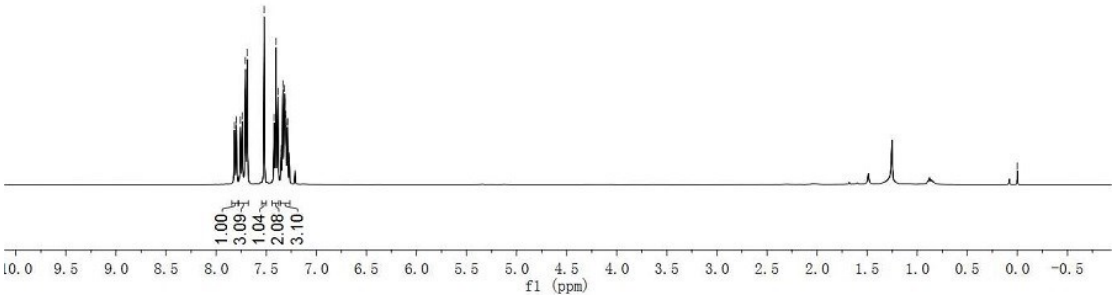
9


180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

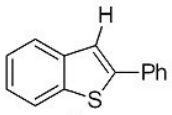

7.817
7.798
7.757
7.739
7.711
7.708
7.690
7.520
7.421
7.417
7.403
7.384
7.352
7.349
7.334
7.317
7.312
7.305
7.300
7.290
7.287
7.272
7.269
0.000


H
Ph
S

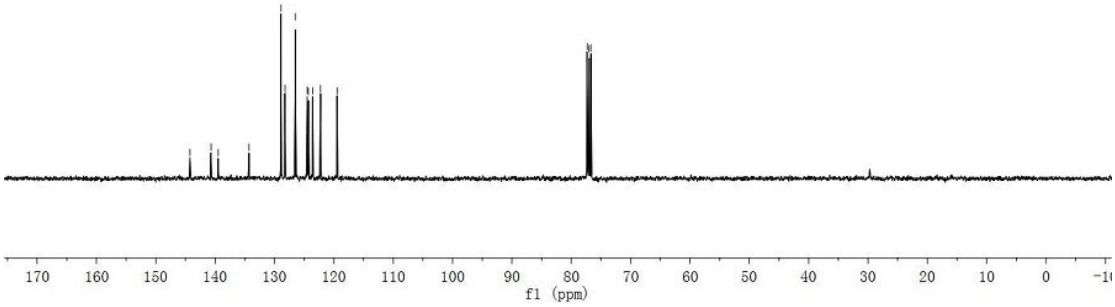
10

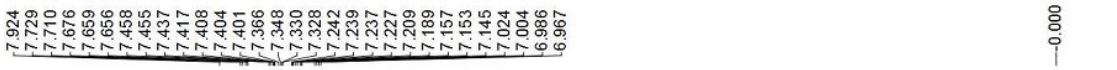

1.00
3.09
1.04
2.08
3.10
f1 (ppm)

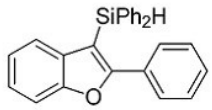

144.24
140.69
139.51
134.30
128.92
128.23
126.48
124.48
124.29
123.54
122.24
119.44
77.32
77.00
76.68


H
Ph
S

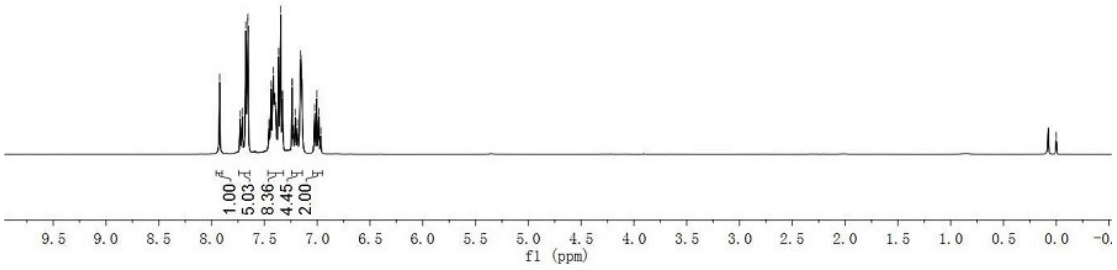
10

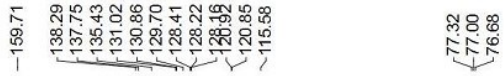

f1 (ppm)

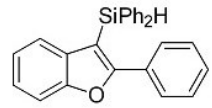

7.924
7.729
7.710
7.676
7.659
7.656
7.458
7.455
7.437
7.417
7.408
7.404
7.401
7.366
7.348
7.330
7.328
7.242
7.239
7.237
7.227
7.209
7.189
7.157
7.153
7.145
7.024
7.004
6.986
6.967
0.000


SiPh2H

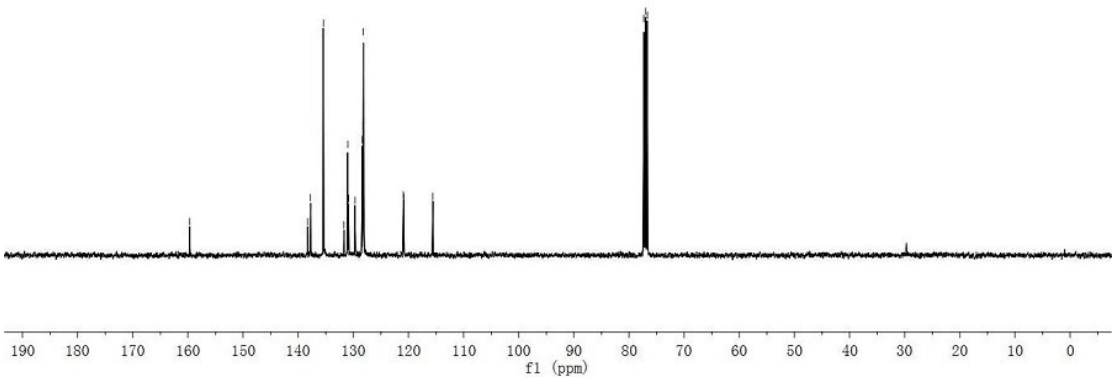
4a


1.00
5.03
8.36
4.45
2.00
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

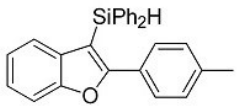

159.71
138.29
137.75
135.43
131.02
130.86
129.70
128.41
128.22
120.92
120.85
115.58
77.32
77.00
76.68


SiPh2H

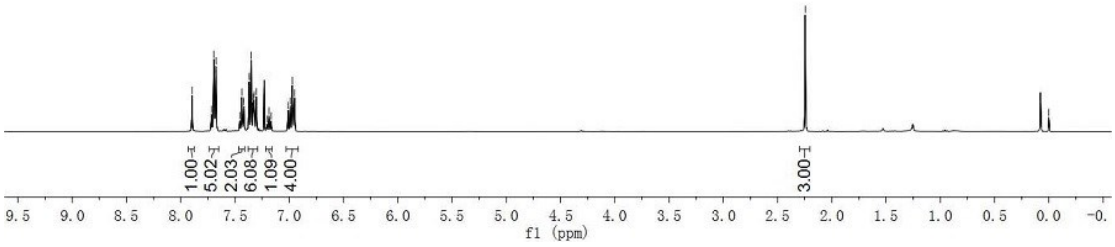
4a


190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

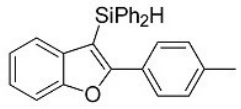

7.896
7.716
7.694
7.677
7.674
7.456
7.437
7.419
7.370
7.351
7.332
7.324
7.304
7.205
7.186
7.167
7.011
6.991
6.972
6.951
2.244
0.000


SiPh2H
O

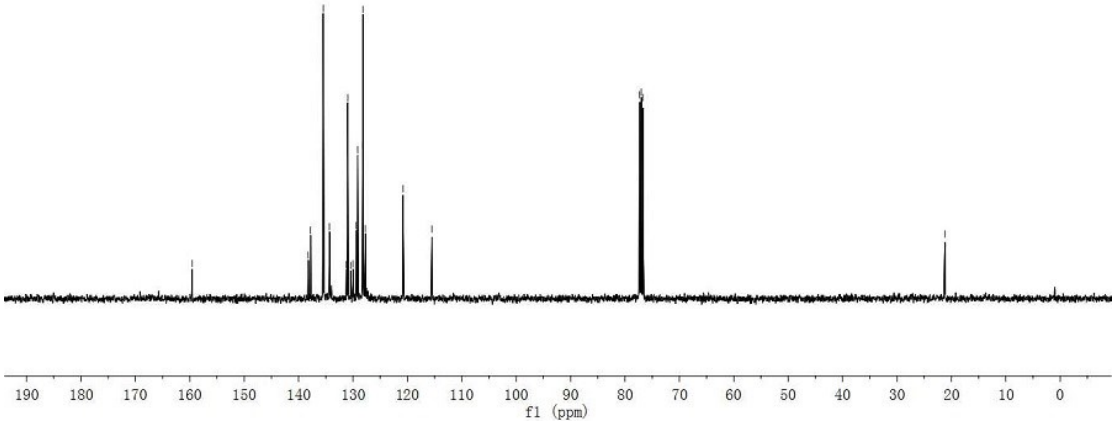
4b


1.00
5.02
2.03
6.08
1.09
4.00
3.00
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.
f1 (ppm)

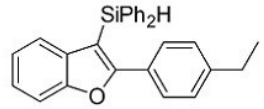

159.57
138.22
137.79
135.47
134.32
131.22
130.96
130.38
129.99
129.40
129.14
128.25
128.15
127.74
120.80
115.50
77.32
77.00
76.68
21.20


SiPh2H
O

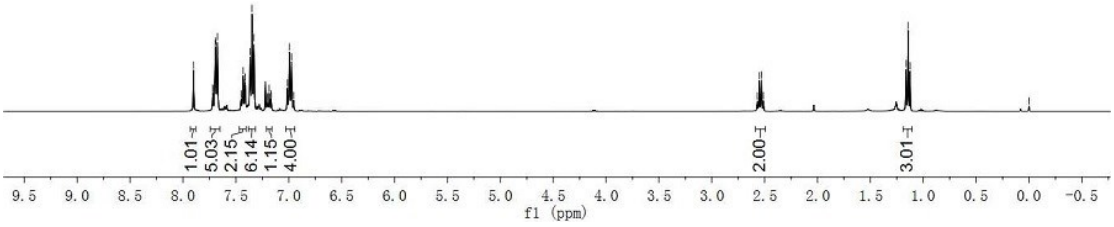
4b


190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

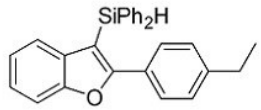

7.901
7.718
7.716
7.694
7.691
7.674
7.671
7.450
7.431
7.415
7.412
7.409
7.365
7.348
7.328
7.205
7.202
7.185
7.167
7.164
7.013
6.994
6.974
6.954
2.570
2.551
2.532
2.513
1.163
1.144
1.125
0.000


SiPh2H
O

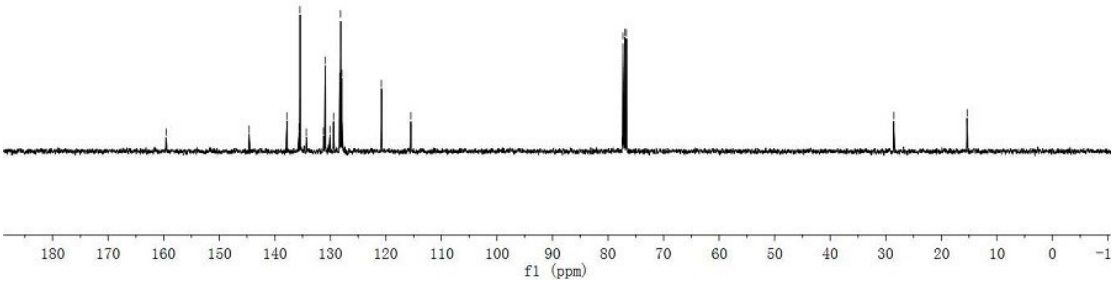
4d

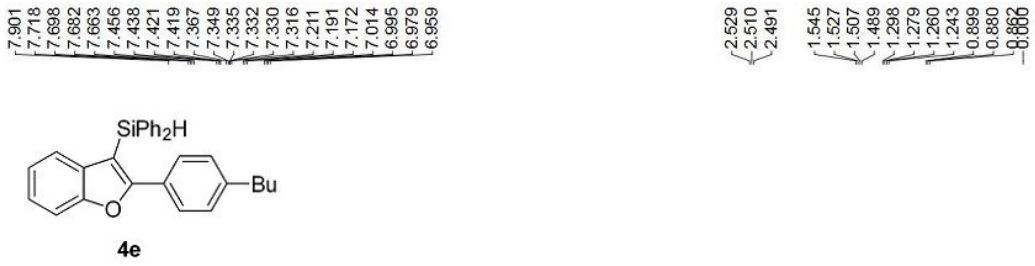

1.01
5.03
2.15
6.14
1.15
4.00
2.00
3.01
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)


159.56
144.61
137.83
135.63
135.46
134.32
131.23
130.96
130.08
129.40
128.32
128.15
127.93
120.80
115.51
77.32
77.00
76.68
28.55
15.35


SiPh2H
O

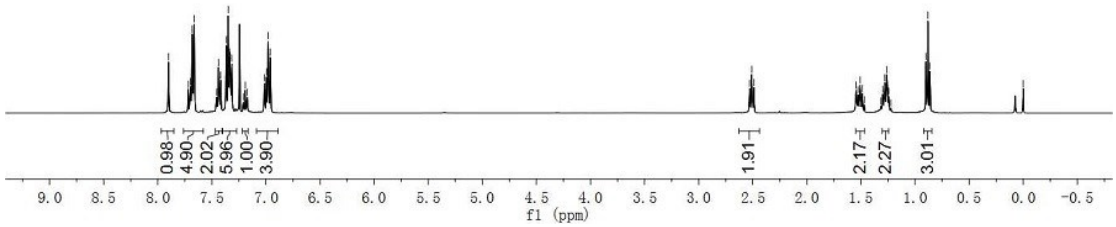
4d


180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -1
f1 (ppm)

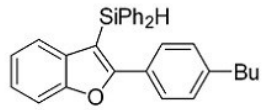

7.901
7.718
7.698
7.682
7.663
7.456
7.438
7.421
7.419
7.367
7.349
7.335
7.332
7.330
7.316
7.211
7.191
7.172
7.014
6.995
6.979
6.959
2.529
2.510
2.491
1.545
1.527
1.507
1.489
1.298
1.279
1.260
1.243
0.899
0.880

SiPh2H
Bu

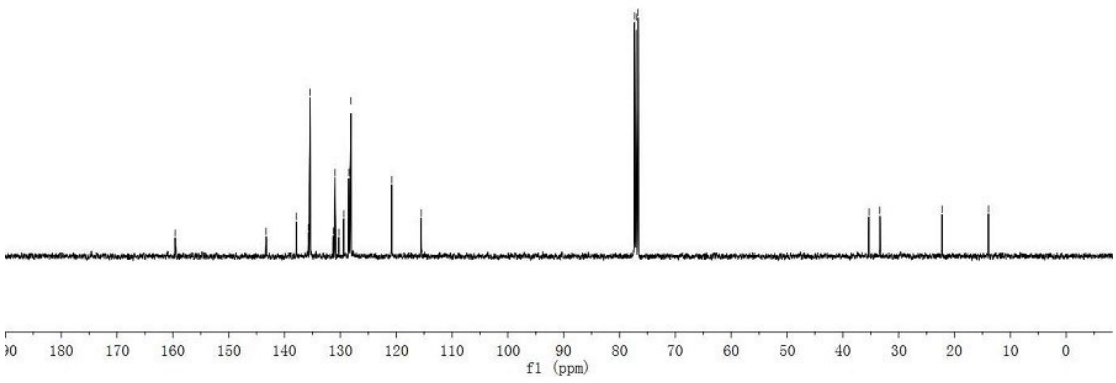
4e


0.98
4.90
2.02
5.96
1.00
3.90
1.91
2.17
2.27
3.01
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

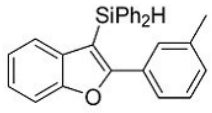

159.58
137.89
135.72
135.46
131.26
131.01
130.94
129.40
128.49
128.21
115.50
77.32
77.20
77.00
76.68
35.32
33.37
22.21
13.92


SiPh2H
Bu

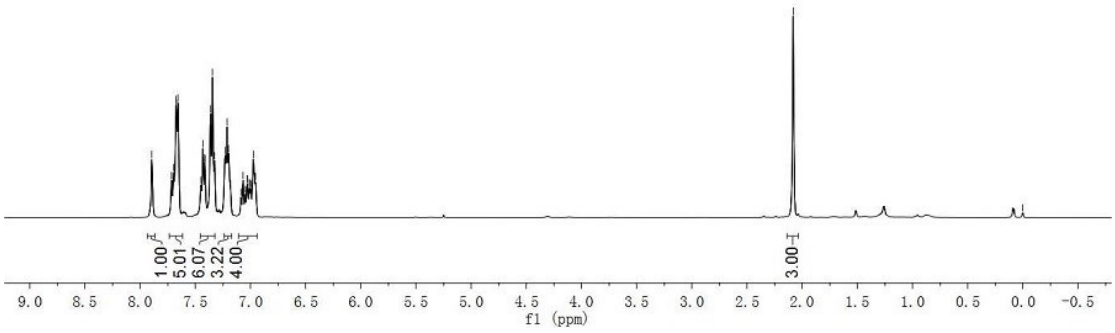
4e


180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

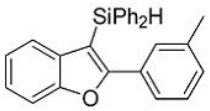

7.895
7.716
7.696
7.674
7.671
7.657
7.449
7.431
7.415
7.412
7.362
7.345
7.326
7.229
7.212
7.198
7.181
7.086
7.067
7.048
7.031
7.028
7.011
7.008
6.997
6.974
6.958
6.955
2.082
0.000


SiPh2H

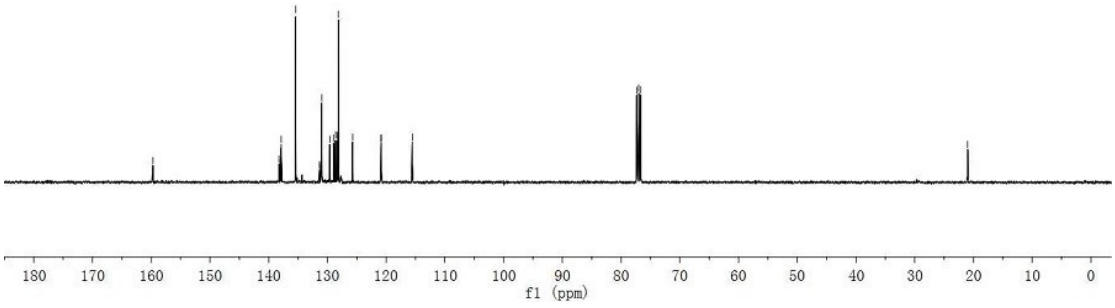
4c


1.00
5.01
6.07
3.22
4.00
3.00
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

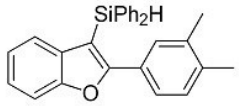

159.71
138.24
138.00
137.87
135.41
131.36
131.09
131.06
130.96
129.58
128.95
128.62
128.33
128.14
125.71
120.89
120.83
115.56
77.32
77.21
77.00
76.68
20.99


SiPh2H

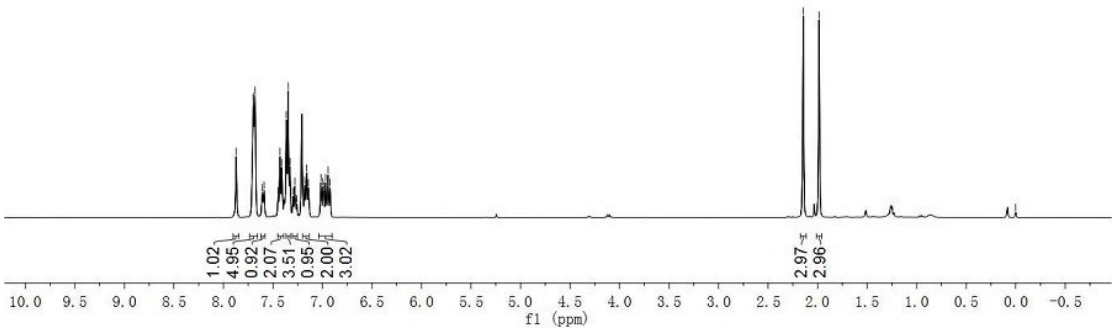
4c


180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

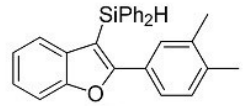

7.871
7.699
7.696
7.688
7.680
7.606
7.589
7.448
7.430
7.411
7.365
7.346
7.327
7.298
7.279
7.260
7.179
7.160
7.142
7.015
6.995
6.987
6.967
6.944
6.924
2.146
1.985
0.000


SiPh2H

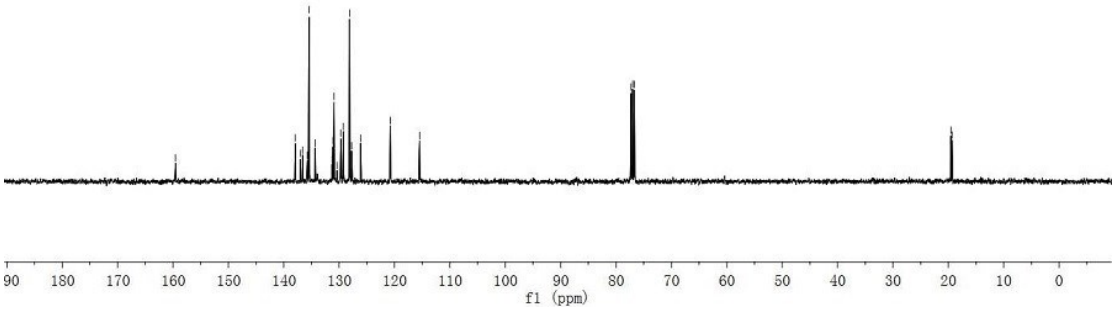
4f

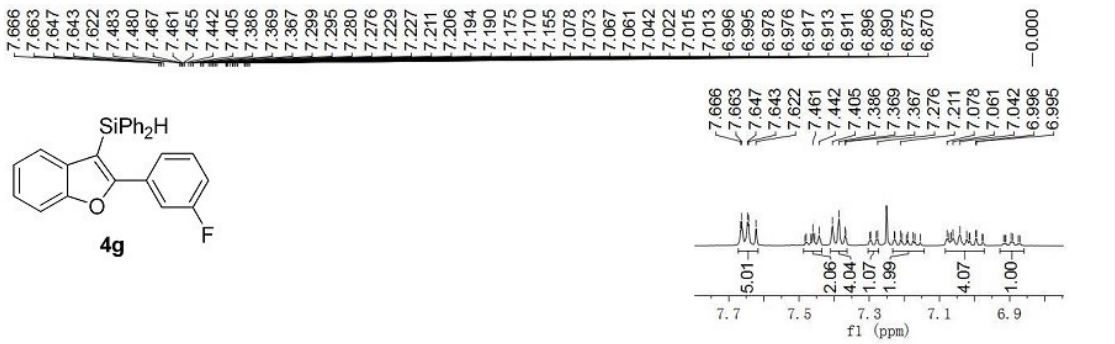

1.02
4.95
0.92
2.07
3.51
0.95
2.00
3.02
2.97
2.96
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

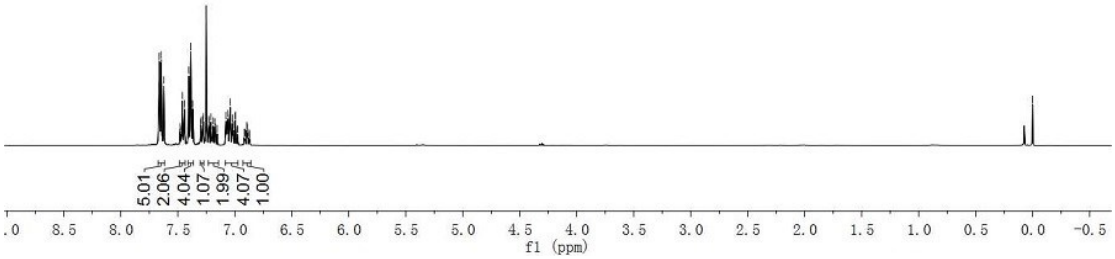

159.55
137.94
136.97
136.57
135.76
135.44
134.31
131.26
131.12
130.92
130.38
129.71
129.26
128.13
127.74
126.10
120.77
115.48
77.32
77.00
76.68
19.51
19.33

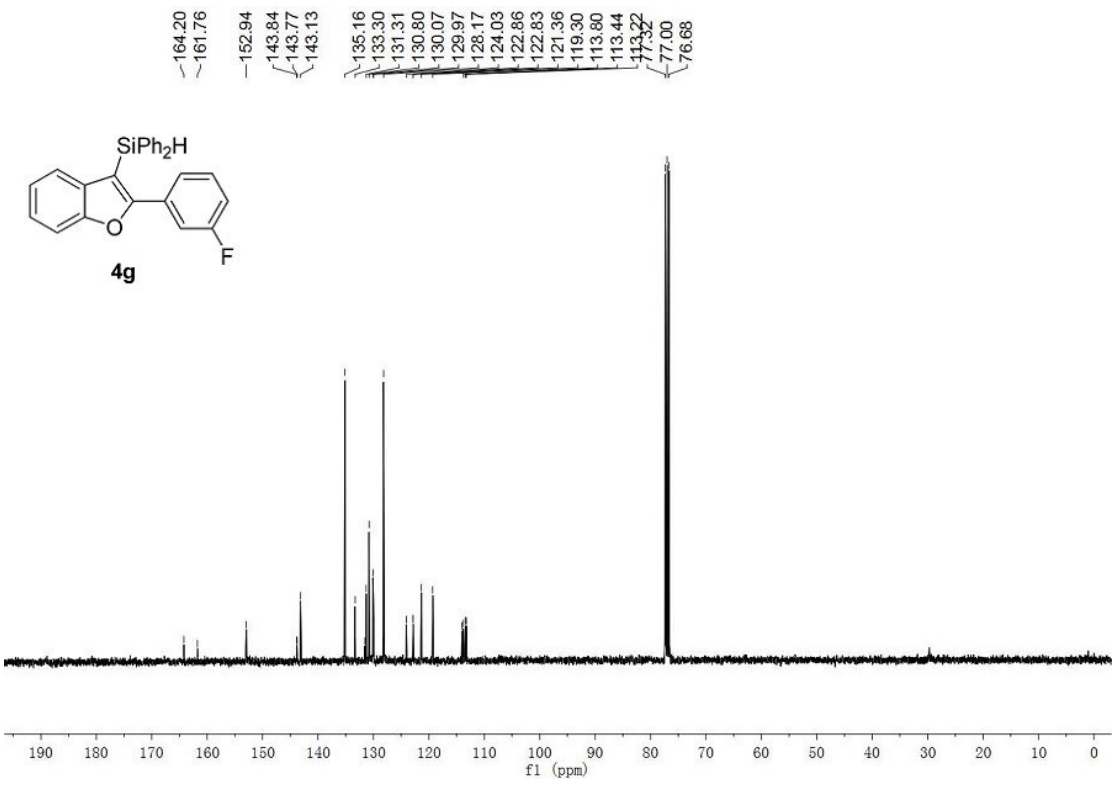

SiPh2H

4f

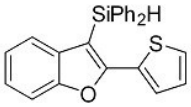

90 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


7.666
7.663
7.647
7.643
7.622
7.483
7.480
7.467
7.461
7.455
7.442
7.405
7.386
7.369
7.367
7.299
7.295
7.280
7.276
7.229
7.227
7.211
7.206
7.194
7.190
7.175
7.170
7.155
7.078
7.073
7.067
7.061
7.042
7.022
7.015
7.013
6.996
6.995
6.978
6.976
6.917
6.913
6.911
6.896
6.890
6.875
6.870
0.000
SiPh2H
O
F
4g
5.01
2.06
4.04
1.07
1.99
4.07
1.00
f1 (ppm)

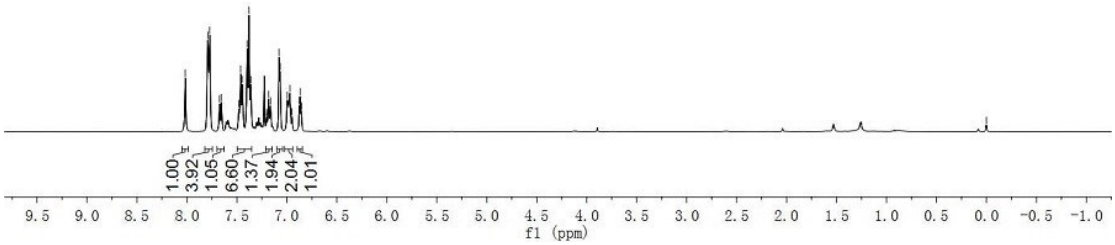

5.01
2.06
4.04
1.07
1.99
4.07
1.00
f1 (ppm)


164.20
161.76
152.94
143.84
143.77
143.13
135.16
133.30
131.31
130.80
130.07
129.97
128.17
124.03
122.86
122.83
121.36
119.30
113.80
113.44
77.32
77.00
76.68
SiPh2H
O
F
4g
f1 (ppm)

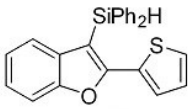

8.017
7.791
7.773
7.674
7.655
7.479
7.462
7.445
7.398
7.380
7.361
7.203
7.184
7.165
7.078
7.067
6.997
6.971
6.950
6.875
6.865
6.854
0.000


SiPh2H
S
O

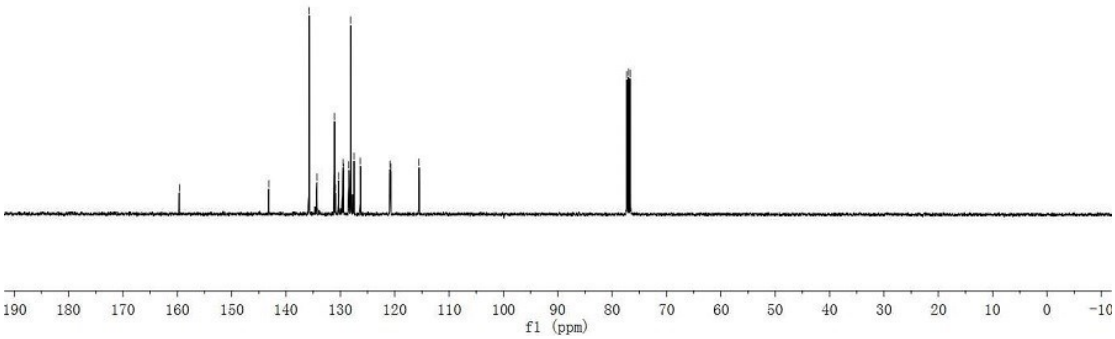
4h

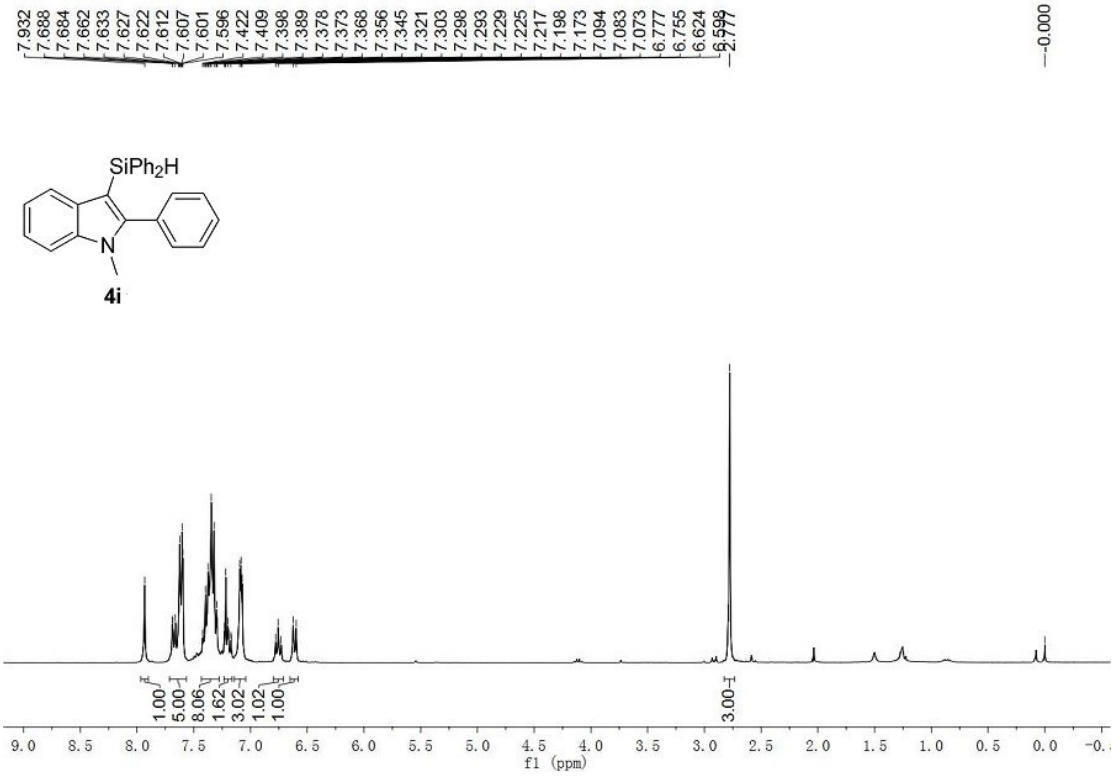

1.00
3.92
1.05
6.60
1.37
1.94
2.04
1.01
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0
f1 (ppm)

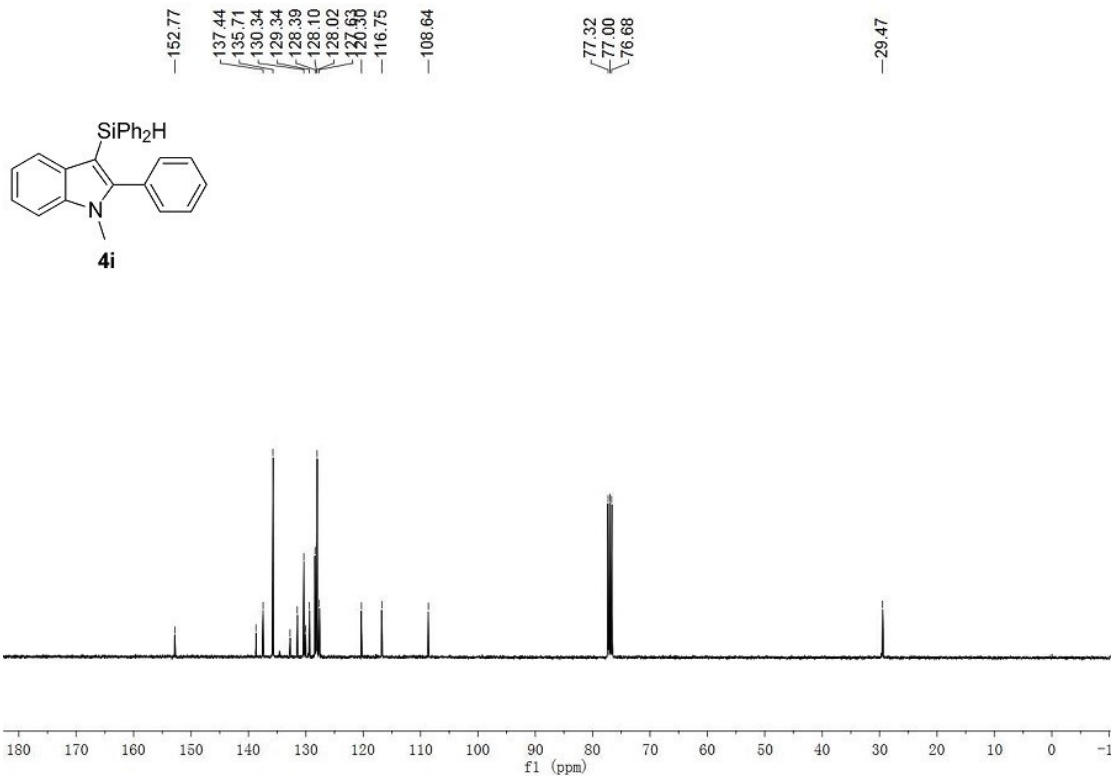

159.63
143.17
135.77
134.31
131.08
130.91
130.32
129.52
129.43
128.45
128.12
127.48
126.34
120.87
120.73
115.55
77.32
77.00
76.68

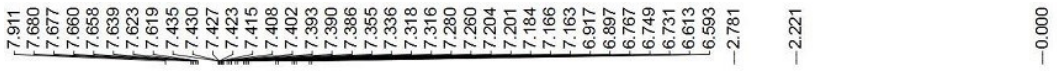

SiPh2H
S
O

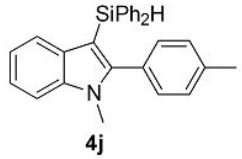
4h


190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

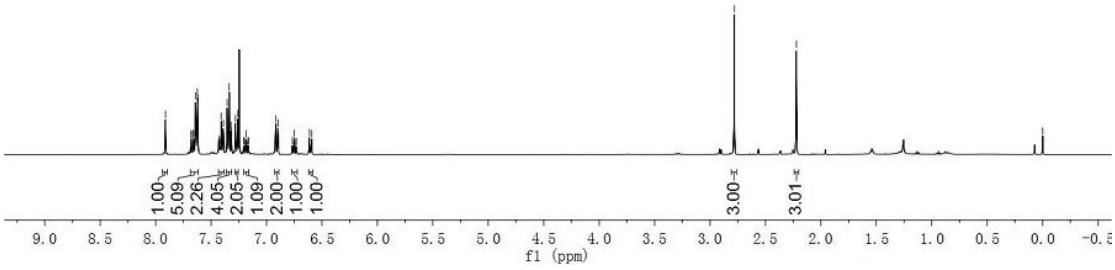

7.932
7.688
7.684
7.662
7.633
7.627
7.622
7.612
7.607
7.601
7.596
7.422
7.409
7.398
7.389
7.378
7.373
7.368
7.356
7.345
7.321
7.303
7.298
7.293
7.229
7.225
7.217
7.198
7.173
7.094
7.083
7.073
6.777
6.755
6.624
6.599
2.777
0.000
SiPh2H
N
4i
1.00
5.00
8.06
1.62
3.02
1.02
1.00
3.00
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


152.77
137.44
135.71
130.34
129.34
128.39
128.10
128.02
116.75
108.64
77.32
77.00
76.68
29.47
SiPh2H
N
4i
180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

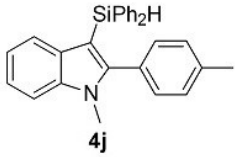

7.911
7.680
7.677
7.660
7.658
7.639
7.623
7.619
7.435
7.430
7.427
7.423
7.415
7.408
7.402
7.393
7.390
7.386
7.355
7.336
7.318
7.316
7.280
7.260
7.204
7.201
7.184
7.166
7.163
6.917
6.897
6.767
6.749
6.731
6.613
6.593
2.781
2.221
0.000


SiPh2H
N

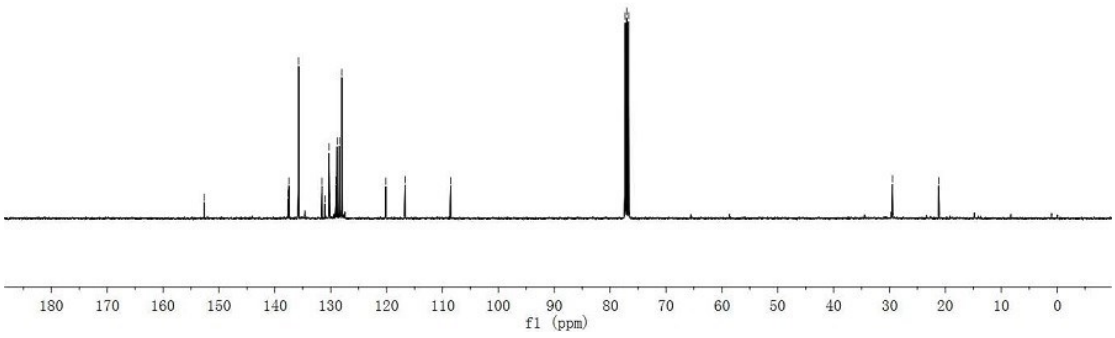
4j

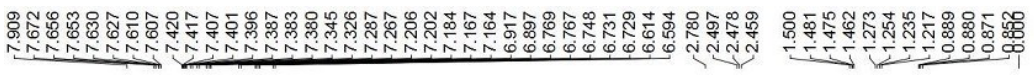

1.00
5.09
2.26
4.05
2.05
1.09
2.00
1.00
1.00
3.00
3.01
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


152.63
137.48
135.75
131.57
130.29
129.06
128.84
128.41
116.71
108.55
77.32
77.00
76.68
29.46
21.16


SiPh2H
N

4j


180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


7.909
7.672
7.656
7.653
7.630
7.627
7.610
7.607
7.420
7.417
7.407
7.401
7.396
7.387
7.383
7.380
7.345
7.326
7.287
7.267
7.206
7.202
7.184
7.167
7.164
6.917
6.897
6.769
6.767
6.748
6.731
6.729
6.614
6.594
2.780
2.497
2.478
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1.500
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1.475
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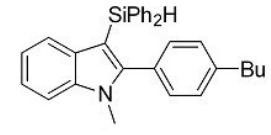
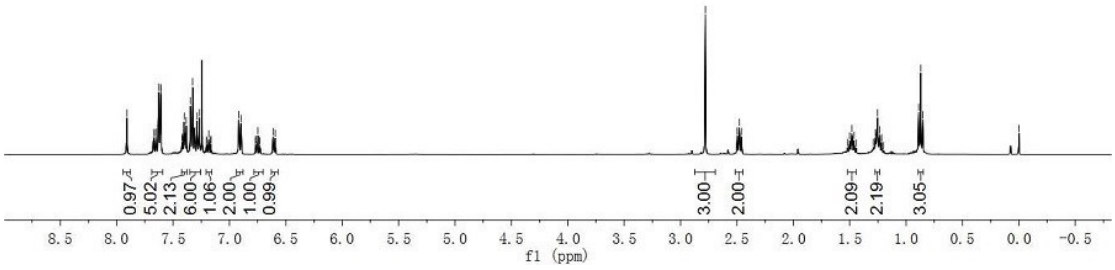
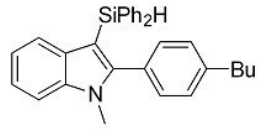
1.254
1.235
1.217
0.889
0.880
0.871


SiPh2H
Bu
N

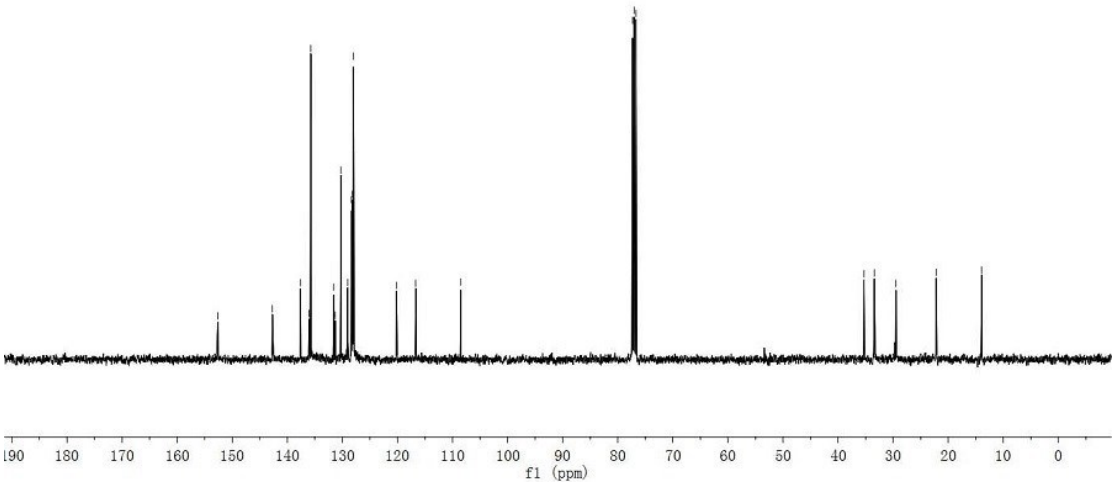
4k


0.97
5.02
2.13
6.00
1.06
2.00
1.00
0.99
3.00
2.00
2.09
2.19
3.05
8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

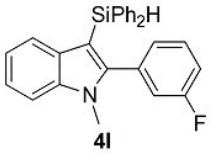

152.63
137.59
135.74
131.58
130.26
129.05
128.36
128.19
116.69
108.53
77.32
77.00
76.68
35.28
33.41
29.49
22.17
13.93


SiPh2H
Bu
N

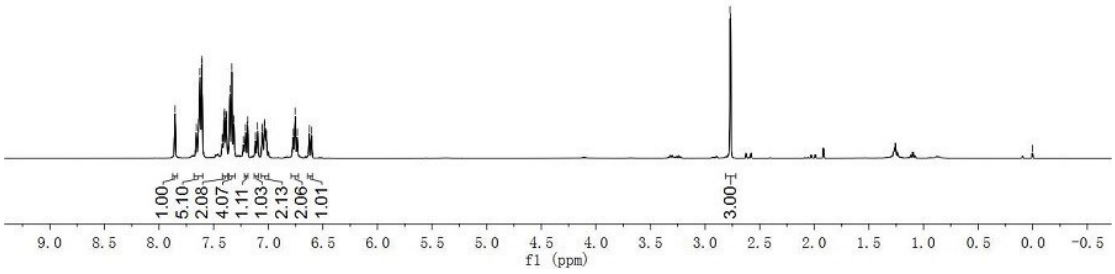
4k


190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

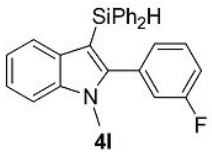

7.855
7.659
7.639
7.626
7.612
7.609
7.607
7.604
7.422
7.419
7.405
7.401
7.387
7.385
7.382
7.351
7.334
7.315
7.227
7.208
7.193
7.188
7.117
7.098
7.056
7.052
7.035
7.031
7.021
7.016
6.772
6.753
6.734
6.624
6.604
2.771
2.766
0.000


SiPh2H
N
F

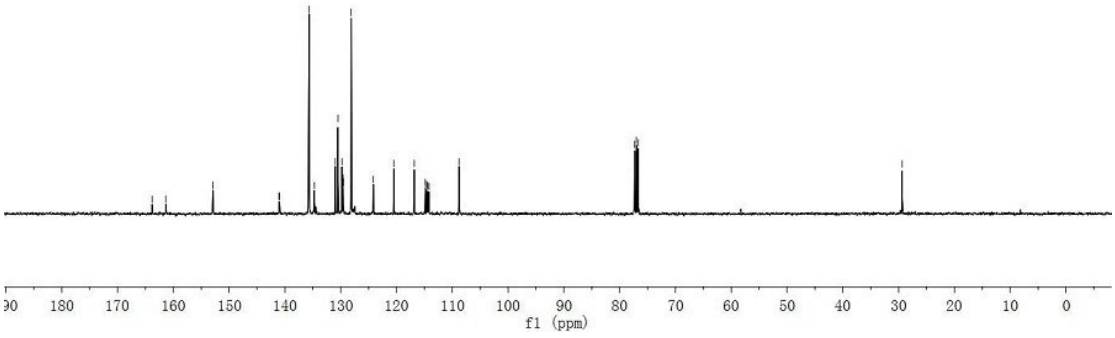
4l


1.00
5.10
2.08
4.07
1.11
1.03
2.13
2.06
1.01
3.00
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

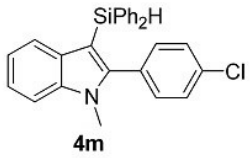

163.79
161.34
152.91
140.98
135.79
135.67
134.73
130.97
130.50
129.77
129.63
129.58
129.50
128.11
124.16
120.46
116.82
114.83
114.61
114.40
114.19
77.32
77.00
76.68
29.38


SiPh2H
N
F

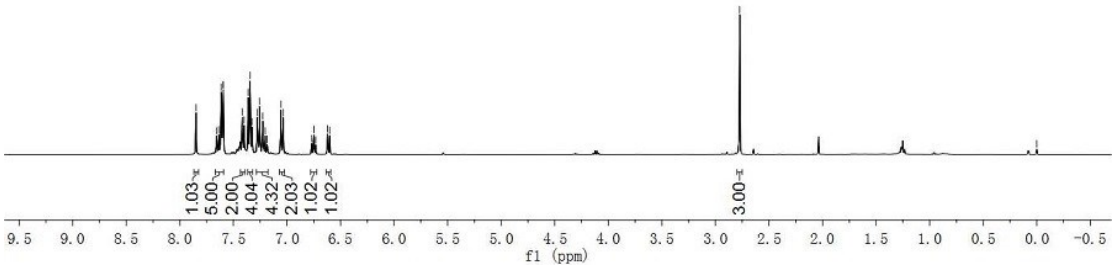
4l


180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

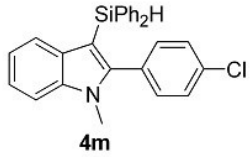

7.849
7.656
7.637
7.613
7.596
7.593
7.418
7.400
7.362
7.343
7.325
7.276
7.255
7.226
7.203
7.183
7.057
7.036
6.769
6.750
6.731
6.621
6.601
2.774
0.000


SiPh2H
Cl
N

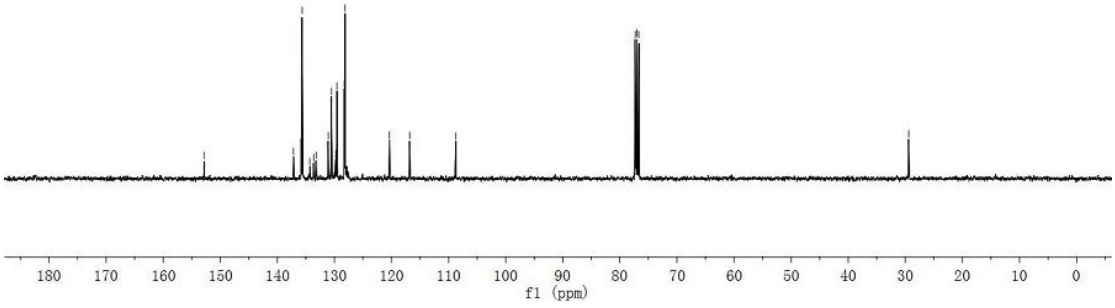
4m

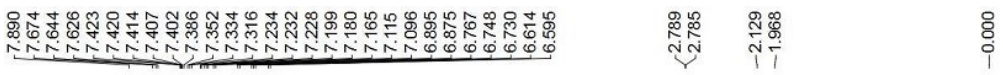

1.03
5.00
2.00
4.04
4.32
2.03
1.02
1.02
3.00
f1 (ppm)

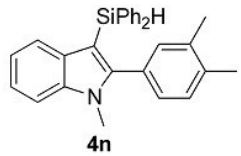

152.81
135.79
135.66
131.09
130.53
129.62
129.55
128.28
116.83
108.77
77.32
77.00
76.68
29.41


SiPh2H
Cl
N

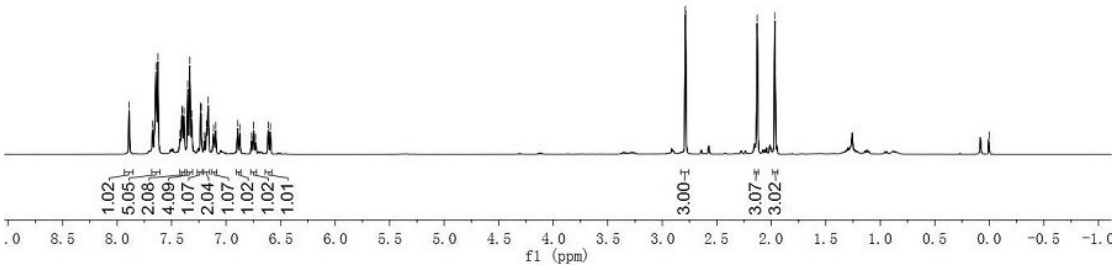
4m

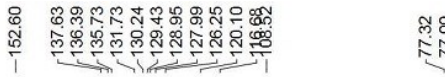

f1 (ppm)

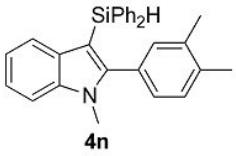

7.890
7.674
7.644
7.626
7.423
7.420
7.414
7.407
7.402
7.386
7.352
7.334
7.316
7.234
7.232
7.228
7.199
7.180
7.165
7.115
7.096
6.895
6.875
6.767
6.748
6.730
6.614
6.595
2.789
2.785
2.129
1.968
0.000


SiPh2H
N

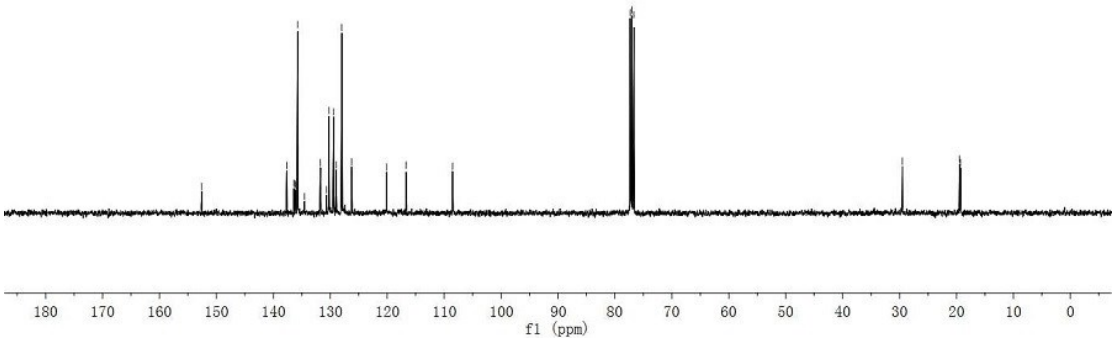
4n

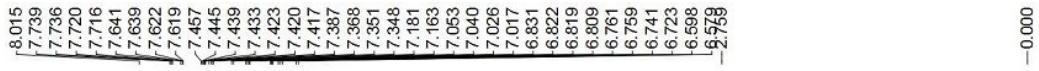

1.02
5.05
2.08
4.09
1.07
2.04
1.07
1.02
1.02
1.01
3.00
3.07
3.02
f1 (ppm)

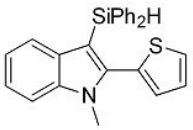

152.60
137.63
136.39
135.73
131.73
130.24
129.43
128.95
127.99
126.25
120.10
77.32
77.00
76.68
29.50
19.48
19.31


SiPh2H
N

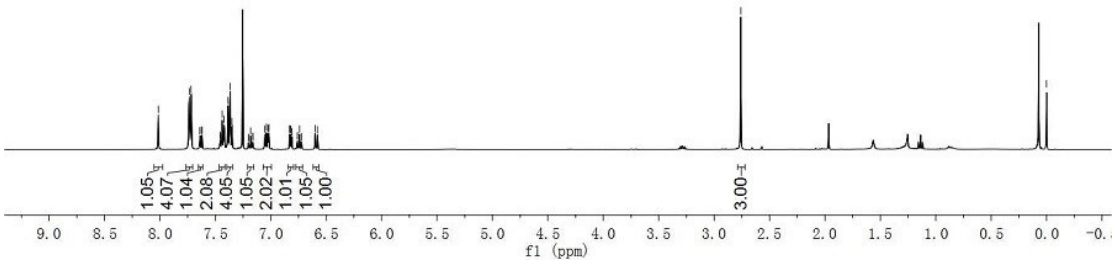
4n


f1 (ppm)

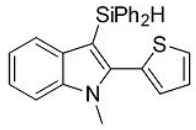

8.015
7.739
7.736
7.720
7.716
7.641
7.639
7.622
7.619
7.457
7.445
7.439
7.433
7.423
7.420
7.417
7.387
7.368
7.351
7.348
7.181
7.163
7.053
7.040
7.026
7.017
6.831
6.822
6.819
6.809
6.761
6.759
6.741
6.723
6.598
6.579
2.759
0.000


SiPh2H
S
N

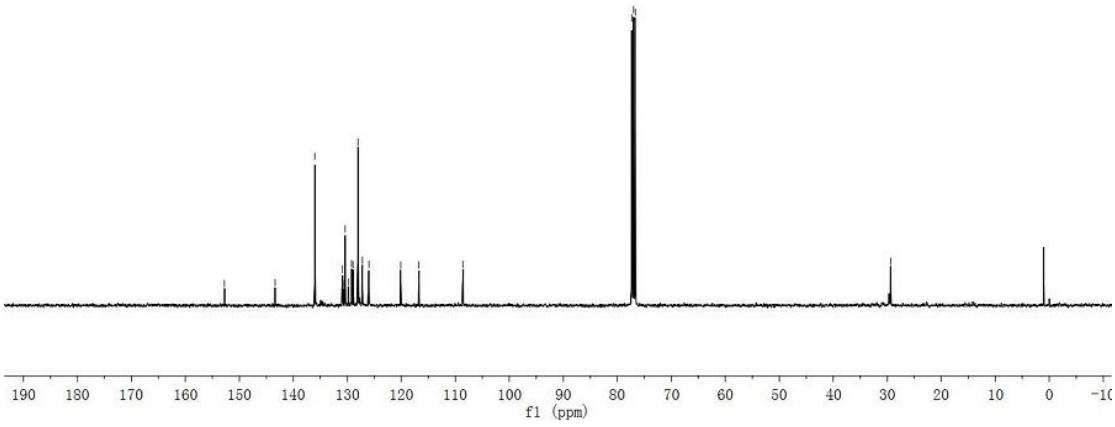
4o


1.05
4.07
1.04
2.08
4.05
1.05
2.02
1.01
1.05
1.00
3.00
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


152.76
143.37
136.01
130.42
129.22
128.92
128.01
127.22
126.01
77.32
77.00
76.68
29.34


SiPh2H
S
N

4o


190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)