Supporting Information

A one-step synthesis of chiral multifluorine-substituted-alkoxy boranils using H_3BO_3 as the boron source

Shumi Han,[a] Yingchao Dou,*[a] and Jun-Long Niu*[a,b]

[a]College of Chemistry, Pingyuan Laboratory, Zhengzhou University, Zhengzhou, 450001, China.
[b]State Key Laboratory of Coking Coal Resources Green Exploitation, Zhengzhou University, Zhengzhou, 450001, China

E-mail address: yingchaodou@zzu.edu.cn (Y.D.); niujunlong@zzu.edu.cn (J.-L.N.)

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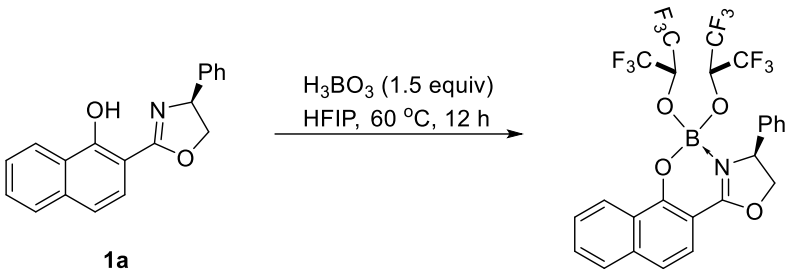
1. General Information.

All materials were commercially obtained and used without further purification. High-resolution mass spectrometry (HRMS) was performed on an Agilent 1290 instrument with an ESI ion source. Fluorescence emission spectra were recorded on an RF-6000 spectrofluorophotometer. Quantum yields were determined using FLS1000 and FLS980 fluorescence spectrometer. UV-vis absorption spectra were recorded on an UV-2600i UV-vis spectrophotometer. Single-crystal X-ray diffraction (SCXRD) analyses were carried out on a Bruker APEX-II CCD diffractometer. ^{1}H NMR, ^{13}C NMR and ^{19}F NMR spectra were recorded at 600 MHz, 151 MHz, and 565 MHz respectively on a Bruker DPX instrument using Me_4Si as an internal standard. Chemical shift multiplicities are reported as follows: (s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet, br = broad, dd = doublet of doublet, dt = doublet of triplet, td = triplet of doublet).The conversion of starting materials was monitored by thin layer chromatography (TLC) using silica gel plates (silica gel 60 F254 0.25 mm), and components were visualized by observation under UV light (254 and 365 nm). Column chromatography was performed on silica gel 200-300 mesh.

2. Optimization of reaction conditions

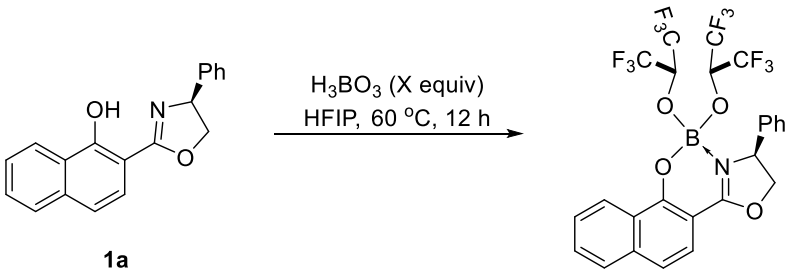
Table S1. Optimization of HFIP[a]



Entry	HFIP	Yield (%)
1[b]	2 equiv	trace
2[c]	2 equiv	trace
3	0.5 mL	53
4	**1.0 mL**	**55**

[a]Reaction conditions: **1a** (0.05 mmol), H_3BO_3 (0.15 mmol) in HFIP (1.0 mL) at 60 °C under air for 12 h, isolated yields.[b]DCE (0.5 mL). [c]$CHCl_3$ (0.5 mL).

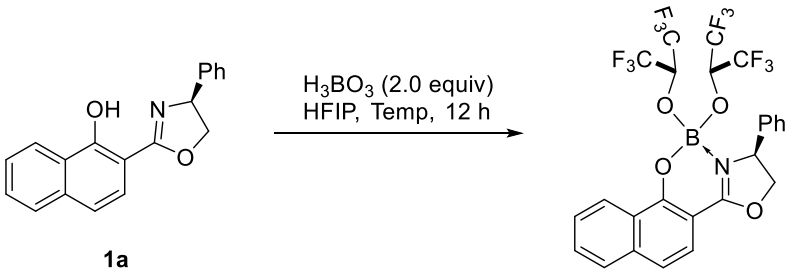
Table S2. Optimization of H_3BO_3[a]



Entry	H_3BO_3 (x equiv)	Yield (%)
1	1.5	55
2	**2.0**	**64**
3	2.5	30
4	5.0	trace

[a]Reaction conditions: **1a** (0.05 mmol), H_3BO_3 (0.1 mmol) in HFIP (1.0 mL) at 60 °C under air for 12 h, isolated yields.

Table S3. Optimization of temperature[a]

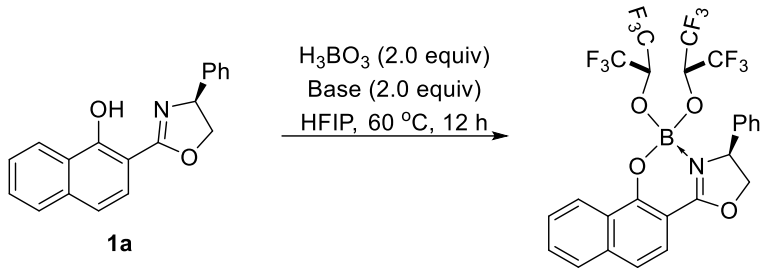


Entry	Temp (°C)	Yield (%)
1	40	68
2	**60**	**64**
3	80	18

4	100	23

[a]Reaction conditions: **1a** (0.05 mmol), H_3BO_3 (0.1 mmol) in HFIP (1.0 mL) at 60 °C under air for 12 h, isolated yields.

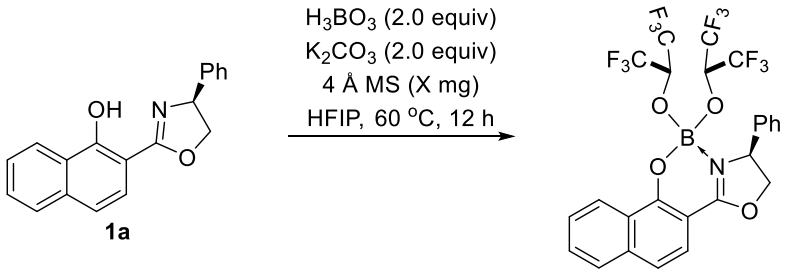
Table S4. Optimization of base[a]



Entry	Base	Yield (%)
1	none	64
2	**K_2CO_3**	**84**
3	Cs_2CO_3	75
4	NaOH	81

[a]Reaction conditions: **1a** (0.05 mmol), H_3BO_3 (0.1 mmol), K_2CO_3 (0.1 mmol) in HFIP (1.0 mL) at 60 °C under air for 12 h, isolated yields.

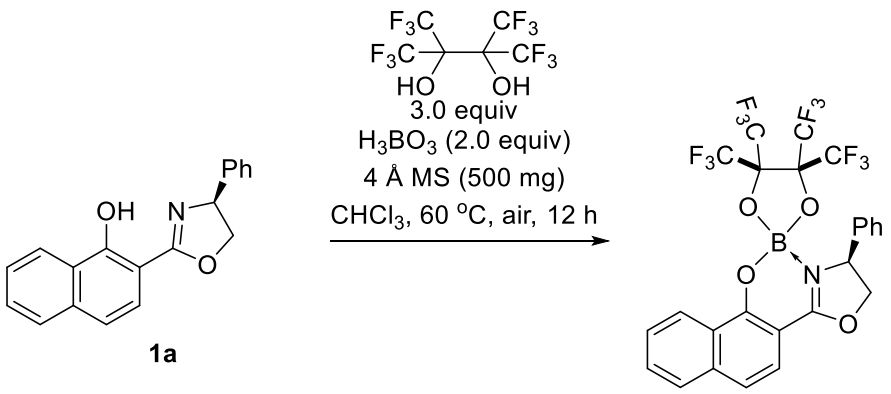
Table S5. Optimization of 4 Å MS[a]



Entry	4 Å MS (x mg)	Yield (%)
1	None	84
2	**250**	**98**

[a]Reaction conditions: **1a** (0.05 mmol), H_3BO_3 (0.1 mmol), K_2CO_3 (0.1 mmol), 4 Å MS (250 mg) in HFIP (1.0 mL) at 60 °C under air for 12 h, isolated yields.

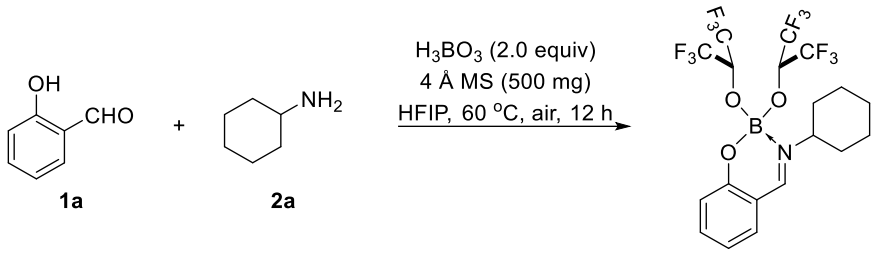
Table S6. Optimization of single-molecule phenoxyoxazoline boron complexes[a]



Entry	Variation from standard conditions	Yield (%)
1	**none**	**98**
2	DCE instead of $CHCl_3$	42

[a]Reaction conditions: **1a** (0.1 mmol), H_3BO_3 (2.0 equiv), perfluoropinacacol (3.0 equiv), 4ÅMS (500 mg) in $CHCl_3$ (2.0 mL) at 60 °C under air for 12 h, isolated yield.

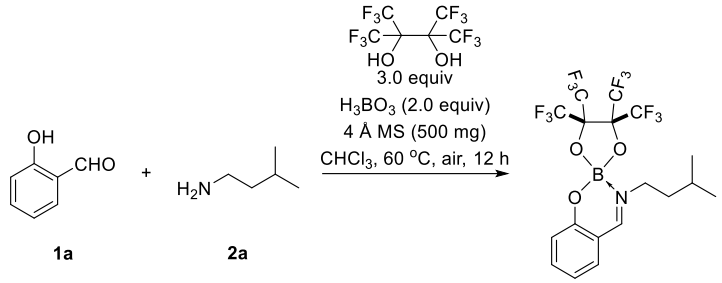
Table S7. Optimization of single-molecule salicylaldehyde imine boron complexes[a]



Entry	Variation from standard conditions	Yield (%)
1	**none**	**75**
2	K_2CO_3 of 30 equiv	trace

[a]Reaction conditions: **1a** (0.1 mmol), **2a** (0.2 mmol), H_3BO_3 (0.2 mmol), 4ÅMS (500 mg) in HFIP (2.0 mL) at 60 °C under air for 12 h, isolated yields.

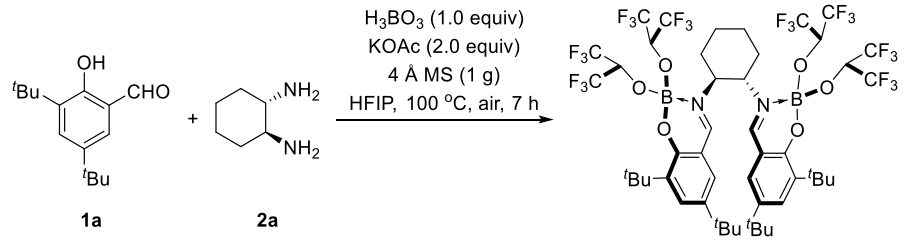
Table S8. Optimizaion of single-molecule salicylaldehyde imine boron complexes[a]



Entry	Variation from standard conditions	Yield (%)
1	none	76
2	2a of 1.0 equiv	33
3	Perfluoropinacacol of 2.0	35
4	Perfluoropinacacol of 4.0	39

[a]Reaction conditions: **1a** (0.1 mmol), **2a** (0.2 mmol), perfluoropinacacol (3.0 equiv), H_3BO_3 (2.0 equiv), 4ÅMS (500 mg) in $CHCl_3$ (2.0 mL) at 60 °C under air for 12 h, isolated yields.

Table S9. Optimization of bimolecular boron complexe[a]

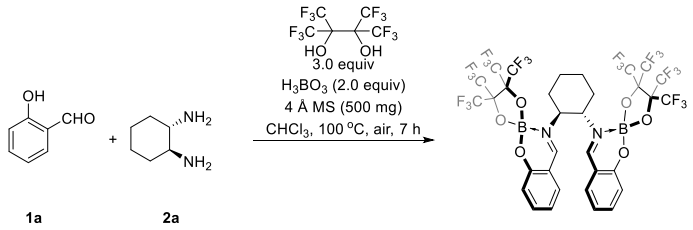


Entry	Variation from standard conditions	Yield (%)
1	none	65

2	60 °C	16
3	2a of 2.0 equiv	13
4	H_3BO_3 of 2.0 equiv	51
5	without KOAc	19
6	KOAc of 1.0 equiv	59
7	HFIP of 2 mL	47

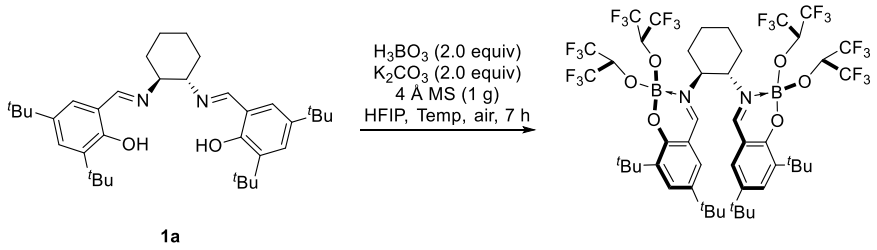
[a]Reaction conditions: **1a** (0.1 mmol), **2a** (0.05 mmol), H_3BO_3 (0.1 mmol), KOAc (0.2 mmol), 4ÅMS (1 g) in HFIP (3.0 mL) at 100 °C under air for 7 h, isolated yields.

Figure S1. Bimolecular boron complexe[a]



[a]Reaction conditions: **1a** (0.1 mmol), **2a** (0.05 mmol), perfluoropinacacol (0.3 mmol), H_3BO_3 (0.2 mmol), 4 Å MS (500 mg) in extra dry $CHCl_3$ (2.0 mL) at 100 °C under air for 7 h, isolated yields, 60%.

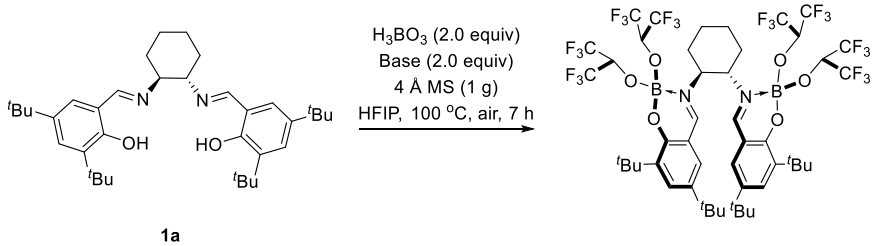
Table S10. Optimization of temperature[a]



Entry	Temp (°C)	Yield (%)
1	25	trace
2	60	9
3	80	11
4	**100**	**17**
5	120	4

[a]Reaction conditions: **1a** (0.05 mmol), H_3BO_3 (0.2 mmol), K_2CO_3 (0.2 mmol), 4 Å MS (1 g) in HFIP (2.0 mL) at 100 °C under air for 7 h, isolated yields.

Table S11. Optimization of base[a]

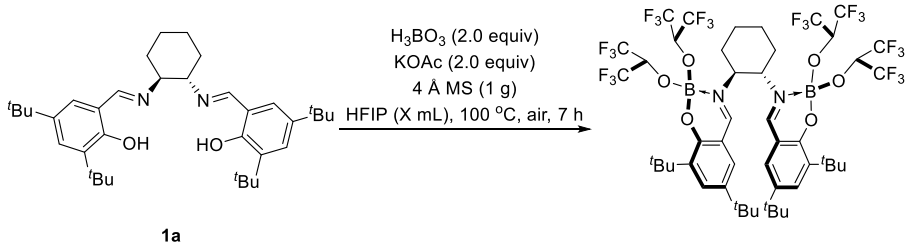


Entry	Base	Yield (%)

1	K_2CO_3	17
2	**KOAc**	**51**

[a]Reaction conditions: **1a** (0.05 mmol), H_3BO_3 (0.2 mmol), KOAc (0.2 mmol), 4 Å MS (1 g) in HFIP (2.0 mL) at 100 °C under air for 7 h, isolated yields. [b]Without 4 Å MS.

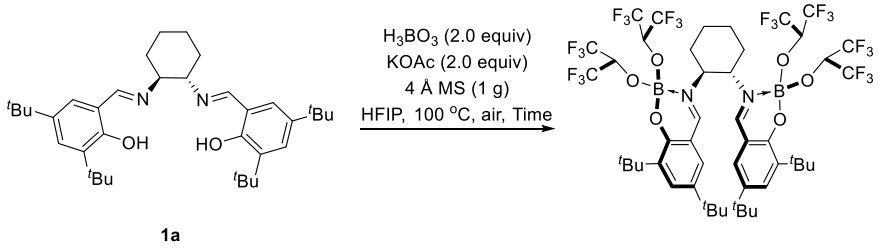
Table S12. Optimization of HFIP[a]



Entry	HFIP (x mL)	Yield (%)
1	2	51
2	**3**	**55**

[a]Reaction conditions: **1a** (0.05 mmol), H_3BO_3 (0.2 mmol), KOAc (0.2 mmol), 4 Å MS (1 g) in HFIP (3.0 mL) at 100 °C under air for 7 h, isolated yields.

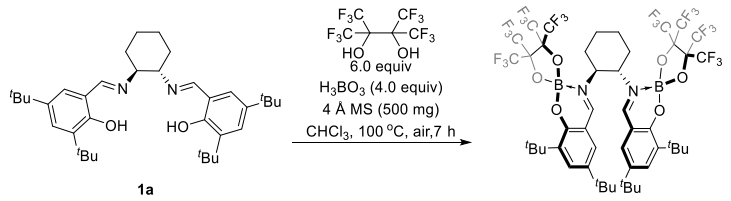
Table S13. Optimization of time[a]



Entry	Time (h)	Yield (%)
1	7	55
2	**12**	**73**

[a]Reaction conditions: **1a** (0.05 mmol), H_3BO_3 (0.2 mmol), KOAc (0.2 mmol), 4 Å MS (1 g) in HFIP (3.0 mL) at 100 °C under air for 12 h, isolated yields.

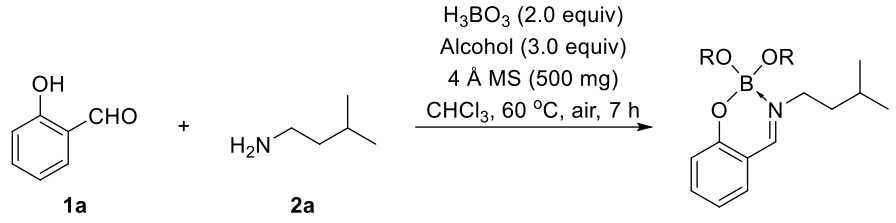
Table S14. Optimization of bimolecular boron complexe[a]



Entry	Variation from standard conditions	Yield (%)
1	none	22
2	$CHCl_3$ instead of extra dry $CHCl_3$	20
3	without 4 Å MS	N.D.[b]
4	4 Å MS of 1000 mg	N.D.[b]

[a]Reaction conditions: **1a** (0.05 mmol), perfluoropinacacol (0.3 mmol), H_3BO_3 (0.2 mmol), 4 Å MS (500 mg) in extra dry $CHCl_3$ (2.0 mL) at 100 °C under air for 7 h, isolated yields. [b]No detected.

Table S15. Optimization of Alcohol[a]



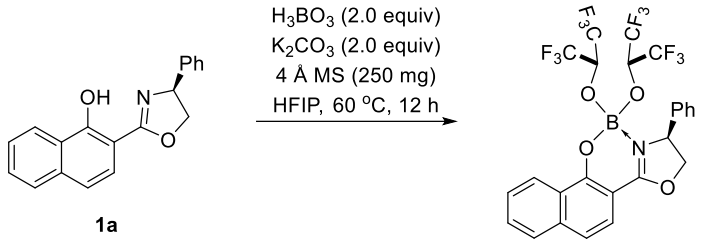
1a 2a

Entry	Alcohol (3.0 equiv)	Yield (%)
1	CF_3CH_2OH	5%
2[b]	CF_3CH_2OH	trace
3	EtOH	N.D.[b]
4[c]	EtOH	N.D.[b]

[a]Reaction conditions: **1a** (0.1 mmol), **2a** (0.2 mmol), H_3BO_3 (0.2 mmol), alcohol (3.0 equiv), 4ÅMS (500 mg) in $CHCl_3$ (2.0 mL) at 60 °C under air for 7 h, isolated yields. [b]CF_3CH_2OH (2 mL), without $CHCl_3$, [c]EtOH (2 mL), without $CHCl_3$.

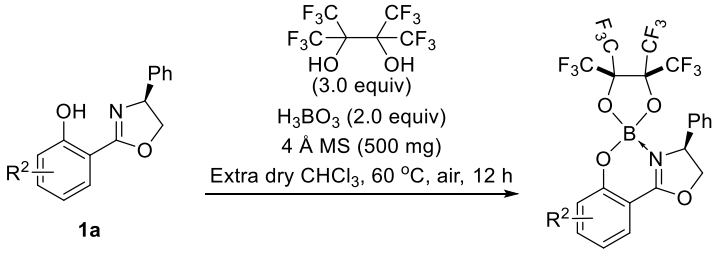
3. General procedure for the synthesis of products 4-6.

3.1 General procedure for the synthesis of products 4a.



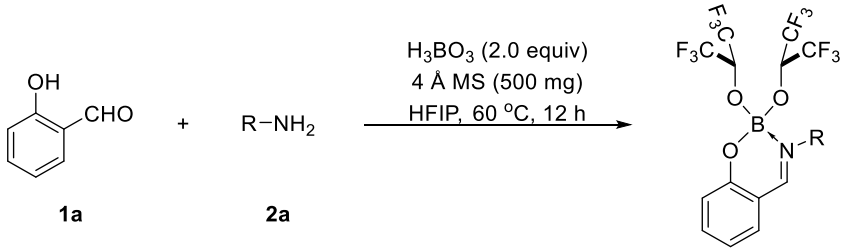
An oven dried 15 mL pressure tube was charged with **1a** (0.05 mmol), the boronic acid (0.1 mmol), potassium carbonate (0.1 mmol) and 4 Å molecular sieves (250 mg) with subsequent addition of hexafluoroisopropanol (1 mL) as solvent. Then, the reaction system was stirred at 60 °C for 12 h. After the reaction was completed, the reaction mixture was filtered through Celite, then the reaction mixture was concentrated and purified by column chromatography using petroleum ether to petroleum ether/ethyl acetate (10:1) as the eluent to afford the corresponding products.

3.2 General procedure for the synthesis of products 4b-4i.



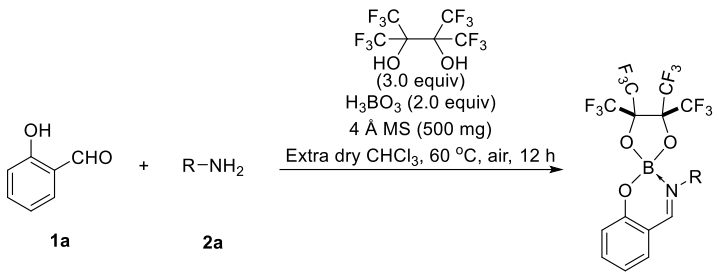
An oven dried 15 mL pressure tube was charged with **1a** (0.1 mmol), perfluoropinacacol (0.3 mmol), the boronic acid (0.2 mmol) and 4 Å molecular sieves (500 mg) with subsequent addition of extra dry chloroform (2 mL) as solvent. Then, the reaction system was stirred at 60 °C for 12 h. After the reaction was completed, the reaction mixture was filtered through Celite, then the reaction mixture was concentrated and purified by column chromatography using petroleum ether to petroleum ether/ethyl acetate (10:1) as the eluent to afford the corresponding products.

3.3 General procedure for the synthesis of products 5a-5c.



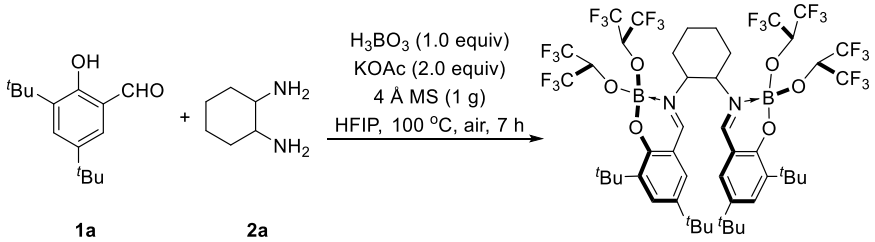
An oven dried 15 mL pressure tube was charged with **1a** (0.1 mmol), **2a** (0.2 mmol), the boronic acid (0.2 mmol), and 4 Å molecular sieves (500 mg) with subsequent addition of hexafluoroisopropanol (2 mL) as solvent. Then, the reaction system was stirred at 60 °C for 12 h. After the reaction was completed, the reaction mixture was filtered through Celite, then the reaction mixture was concentrated and purified by column chromatography using petroleum ether to petroleum ether/ethyl acetate (10:1) as the eluent to afford the corresponding products.

3.4 General procedure for the synthesis of products 5d-5i.



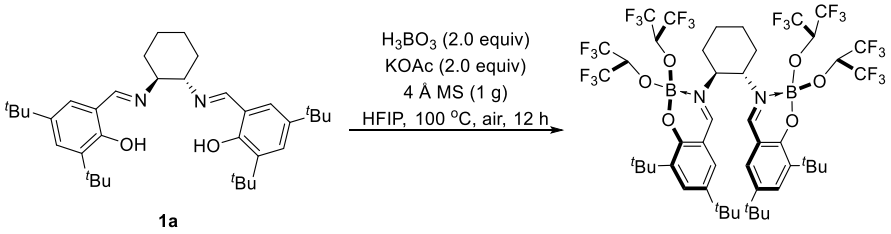
An oven dried 15 mL pressure tube was charged with **1a** (0.1 mmol), **2a** (0.2 mmol), perfluoropinacacol (0.3 mmol), the boronic acid (0.2 mmol) and 4 Å molecular sieves (500 mg) with subsequent addition of extra dry chloroform (2 mL) as solvent. Then, the reaction system was stirred at 60 °C for 12 h. After the reaction was completed, the reaction mixture was filtered through Celite, then the reaction mixture was concentrated and purified by column chromatography using petroleum ether to petroleum ether/ethyl acetate (10:1) as the eluent to afford the corresponding products.

3.5 General procedure for the synthesis of products 6a and 6b.



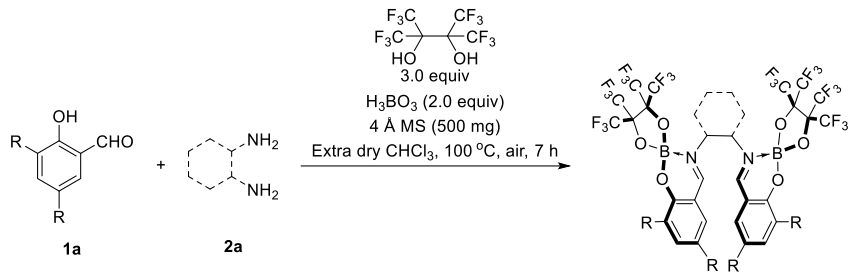
An oven dried 15 mL pressure tube was charged with **1a** (0.1 mmol), **2a** (0.05 mmol), the boronic acid (0.1 mmol), potassium acetate (0.2 mmol), and 4 Å molecular sieves (1 g) with subsequent addition of hexafluoroisopropanol (3 mL) as solvent. Then, the reaction system was stirred at 100 °C for 7 h. After the reaction was completed, the reaction mixture was filtered through Celite, then the reaction mixture was concentrated and purified by column chromatography using petroleum ether as the eluent to afford the corresponding products.

3.6 General procedure for the synthesis of products 6a,6b and 6f.



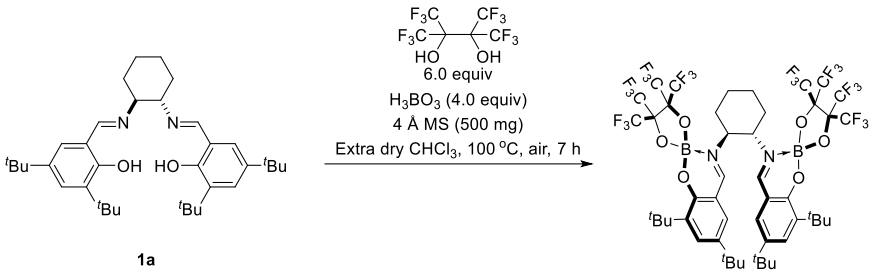
An oven dried 15 mL pressure tube was charged with **1a** (0.05 mmol), the boronic acid (0.2 mmol), potassium acetate (0.2 mmol), and 4 Å molecular sieves (1 g) with subsequent addition of hexafluoroisopropanol (3 mL) as solvent. Then, the reaction system was stirred at 100 °C for 7 h. After the reaction was completed, the reaction mixture was filtered through Celite, then the reaction mixture was concentrated and purified by column chromatography using petroleum ether as the eluent to afford the corresponding products.

3.7 General procedure for the synthesis of products 6c-6e.



An oven dried 15 mL pressure tube was charged with **1a** (0.1 mmol), **2a** (0.05 mmol), the boronic acid (0.2 mmol), perfluoropinacacol (0.3 mmol), and 4 Å molecular sieves (500 mg) with subsequent addition of extra dry Chloroform (2 mL) as solvent. Then, the reaction system was stirred at 100 °C for 7 h. After the reaction was completed, the reaction mixture was filtered through Celite, then the reaction mixture was concentrated and purified by column chromatography using petroleum ether to petroleum ether/ethyl acetate (10:1) as the eluent to afford the corresponding products.

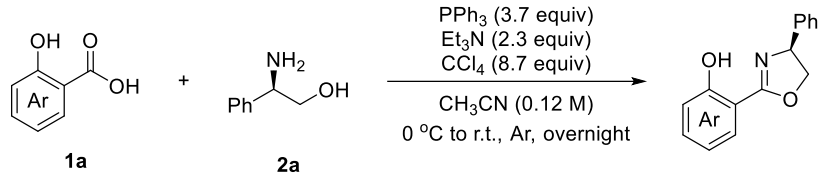
3.8 General procedure for the synthesis of products 6g.



An oven dried 15 mL pressure tube was charged with **1a** (0.05 mmol), the boronic acid (0.2 mmol), perfluoropinacacol (0.3 mmol), and 4 Å molecular sieves (500 mg) with subsequent addition of extra dry Chloroform (2 mL) as solvent. Then, the reaction system was stirred at 100 °C for 7 h. After the reaction was completed, the reaction mixture was filtered through Celite, then the reaction mixture was concentrated and purified by column chromatography using petroleum ether as the eluent to afford the corresponding products.

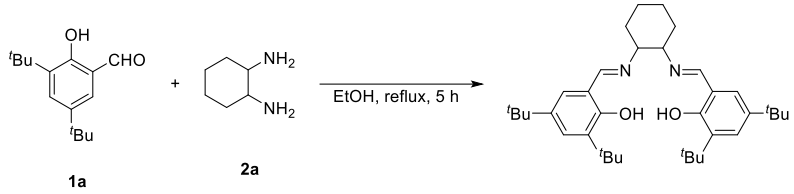
4. General procedure for the synthesis of substrates.

4.1 General procedure for the monoxazoline compound.



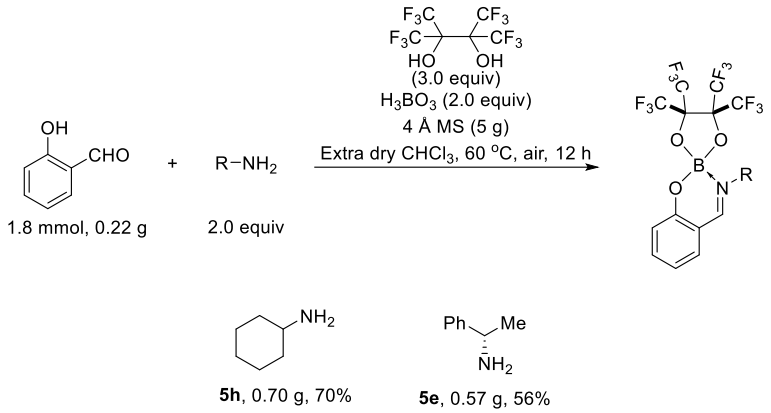
An oven-dried 150 mL Schlenk flask was charged with **1a** (11 mmol), **2a** (1.37 g, 10 mmol) and PPh_3 (9.70 g, 37 mmol) under argon atmosphere. Then CH_3CN (83 mL), Et_3N (3.20 mL, 23 mmol) and CCl_4 (8.40 mL, 87 mmol) were added sequentially. The mixture was stirred at 0 ºC for 1 h, After being stirred at room temperature overnight, the reaction was quenched with water. The organic layer was separated and extracted with ethyl acetate, washed with water, brine, dried over anhydrous Na_2SO_4. then the reaction mixture was concentrated and purified by column chromatography using petroleum ether to petroleum ether/ethyl acetate (10:1) as the eluent to afford target product.

4.2 General procedure for salen.



An oven-dried 10 mL pressure tube was charged with **1a** (0.47 g, 2 mmol), **2a** (0.12 mL, 1 mmol). Then EtOH (10 mL) was added sequentially. The mixture was stirred at 80 ºC for 5 h, Upon completion, the reaction was Cooled to r.t.. Then Collect the resulting solid by filtration, and wash the solid with a small portion of ethanol to afford target product in 80% yield.

5. Large-scale experiment.



5h, 0.70 g, 70%

5e, 0.57 g, 56%

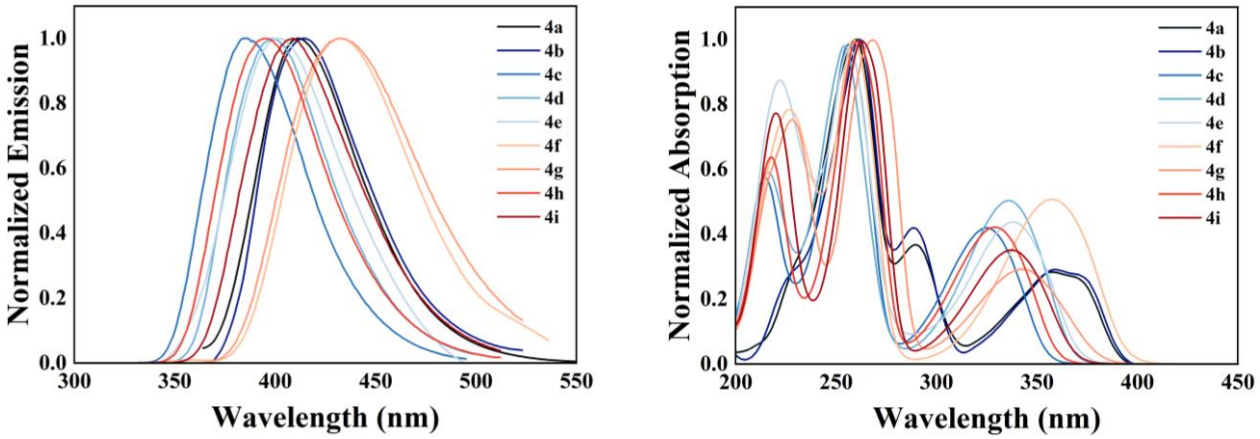
An oven dried 100 mL pressure tube was charged with syringaldehyde (1.8 mmol), amine (3.6 mmol), perfluoropinacacol (5.4 mmol), the boronic acid (3.6 mmol) and 4 Å molecular sieves (5 g) with subsequent addition of extra dry chloroform (36 mL) as solvent. The solution was stirred at 60 °C for 12 h. After the reaction was completed, the reaction mixture was filtered through Celite, then the reaction mixture was concentrated and purified by column chromatography using petroleum ether/ethyl acetate (from 100:1 to 10:1) as the eluent to afford target product.

6. Fluorescence spectrum, quantum yield, CPL spectra of several representative products.

6.1 Fluorescence spectrum of several representative products.

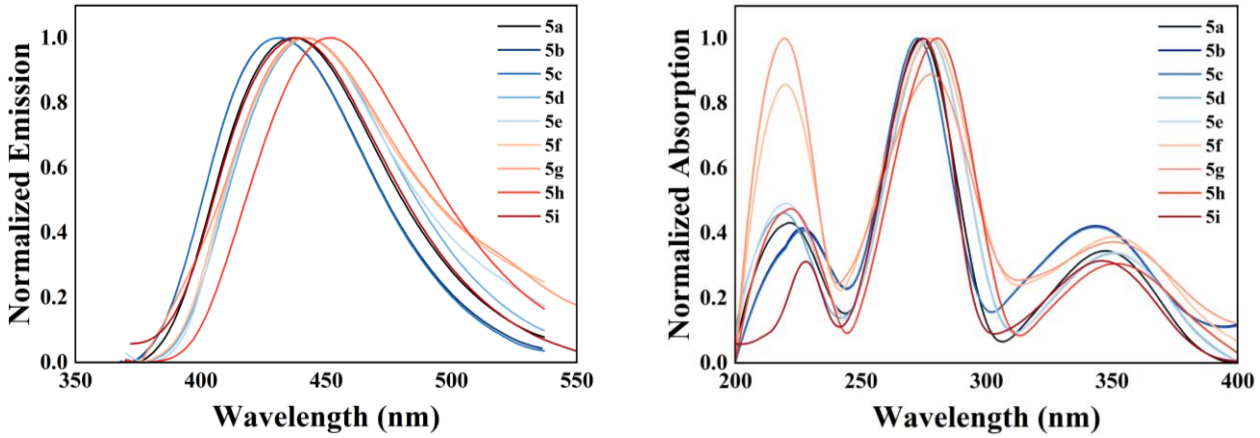
(a) Fluorescence emission spectra of 4a-4i

(b) Fluorescence absorption spectra of 4a-4i



(c) Fluorescence emission spectra of 5a-5i

(d) Fluorescence absorption spectra of 5a-5i



(e) Fluorescence emission spectra of 6a-6g

(f) Fluorescence absorption spectra of 6a-6g

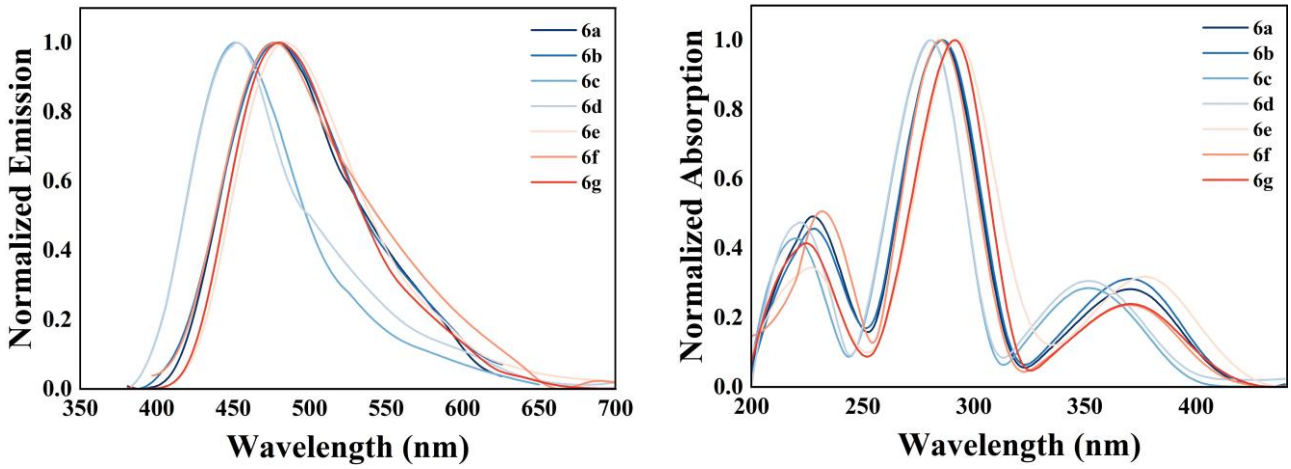


Figure S2. Normalized fluorescence spectra of selected compounds (1×10^{-5} mol/L) recorded in CH_3CN.

6.2 Normalized UV-vis absorption spectra of several representative products.

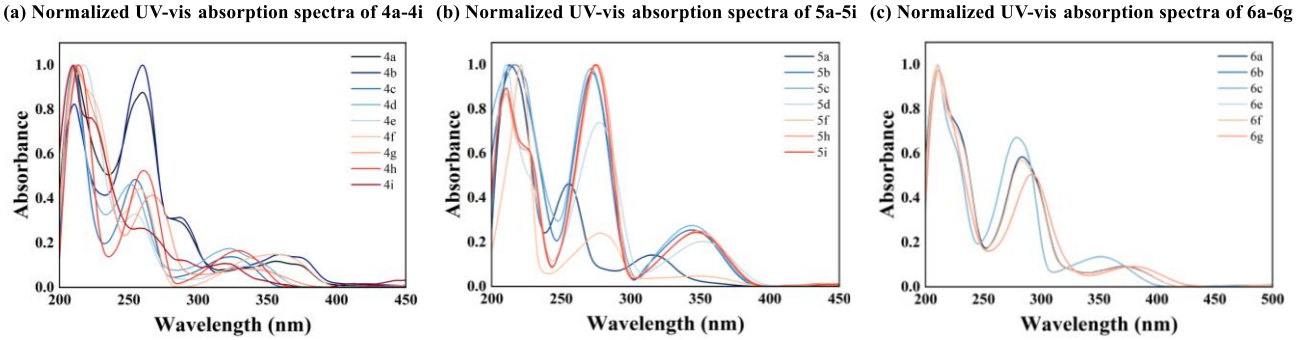


Figure S3. Normalized UV-vis absorption spectra of selected compounds (1×10^{-5} mol/L) recorded in CH_3CN.

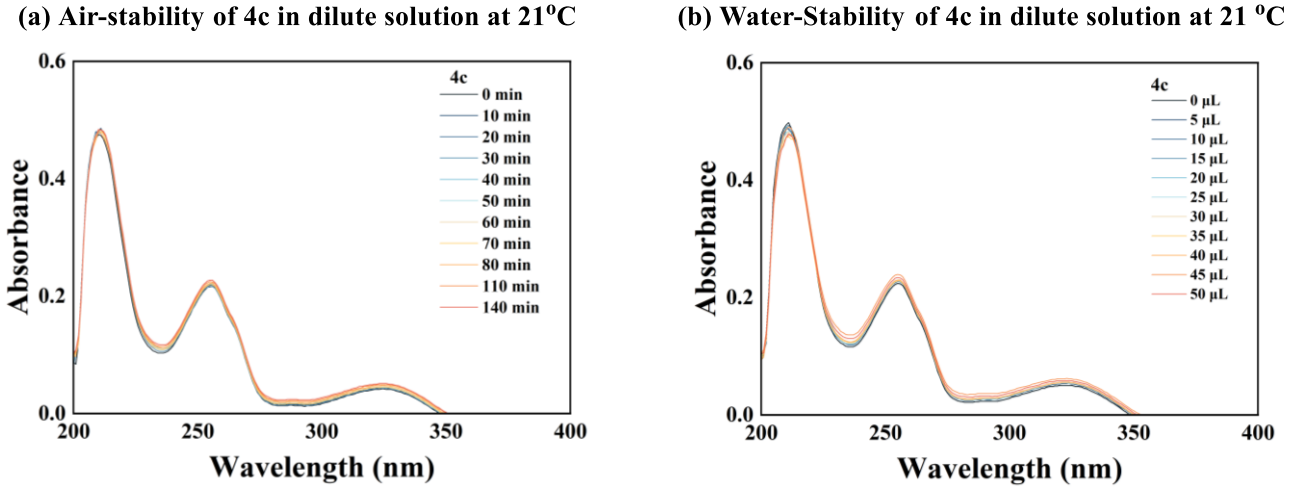


Figure S4. To evaluate if the prepared compounds are prone to hydrolytic degradation, we measured the UV-Vis spectroscopy of compound **4c** (concentration: 1×10^{-5} mol/L) at 21 °C, and no significant decrease in its UV absorption intensity was observed over time. Subsequently, water was added to the dilute solution of **4c**. Only a slight decrease of absorption intensity was observed.

6.3 Quantum yield spectra of several representative products.

The QY of representative compounds were measured in dichloromethane (concentration: 1×10^{-5} mol/L) using an FLS980 and an FLS 1000 fluorescence spectrometer. First, a blank experiment was conducted by adjusting the excitation and emission slits at the maximum excitation wavelength, with the excitation slit approximately 10 times wider than the emission slit. Subsequently, the sample to be tested was scanned under the same conditions within its fluorescence emission wavelength range. After scanning, the obtained sample spectrum was overlaid with the blank spectrum, and integration was performed to determine the quantum yield of the sample compound.

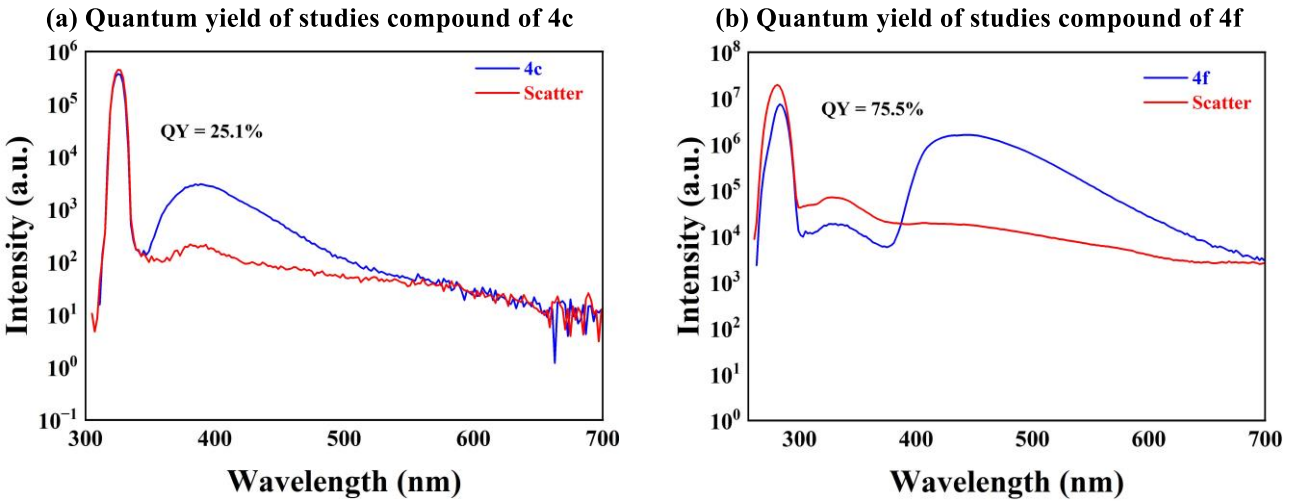


Figure S5. Fluorescence quantum yields of **4c and 4f** (1×10^{-5} mol/L) recorded in DCM. Excitation at 325 nm, 280 nm, respectively. Use FLS1000.

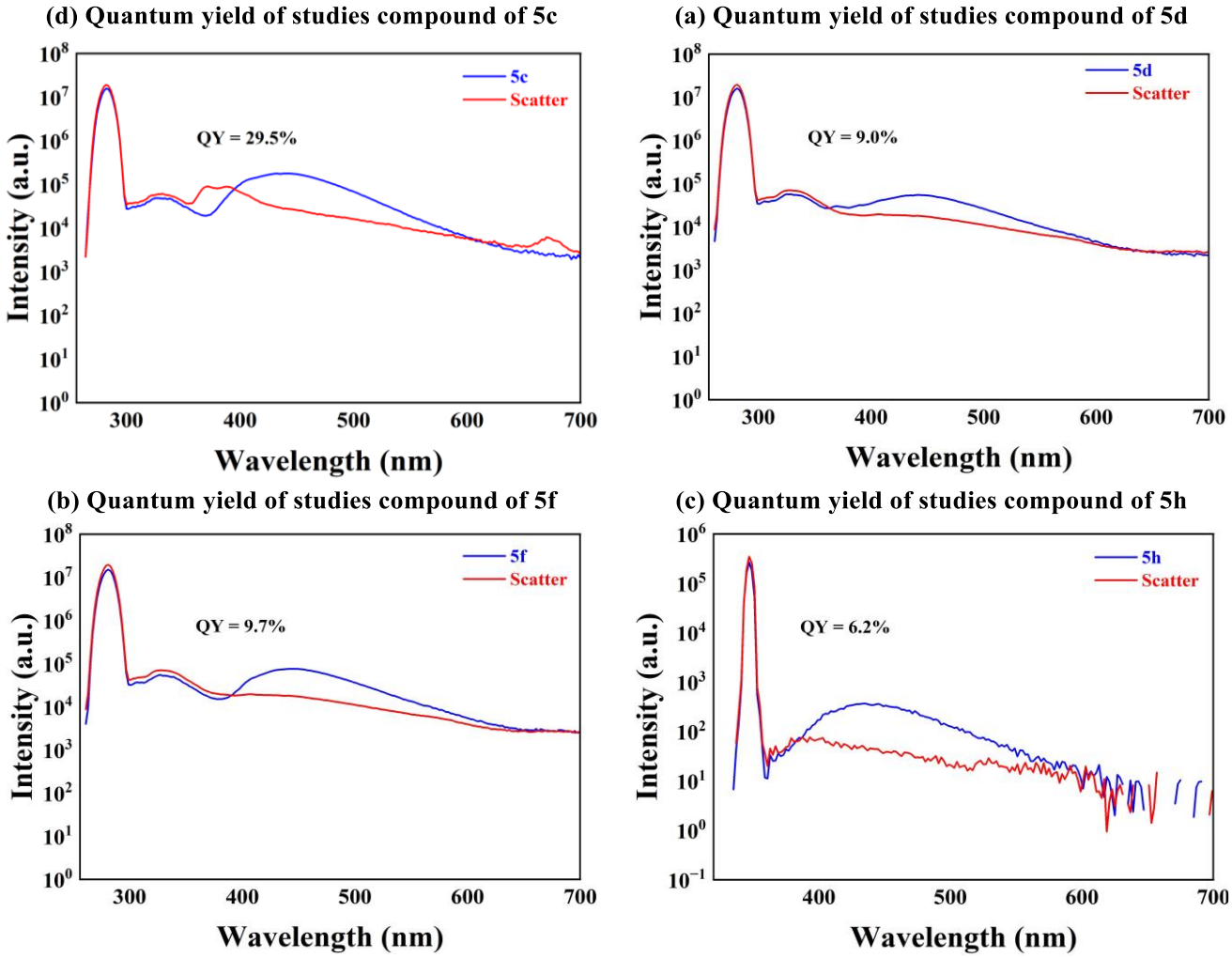


Figure S6. Fluorescence quantum yields of **5d-5h** (1×10^{-5} mol/L) recorded in DCM. Excitation wavelength (**5c** is 283 nm, **5d**, **5f** and **5h** is 281 nm). Use an FLS1000 fluorescence spectrometer.

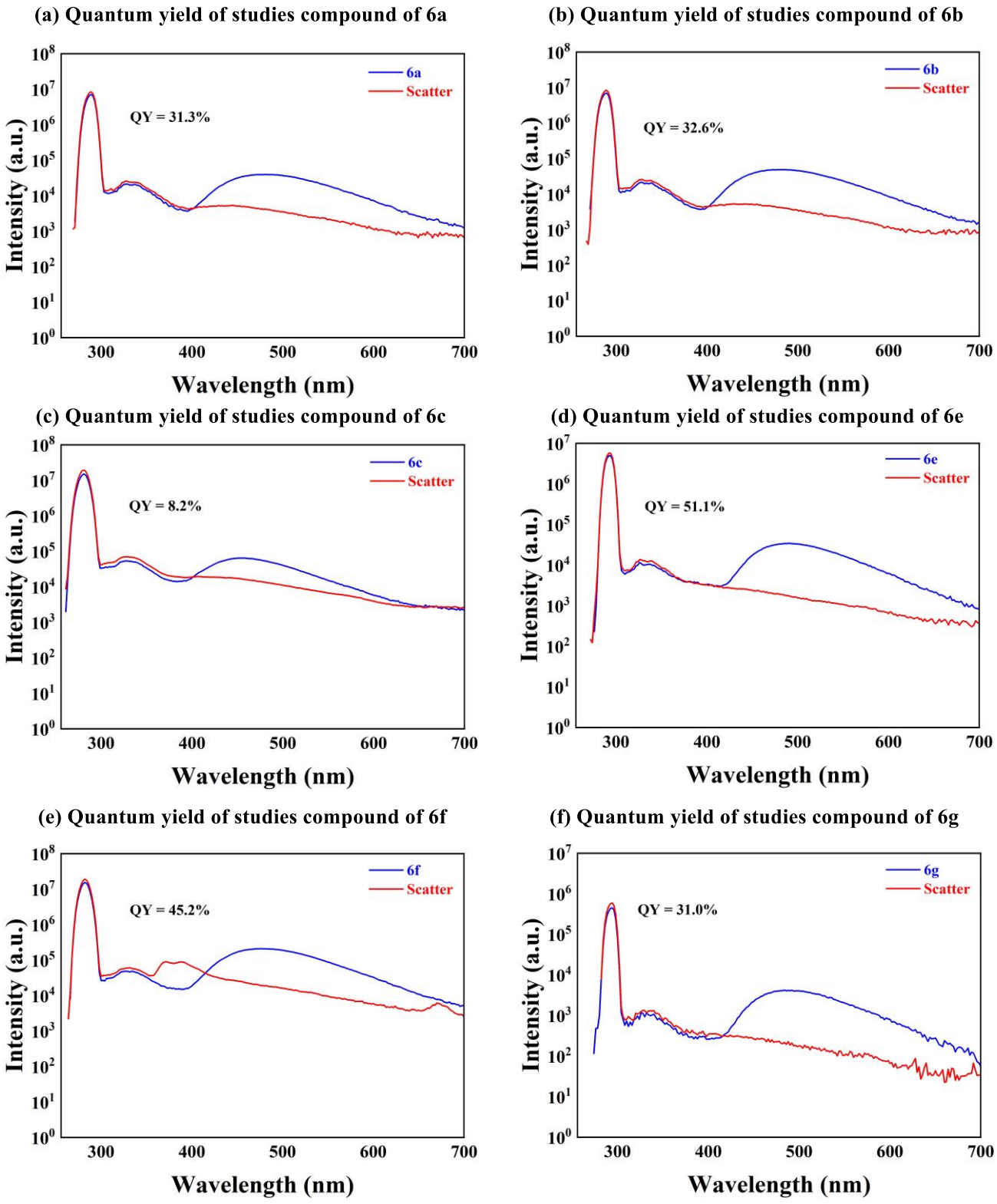


Figure S7. Fluorescence quantum yields of **6a-6g** (1×10^{-5} mol/L) recorded in DCM. Excitation wavelength (**6a** and **6b** is 287 nm, **6f** is 283 nm, **6c** is 281 nm, **6e** and **6g** is 292 nm). Use an FLS1000 fluorescence spectrometer.

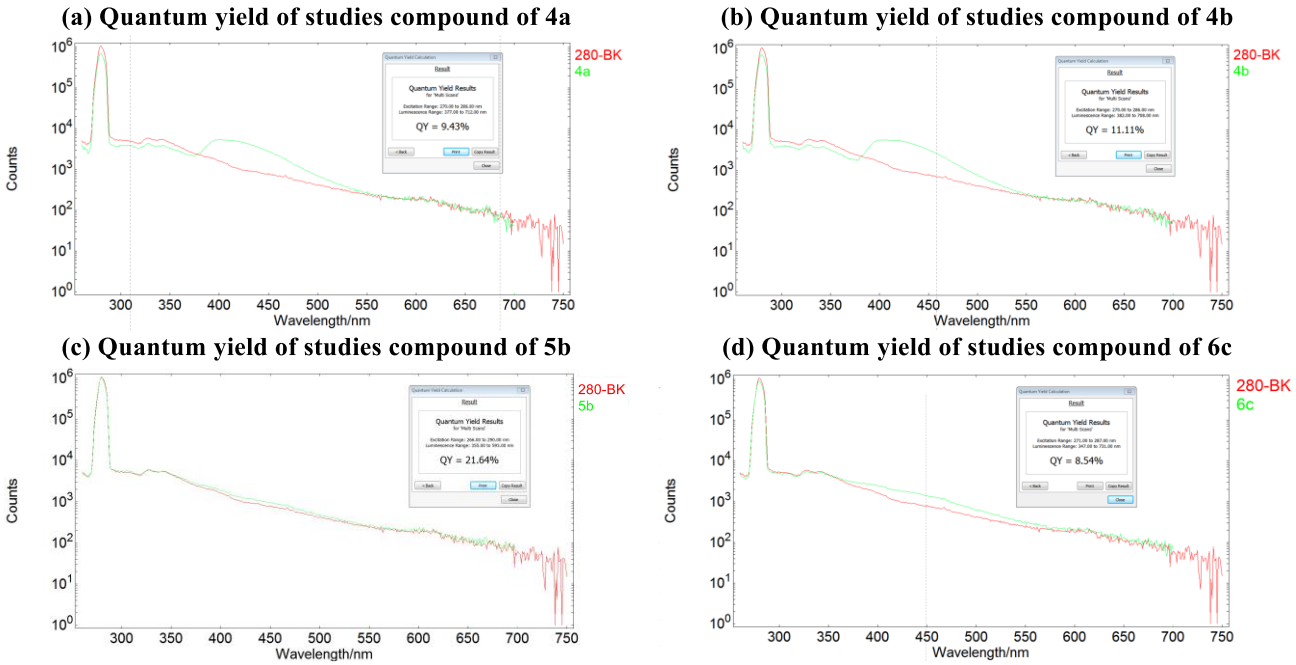


Figure S8. Fluorescence quantum yields of selected compounds (1×10^{-5} mol/L) recorded in DCM. Excitation wavelength (280 nm). Use an FLS980 fluorescence spectrometer.

6.4 Fluorescence spectra data of several representative products.

Table S16 Photophysical data of Selected Compounds.

Compounds	λ_{abs} (nm)[a]	λ_{ex} (nm)[b]	λ_{em} (nm)[c]	QY (%)[d]
4a	260	255	413	9.4
4b	260	263	415	11.1
4c	255	255	385	25.1
4d	251	255	398	–[e]
4e	255	255	401	–[e]
4f	258	259	433	75.5
4g	267	268	431	–[e]
4h	261	261	396	–[e]
4i	261	263	409	–[e]
5a	255	273	438	–[e]
5b	272	273	432	21.6
5c	272	273	432	29.5
5d	278	279	440	9.0
5e	–[f]	277	439	–[e]
5f	278	279	441	9.7
5g	–[f]	274	442	–[e]
5h	276	281	451	6.2
5i	275	275	438	–[e]
6a	284	284	477	31.3
6b	283	284	477	32.6
6c	279	281	452	8.2
6d	–[f]	281	451	–[e]
6e	292	292	483	51.1

6f	283	281	477	45.2
6g	292	292	480	31.0

[a]Absorption wavelength (concentration: 1×10^{-5} mol/L, in CH_3CN). [b]Maximum excitation wavelength. [c]Maximum emission wavelength (concentration: 1×10^{-5} mol/L, in CH_3CN). [d]Quantum yield (concentration: 1×10^{-5} mol/L, in CH_2Cl_2), [e]The QY was not measured. [f]The UV-Vis was not measured.

6.5 CPL spectra of 6a and 6b, color-tunable fluorescence and image of partial products.

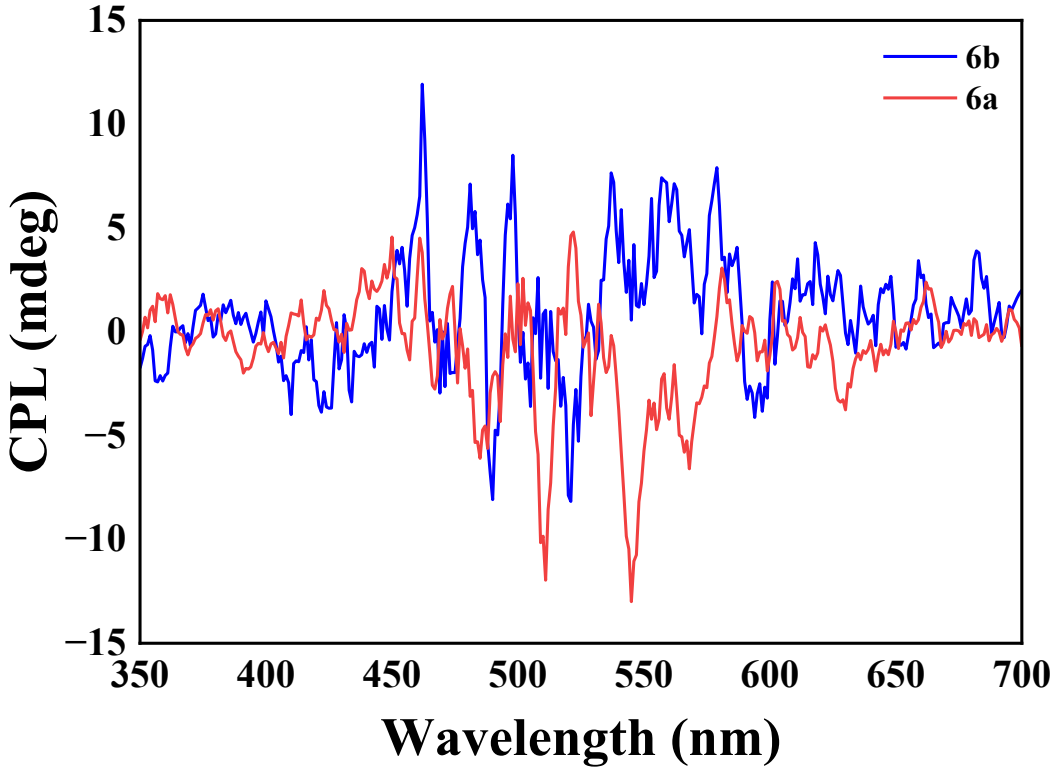


Figure S9. CPL spectra of **6a** and **6b** (1×10^{-5} mol/L) recorded in CH_3CN.

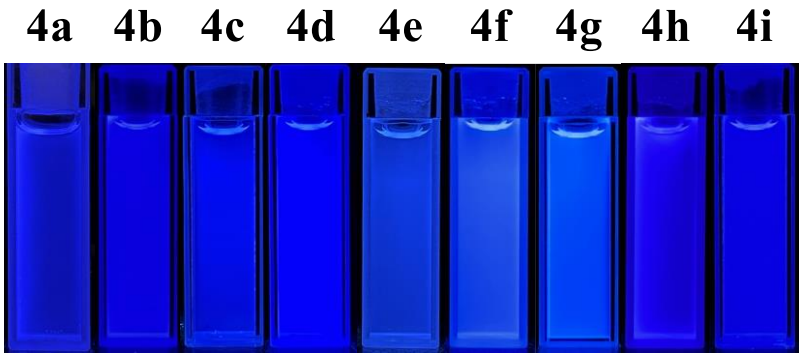


Figure S10. Color-tunable fluorescence of **4a-4i**.

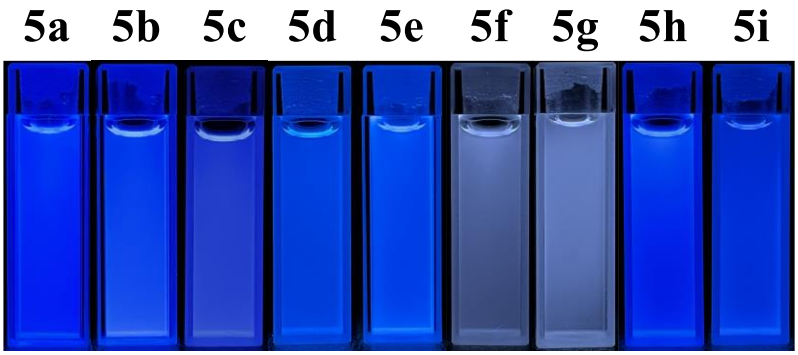


Figure S11. Color-tunable fluorescence of **5a**-**5i**.

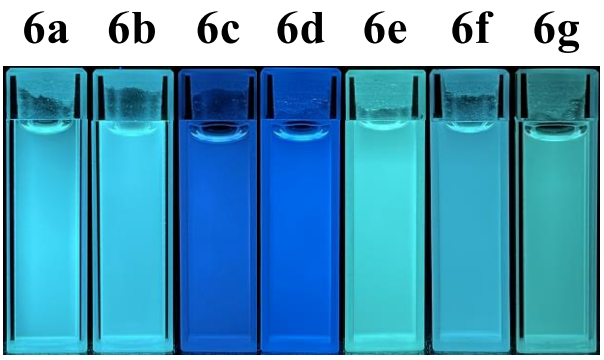


Figure S12. Color-tunable fluorescence of **6a**-**6g**.

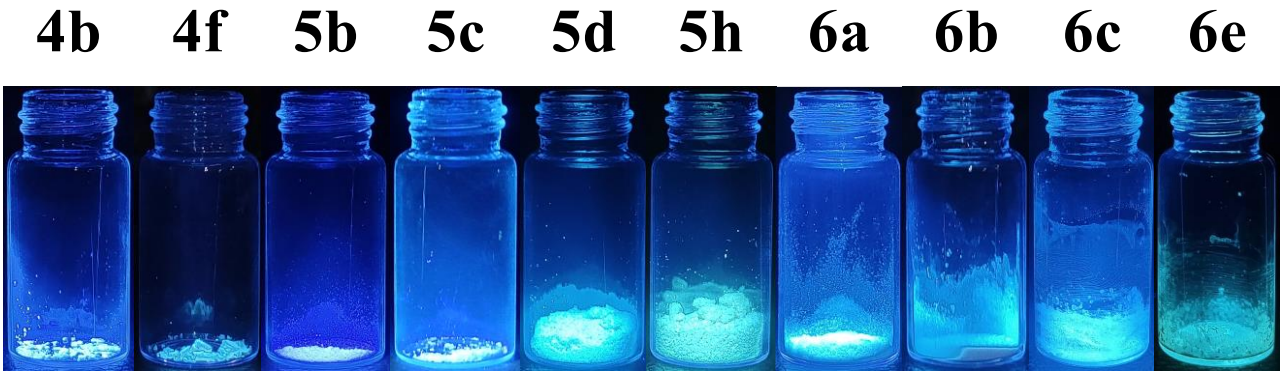


Figure S13. Image of partial products in the solid state at room temperature.

7. X-ray crystal structure of 6a

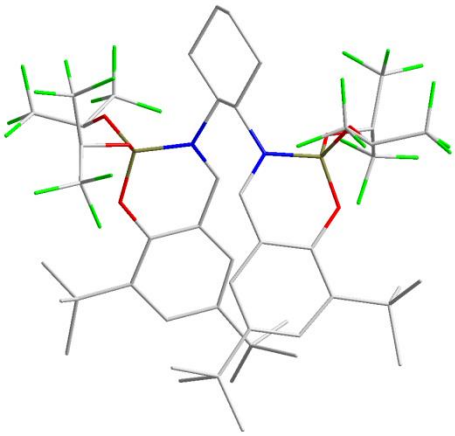


Figure S11. X-ray crystal structure of **6a** (CCDC: 2500278)
Red spheres depict O atoms, gray spheres represent C; blue spheres depict N atoms, brown spheres depict B atoms, greeen spheres depict F atoms; Hydrogen atoms have been omitted for clarity in packing

Crystal data and structure refinement for 6a

Identification code	**6a**
Empirical formula	$C_{48}H_{56}B_2F_{24}N_2O_6$
Formula weight	1234.56
Temperature/K	293.00
Crystal system	monoclinic
Space group	C2
a/Å	23.6425(8)
b/Å	13.8768(8)
c/Å	36.1840(14)
α/	90
β/	104.233(3)
γ/	90
Volume/Å^3	11506.9(9)
Z	8
ρ_{calc}g/cm^3	1.425
μ/mm^{-1}	0.144
F(000)	5056.0
Crystal size/mm^3	0.2 × 0.18 × 0.12
Radiation	MoKα (λ = 0.71073)
2Θ range for data collection/	3.76 to 50.054
Index ranges	-28 ≤ h ≤ 28, -16 ≤ k ≤ 16, -43 ≤ l ≤ 43
Reflections collected	181831
Independent reflections	19998 [R_{int} = 0.0786, R_{sigma} = 0.0357]
Data/restraints/parameters	19998/790/1658

Goodness-of-fit on F^2	1.232
Final R indexes [I>=2σ (I)]	R_1 = 0.0960, wR_2 = 0.2687
Final R indexes [all data]	R_1 = 0.1320, wR_2 = 0.3352
Largest diff. peak/hole / e $Å^{-3}$	0.44/-0.32
Flack parameter	0.0(2)

7.1 Method for crystal growth

The 30 mg of pure compound **6a** was dissolved in 2 mL DCM in a little sample bottle, and 6 mL hexane was added dropwise in the bottle. Then, the bottle was sealed with plastic film, and two holes are made in the plastic film. The bottle was placed in a quiet environment.

7.2 Crystal measurement

A DCM and hexane mixture of **6a** were slowly evaporated at ambient temperature over a period of one day, to afford single crystals suitable for an X-ray crystallographic study. Single-crystal X-ray diffraction data were collected on a Bruker APEX-II CCD diffractometer with MoKα radiation (λ = 0.71073) for compound **6a**. The crystal was kept at 293.00 K during data collection. Using Olex2, the structure was solved with the olex2.solve structure solution program using Charge Flipping and refined with the SHELXL refinement package using Least Squares minimisation.

8. Supplemental references.

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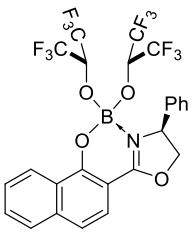
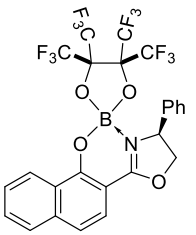
9. Characterization data

(S)-11,11-bis((1,1,1,3,3,3-hexafluoropropan-2-yl)oxy)-1-phenyl-1,2-dihydro-11H-11λ^4,12λ^4-naphtho[2,1-e]oxazolo[3,2-c][1,3,2]oxazaborinine (4a)



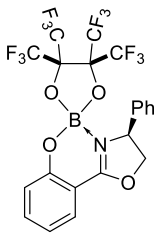
Yield: 31.0 mg (98%). Colorless oil. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 8.4 (d, *J* = 8.34 Hz, 1H), 7.9 (d, *J* = 8.21 Hz, 1H), 7.7 (td, *J* = 7.38, 1.22 Hz, 1H), 7.7 (d, *J* = 8.73 Hz, 1H), 7.6 (t, *J* = 7.64 Hz, 1H), 7.5 (d, *J* = 8.75 Hz, 1H), 7.4 – 7.3 (m, 5H), 5.5 (dd, *J* = 9.84, 6.54 Hz, 1H), 5.2 (t, *J* = 9.56 Hz, 1H), 4.8 (dd, *J* = 9.29, 6.55 Hz, 1H), 4.8 (s, 1H), 4.7 (s, 1H). **^{13}C NMR** (151 MHz, CD_3CN) δ 170.1, 160.8, 139.4, 138.7, 131.8, 129.6, 129.5, 129.0, 128.7, 127.8, 126.1, 125.1, 124.5 (q, $^1J_{C\text{-}F}$ = 283.8 Hz), 122.1, 121.1, 101.1, 80.3, 70.5 (q, $^2J_{C\text{-}F}$ = 32.1 Hz), 64.3. **^{19}F NMR** (565 MHz, $CDCl_3$) δ -69.9 (q, *J* = 9.0 Hz), -70.0 (q, *J* = 9.0 Hz), -70.1 (q, *J* = 9.9 Hz), -70.2 (q, *J* = 9.9 Hz). **^{11}B NMR** (193 MHz, $CDCl_3$) δ 7.6.

(S)-1-phenyl-4',4',5',5'-tetrakis(trifluoromethyl)-1,2-dihydro-11λ^4,12λ^4-spiro[naphtho[2,1-e]oxazolo[3,2-c][1,3,2]oxazaborinine-11,2'-[1,3,2]dioxaborolane] (4b)



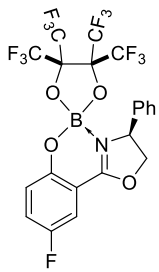
Yield: 30.9 mg (98%). Colorless solid. **^{1}H NMR** (600 MHz, CD_3CN) δ 8.4 (d, *J* = 8.3 Hz, 1H), 8.0 (d, *J* = 8.2 Hz, 1H), 7.8 (ddd, *J* = 8.2, 6.9, 1.3 Hz, 1H), 7.8 – 7.7 (m, 2H), 7.6 (d, *J* = 8.7 Hz, 1H), 7.4 – 7.3 (m, 3H), 7.3 (dd, *J* = 7.6, 2.1 Hz, 2H), 5.7 (dd, *J* = 9.5, 4.2 Hz, 1H), 5.3 (t, *J* = 9.2 Hz, 1H), 4.7 (dd, *J* = 9.0, 4.2 Hz, 1H). **^{13}C NMR** (151 MHz, CD_3CN) δ 171.7, 157.9, 157.6, 156.0, 139.5, 129.3, 129.3, 128.0, 127.8, 127.0, 123.7 (q, $^1J_{C\text{-}F}$ = 289.9 Hz), 122.0 (d, *J* = 7.84 Hz), 113.4, 113.0, 107.4, 107.3, 89.2 (q, $^2J_{C\text{-}F}$ = 31.8 Hz), 81.1, 63.8. **^{19}F NMR** (565 MHz, CD_3CN) δ -67.9 – -68.1 (m), -68.2 (tt, *J* = 23.9, 10.0 Hz), -69.6 (td, *J* = 21.8, 10.9 Hz), -70.1 (ddd, *J* = 35.5, 17.8, 10.4 Hz). **^{11}B NMR** (193 MHz, CD_3CN) δ 7.6.

(S)-3-phenyl-4',4',5',5'-tetrakis(trifluoromethyl)-2,3-dihydro-4λ^4,5λ^4-spiro[benzo[*e*]oxazolo[3,2-c][1,3,2]oxazaborinine-5,2'-[1,3,2]dioxaborolane] (4c)



Yield: 56.9 mg (98%). White solid. **^{1}H NMR** (600 MHz, CD_3CN) δ 7.84 (dd, *J* = 8.0, 1.7 Hz, 1H), 7.77 – 7.73 (m, 1H), 7.38 – 7.33 (m, 3H), 7.20 (d, *J* = 8.0 Hz, 2H), 7.14 (t, *J* = 7.6 Hz, 1H), 7.10 (d, *J* = 8.5 Hz, 1H), 5.65 (dd, *J* = 9.6, 4.4 Hz, 1H), 5.25 (t, *J* = 9.3 Hz, 1H), 4.69 (dd, *J* = 9.2, 4.4 Hz, 1H).**^{13}C NMR** (151 MHz,CD_3CN) δ 172.2, 161.2, 140.1, 139.7, 129.7, 129.6, 128.7, 127.0, 121.9 (q, $^1J_{C\text{-}F}$ = 288.8 Hz), 121.7, 120.0, 107.4, 89.2 (q, $^2J_{C\text{-}F}$ = 32.5 Hz), 80.8, 63.5. **^{19}F NMR** (565 MHz, CD_3CN) δ -68.1 (ddd, *J* = 32.0, 25.6, 10.9 Hz), -68.2 – -68.4 (m), -69.7 (qt, *J* = 20.9, 10.9 Hz), -70.0 – -70.3 (m). **^{11}B NMR** (193 MHz, CD_3CN) δ 7.1. **HRMS** (ESI): m/z $[M+Na]^+$Calcd for $[C_{21}H_{12}BF_{12}NO_4Na]^+$ required 604.1059, found: 604.0542.

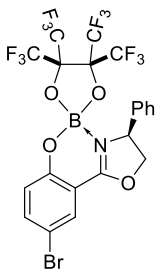
(S)-9-fluoro-3-phenyl-4',4',5',5'-tetrakis(trifluoromethyl)-2,3-dihydro-4λ^4,5λ^4-spiro[benzo[*e*]oxazolo[3,2-c][1,3,2]oxazaborinine-5,2'-[1,3,2]dioxaborolane] (4d)



Yield: 59.3 mg (99%). White solid. **^{1}H NMR** (600 MHz, CD_3CN) δ 7.57 (t, *J* = 8.3 Hz, 2H), 7.42 – 7.37 (m, 3H), 7.26 – 7.22 (m, 2H), 7.15 (ddd, *J* = 8.4, 4.3, 1.4 Hz, 1H), 5.73 – 5.68 (m, 1H), 5.30 (t, *J* = 9.4 Hz, 1H), 4.75 (dd, *J* = 9.1, 4.5 Hz, 1H). **^{13}C NMR** (151 MHz,CD_3CN) δ 171.7, 157.9, 156.8 (d, *J* = 239.39 Hz), 139.5, 129.7, 129.7, 127.9 (d, *J* = 24.88 Hz), 127.0, 123.7 (q, $^1J_{C\text{-}F}$ = 289.9 Hz), 122.0 (d, *J* = 7.91 Hz), 113.3 (d, *J* = 24.88 Hz), 107.4 (d, *J* = 9.95 Hz), 89.2 (q, $^2J_{C\text{-}F}$ = 31.4 Hz), 81.1, 63.8. **^{19}F NMR** (565 MHz, CD_3CN) δ -68.2 (dddd, *J* = 47.0, 32.3, 19.2, 10.7 Hz), -69.7 (dq, *J*

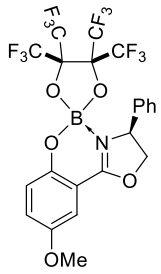
= 29.1, 12.7 Hz), -70.1 (td, *J*= 21.4, 10.2 Hz), -123.6. **^{11}B NMR** (193 MHz, CD_3CN) δ 7.2. **HRMS** (ESI): m/z $[M+H]^+$Calcd for $[C_{21}H_{12}BF_{13}NO_4]^+$ required 600.1145, found: 600.0202.

(S)-9-bromo-3-phenyl-4',4',5',5'-tetrakis(trifluoromethyl)-2,3-dihydro-4λ^4,5λ^4-spiro[benzo[*e*]oxazolo[3,2-c][1,3,2]oxazaborinine-5,2'-[1,3,2]dioxaborolane] (4e)



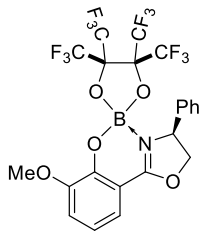
Yield: 65.2 mg 99%. White solid. **^{1}H NMR** (600 MHz, CD_3CN) δ 7.96 (d, *J* = 2.5 Hz, 1H), 7.84 (dd, *J* = 9.0, 2.5 Hz, 1H), 7.36 (qd, *J* = 4.8, 1.3 Hz, 3H), 7.20 (dd, *J* = 7.3, 2.2 Hz, 2H), 7.04 (d, *J* = 9.0 Hz, 1H), 5.66 (dd, *J* = 9.7, 4.5 Hz, 1H), 5.26 (t, *J* = 9.4 Hz, 1H), 4.71 (dd, *J* = 9.1, 4.5 Hz, 1H).**^{13}C NMR** (151 MHz,CD_3CN) δ 171.3, 160.3, 142.6, 139.4, 130.6, 129.7, 129.7 (d, *J* = 8.3 Hz), 127.1, 123.7 (q, $^1J_{C\text{-}F}$ = 289.0 Hz), 122.3, 121.8, 112.7, 109.1, 89.6 (q, $^2J_{C\text{-}F}$ = 31.1 Hz), 81.1, 63.7. **^{19}F NMR** (565 MHz, CD_3CN) δ -68.2 (dp, *J* = 47.9, 16.1 Hz), -69.6 – -69.8 (m), -70.1 (pd, *J* = 18.1, 10.1 Hz). **^{11}B NMR** (193 MHz, CD_3CN) δ 7.1. **HRMS** (ESI): m/z $[M+H]^+$Calcd for $[C_{21}H_{12}BBrF_{12}NO_4]^+$ required 661.0201, found: 661.9887.

(S)-9-methoxy-3-phenyl-4',4',5',5'-tetrakis(trifluoromethyl)-2,3-dihydro-4λ^4,5λ^4-spiro[benzo[*e*]oxazolo[3,2-c][1,3,2]oxazaborinine-5,2'-[1,3,2]dioxaborolane] (4f)



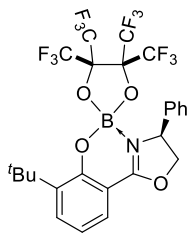
Yield: 127.3 mg (99%). White solid. **^{1}H NMR** (600 MHz, CD_3CN) δ 7.42 – 7.37 (m, 4H), 7.26 – 7.22 (m, 3H), 7.08 (d, *J* = 9.1 Hz, 1H), 5.69 (dd, *J* = 9.6, 4.3 Hz, 1H), 5.29 (t, *J* = 9.3 Hz, 1H), 4.73 (dd, *J* = 9.1, 4.3 Hz, 1H), 3.84 (s, 3H).**^{13}C NMR** (151 MHz,CD_3CN) δ 172.1, 156.2, 154.2, 139.8, 129.7, 129.6, 129.4, 127.0, 123.8 (q, $^1J_{C\text{-}F}$ = 289.3 Hz), 121.4, 108.9, 106.8, 89.4 (q, $^2J_{C\text{-}F}$ = 30.4 Hz), 80.8, 63.6, 56.7. **^{19}F NMR** (565 MHz, CD_3CN) δ -68.0 – -68.2 (m), -68.3 (tt, *J* = 23.0, 12.8 Hz), -69.7 (qt, *J* = 21.4, 11.0 Hz), -70.1 (ddt, *J* = 27.7, 19.2, 9.9 Hz). **^{11}B NMR** (193 MHz, CD_3CN) δ 7.2. .**HRMS** (ESI): m/z $[M+H]^+$Calcd for $[C_{22}H_{14}BF_{12}NO_5Na]^+$ required 634.1318, found: 634.0651.

(S)-7-methoxy-3-phenyl-4',4',5',5'-tetrakis(trifluoromethyl)-2,3-dihydro-4λ^4,5λ^4-spiro[benzo[*e*]oxazolo[3,2-c][1,3,2]oxazaborinine-5,2'-[1,3,2]dioxaborolane] (4g)



Yield: 60.5 mg (99%). White solid. **^{1}H NMR** (600 MHz, CD_3CN) δ 7.43 (dd, *J* = 8.1, 1.4 Hz, 1H), 7.38 (tt, *J* = 9.3, 3.4 Hz, 4H), 7.23 (dd, *J* = 7.5, 2.1 Hz, 2H), 7.09 (t, *J* = 8.0 Hz, 1H), 5.69 (dd, *J* = 9.6, 4.3 Hz, 1H), 5.27 (t, *J* = 9.3 Hz, 1H), 4.71 (dd, *J* = 9.1, 4.3 Hz, 1H), 3.90 (s, 3H).**^{13}C NMR** (151 MHz,CD_3CN) δ 172.4, 152.2, 150.9, 139.8, 129.7, 129.5, 126.9, 123.8 (q, $^1J_{C\text{-}F}$ = 289.7 Hz), 121.5, 121.2, 119.5, 107.7, 89.0 (q, $^2J_{C\text{-}F}$ = 30.0 Hz), 80.8, 63.6, 57.3. **^{19}F NMR** (565 MHz, CD_3CN) δ -68.2 (dh, *J* = 48.0, 16.6 Hz), -69.6 (qt, *J* = 21.2, 10.5 Hz), -70.0 – -70.2 (m). **^{11}B NMR** (193 MHz, CD_3CN) δ 7.3. **HRMS** (ESI): m/z $[M+H]^+$Calcd for $[C_{22}H_{14}BF_{12}NO_5Na]^+$ required 634.1318, found: 634.0667.

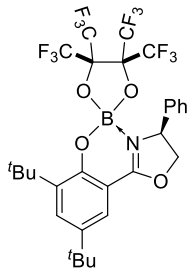
(S)-7-(*tert*-butyl)-3-phenyl-4',4',5',5'-tetrakis(trifluoromethyl)-2,3-dihydro-4λ^4,5λ^4-spiro[benzo[*e*]oxazolo[3,2-c][1,3,2]oxazaborinine-5,2'-[1,3,2]dioxaborolane] (4h)



Yield: 28.3 mg (44%). White solid. **^{1}H NMR** (600 MHz, CD_3CN) δ 7.78 (dd, *J* = 7.7, 1.7 Hz, 1H), 7.74 (dd, *J* = 7.9, 1.7 Hz, 1H), 7.38 – 7.33 (m, 3H), 7.17 (dd, *J* = 7.5, 2.0 Hz, 2H), 7.09 (t, *J* = 7.8 Hz, 1H), 5.64 (dd, *J* = 9.4, 3.8 Hz, 1H), 5.19 (t, *J* = 9.2 Hz, 1H), 4.68 (dd, *J* = 9.1, 3.8 Hz, 1H), 1.39 (s, 9H). **^{13}C NMR** (151 MHz, CD_3CN) δ 172.4, 152.2, 150.9, 139.8, 129.7, 129.5, 126.9, 123.8 (q, $^1J_{C\text{-}F}$ = 289.7 Hz), 121.5, 121.2, 119.5, 107.7, 89.0 (q, $^2J_{C\text{-}F}$ = 30.4 Hz), 80.8, 63.6, 57.3. **^{19}F NMR** (565 MHz, CD_3CN) δ -68.1 – -68.3 (m), -68.6 (ttd, *J* = 47.0, 24.9, 14.0 Hz), -70.1 (qq,

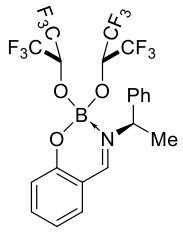
J = 22.8, 15.1 Hz). **^{11}B NMR** (193 MHz, CD_3CN) δ 7.3. **HRMS** (ESI): m/z $[M+H]^+$Calcd for $[C_{25}H_{20}BF_{12}NO_4Na]^+$ required 660.2122, found: 660.1171.

(S)-7,9-di-*tert*-butyl-3-phenyl-4',4',5',5'-tetrakis(trifluoromethyl)-2,3-dihydro-4λ^4,5λ^4-spiro[benzo[*e*]oxazolo[3,2-c][1,3,2]oxazaborinine-5,2'-[1,3,2]dioxaborolane] (4i)



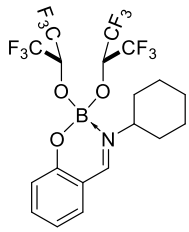
Yield: 61.2 mg (99%). Light yellow solid. **^{1}H NMR** (600 MHz, CD_3CN) δ 7.43 (dd, J = 8.1, 1.4 Hz, 1H), 7.38 (tt, J = 9.3, 3.4 Hz, 4H), 7.23 (dd, J = 7.5, 2.1 Hz, 2H), 7.09 (t, J = 8.0 Hz, 1H), 5.69 (dd, J = 9.6, 4.3 Hz, 1H), 5.27 (t, J = 9.3 Hz, 1H), 4.71 (dd, J = 9.1, 4.3 Hz, 1H), 3.90 (s, 3H).**^{13}C NMR** (151 MHz,CD_3CN) δ 172.5, 158.2, 143.9, 140.3, 140.1, 135.1, 129.7, 129.5, 126.9, 124.1 (q, $^1J_{C\text{-}F}$ = 292.4 Hz), 122.2, 106.8, 89.8 (q, $^2J_{C\text{-}F}$ = 31.7 Hz), 80.4, 63.7, 35.9, 35.2, 31.4, 29.4. **^{19}F NMR** (565 MHz, CD_3CN) δ -68.2 (qd, J = 19.07, 7.47 Hz), -68.6 (dqt, J = 58.90, 23.14, 12.18 Hz), -70.1 (qq, J = 22.77, 15.12 Hz). **^{11}B NMR** (193 MHz, CD_3CN) δ 7.4. **HRMS** (ESI): m/z $[M+H]^+$Calcd for $[C_{22}H_{14}BF_{12}NO_5Na]^+$ required 634.1318, found: 634.0667.

(R)-2,2-bis((1,1,1,3,3,3-hexafluoropropan-2-yl)oxy)-3-(1-phenylethyl)-2*H*-2λ^4,3λ^4-benzo[*e*][1,3,2]oxazaborinine (5a)



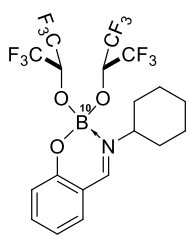
Yield: 43.5 mg (76%). Light yellow oil. **^{1}H NMR** (600 MHz, CD_3CN) δ 8.6 (q, J = 3.9 Hz, 1H), 7.6 (ddd, J = 8.8, 7.4, 1.7 Hz, 1H), 7.5 (dd, J = 8.1, 1.7 Hz, 1H), 7.5 – 7.4 (m, 2H), 7.4 – 7.4 (m, 2H), 7.4 – 7.3 (m, 1H), 7.0 (dd, J = 8.0, 6.4 Hz, 2H), 5.4 (q, J = 7.1 Hz, 1H), 4.9 (h, J = 6.2 Hz, 1H), 4.8 (h, J = 6.5 Hz, 1H), 1.8 (d, J = 7.1 Hz, 3H). **^{13}C NMR** (151 MHz,CD_3CN) δ 165.5, 158.3, 140.9, 139.5, 133.6, 129.7, 129.3, 128.6, 124.4 (q, $^1J_{C\text{-}F}$ = 289.0 Hz), 121.6, 119.5, 116.7, 71.1 – 68.3 (q, $^2J_{C\text{-}F}$ = 32.3 Hz), 60.0, 21.7. **^{19}F NMR** (565 MHz, CD_3CN) δ -75.1 (q, J = 9.6 Hz), -75.2 (td, J = 13.9, 8.2 Hz). **^{11}B NMR** (193 MHz, CD_3CN) δ 2.1. **HRMS** (ESI): m/z $[M+Na]^+$Calcd for $[C_{21}H_{16}BF_{12}NO_3Na]^+$ required 592.1382, found: 592.0888.

3-cyclohexyl-2,2-bis((1,1,1,3,3,3-hexafluoropropan-2-yl)oxy)-2*H*-2λ^4,3λ^4-benzo[*e*][1,3,2]oxazaborinine (5b)



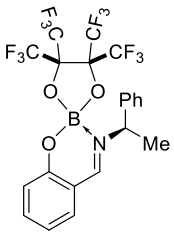
Yield: 41.0 mg (75%). White solid. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 8.2 (d, J = 6.8 Hz, 1H), 7.6 (ddd, J = 8.8, 7.3, 1.7 Hz, 1H), 7.4 (dd, J = 7.8, 1.7 Hz, 1H), 7.1 – 7.0 (m, 2H), 4.6 (dd, J = 11.0, 5.8 Hz, 2H), 3.9 (tt, J = 8.3, 3.8 Hz, 1H), 2.2 (d, J = 9.2 Hz, 2H), 1.9 – 1.9 (m, 2H), 1.8 – 1.7 (m, 1H), 1.4 (td, J = 11.9, 6.2 Hz, 4H), 1.2 (dt, J = 12.8, 3.9 Hz, 1H). **^{13}C NMR** (151 MHz, $CDCl_3$) δ 161.2, 157.8, 138.0, 131.4, 121.4 (q, $^1J_{C\text{-}F}$ = 283.6 Hz), 120.3, 119.0, 115.5, 69.1 (q, $^2J_{C\text{-}F}$ = 32.7 Hz), 59.3, 34.1, 25.6, 25.3. **^{19}F NMR** (565 MHz, $CDCl_3$) δ -74.8 (q, J = 9.41 Hz), -74.9 (q, J = 9.37 Hz). **^{11}B NMR** (193 MHz, $CDCl_3$) δ 2.0. **HRMS** (ESI): m/z $[M+Na]^+$Calcd for $[C_{19}H_{18}BF_{12}NO_3Na]^+$ required 570.1327, found: 570.0609.

3-cyclohexyl-2,2-bis((1,1,1,3,3,3-hexafluoropropan-2-yl)oxy)-2*H*-2λ^4,3λ^4-benzo[*e*][1,3,2]oxazaborinine-2-10B (5c)



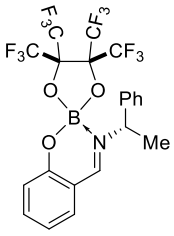
Yield: 40.4 mg (74%). White solid. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 8.2 (d, J = 4.7 Hz, 1H), 7.6 – 7.5 (m, 1H), 7.4 (dd, J = 7.8, 1.7 Hz, 1H), 7.1 – 7.0 (m, 2H), 4.7 (h, J = 6.8 Hz, 2H), 3.9 (tt, J = 8.1, 3.7 Hz, 1H), 2.2 (d, J = 10.3 Hz, 2H), 1.9 – 1.9 (m, 2H), 1.8 – 1.7 (m, 1H), 1.5 – 1.4 (m, 4H), 1.2 (ddd, J = 12.6, 8.3, 4.3 Hz, 1H). **^{13}C NMR** (151 MHz, $CDCl_3$) δ 161.2, 157.8, 138.0, 131.4, 121.4 (q, $^1J_{C\text{-}F}$ = 280.3 Hz), 120.3, 119.0, 115.5, 69.1 (q, $^2J_{C\text{-}F}$ = 32.6 Hz), 59.3, 34.1, 25.6, 25.3. **^{19}F NMR** (565 MHz, $CDCl_3$) δ -74.8 (q, J = 9.4 Hz), -74.9 (q, J = 9.4 Hz). **^{11}B NMR** (193 MHz, $CDCl_3$) δ 2.0. **HRMS** (ESI): m/z $[M+Na]^+$Calcd for $[C_{19}H_{18}{}^{10}BF_{12}NO_3Na]^+$ required 569.1327, found: 569.3545.

(R)-3-(1-phenylethyl)-4',4',5',5'-tetrakis(trifluoromethyl)-2λ⁴,3λ⁴-spiro[benzo[*e*][1,3,2]oxazaborinine-2,2'-[1,3,2]dioxaborolane] (5d)



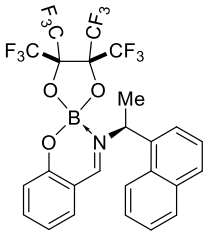
Yield: 50.0 mg (88%). Light yellow solid. **^{1}H NMR** (600 MHz, CD_3CN) δ 8.59 – 8.54 (m, 1H), 8.30 – 8.25 (m, 1H), 7.97 (d, *J* = 8.3 Hz, 1H), 7.96 – 7.93 (m, 1H), 7.70 (d, *J* = 7.2 Hz, 1H), 7.64 (ddd, *J* = 8.7, 7.2, 1.7 Hz, 1H), 7.59 (t, *J* = 7.8 Hz, 1H), 7.55 – 7.51 (m, 2H), 7.44 (dd, *J* = 7.9, 1.7 Hz, 1H), 7.02 (d, *J* = 8.5 Hz, 1H), 7.01 – 6.96 (m, 1H), 6.08 (q, *J* = 6.8 Hz, 1H), 1.98 (d, *J* = 6.8 Hz, 3H). **^{13}C NMR** (151 MHz, CD_3CN) δ 168.3, 159.3, 140.9, 133.6, 129.5, 123.8 (q, $^{1}J_{C\text{-}F}$ = 289.7 Hz), 122.0, 119.5, 117.5, 90.5 (q, $^{2}J_{C\text{-}F}$ = 30.6 Hz), 59.2, 21.0. **^{19}F NMR** (565 MHz, CD_3CN) δ -67.7 – -68.0 (m, *J* = 7.8 Hz), -68.9 (tdt, *J* = 22.4, 12.6, 7.4 Hz), -69.4 (ttd, *J* = 25.9, 18.6, 10.9 Hz). **^{11}B NMR** (193 MHz, CD_3CN) δ 7.3. **HRMS** (ESI): m/z $[M+H]^+$Calcd for $[C_{21}H_{15}BF_{12}NO_3]^+$ required 568.1405, found: 568.0929.

(S)-3-(1-phenylethyl)-4',4',5',5'-tetrakis(trifluoromethyl)-2λ⁴,3λ⁴-spiro[benzo[*e*][1,3,2]oxazaborinine-2,2'-[1,3,2]dioxaborolane] (5e)



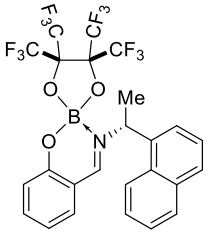
Yield: 45.5 mg (80%). Light yellow solid. **^{1}H NMR** (600 MHz, CD_3CN) δ 8.77 (d, *J* = 6.0 Hz, 1H), 7.68 (ddd, *J* = 8.7, 7.2, 1.7 Hz, 1H), 7.62 (dd, *J* = 7.9, 1.7 Hz, 1H), 7.44 – 7.33 (m, 5H), 7.08 (t, *J* = 7.6 Hz, 1H), 7.03 (d, *J* = 8.4 Hz, 1H), 5.47 (q, *J* = 7.0 Hz, 1H), 1.81 (d, *J* = 7.0 Hz, 3H). **^{13}C NMR** (151 MHz, CD_3CN) δ 168.3, 159.3, 140.9, 133.6, 130.1, 129.5, 128.2, 123.9 (q, $^{1}J_{C\text{-}F}$ = 290.3 Hz), 122.0, 119.5, 117.6, 90.6 (q, $^{2}J_{C\text{-}F}$ = 29.4 Hz), 59.2, 21.0. **^{19}F NMR** (565 MHz, CD_3CN) δ -68.3 (dtt, *J* = 48.9, 34.1, 11.0 Hz), -69.0 (qd, *J* = 22.6, 10.0 Hz), -69.9 (dtt, *J* = 37.6, 22.9, 13.4 Hz). **^{11}B NMR** (193 MHz, CD_3CN) δ 7.0. **HRMS** (ESI): m/z $[M+H]^+$Calcd for [C21H15BF12NO3]$^+$ required 568.1405, found: 568.0923.

(S)-3-(1-(naphthalen-1-yl)ethyl)-4',4',5',5'-tetrakis(trifluoromethyl)-2λ⁴,3λ⁴-spiro[benzo[*e*][1,3,2]oxazaborinine-2,2'-[1,3,2]dioxaborolane] (5f)



Yield:57.3 mg (91%). Light yellow oil. **^{1}H NMR** (600 MHz, CD_3CN) δ 8.77 (d, *J* = 6.1 Hz, 1H), 7.68 (ddd, *J* = 8.6, 7.2, 1.7 Hz, 1H), 7.62 (dd, *J* = 7.8, 1.7 Hz, 1H), 7.44 – 7.33 (m, 5H), 7.08 (t, *J* = 7.6 Hz, 1H), 7.03 (d, *J* = 8.4 Hz, 1H), 5.47 (q, *J* = 7.1 Hz, 1H), 1.81 (d, *J* = 7.0 Hz, 3H). **^{13}C NMR** (151 MHz, CD_3CN) δ 167.7, 159.0, 140.0, 134.9, 134.6, 133.3, 131.2, 130.5, 129.7, 127.5, 126.9, 126.6, 126.0, 123.7, 123.6 (d, $^{1}J_{C\text{-}F}$ = 289.4 Hz), 121.5, 119.0, 116.8, 90.4 (q, $^{2}J_{C\text{-}F}$ = 32.7 Hz), 56.9, 20.9. **^{19}F NMR** (565 MHz, CD_3CN) δ -68.1 – -68.5 (m), -69.0 (qt, *J* = 22.4, 12.8 Hz), -69.9 (qt, *J* = 29.3, 11.4 Hz). **^{11}B NMR** (193 MHz, CD_3CN) δ 7.0. **HRMS** (ESI): m/z $[M+H]^+$Calcd for $[C_{25}H_{17}BF_{12}NO_3]^+$ required 618.1992, found: 618.4500.

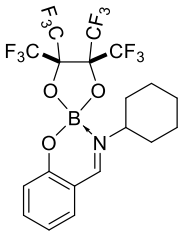
(R)-3-(1-(naphthalen-1-yl)ethyl)-4',4',5',5'-tetrakis(trifluoromethyl)-2λ⁴,3λ⁴-spiro[benzo[*e*][1,3,2]oxazaborinine-2,2'-[1,3,2]dioxaborolane] (5g)



Yield: 53.6 mg (87%). Light yellow oil. **^{1}H NMR** (600 MHz, CD_3CN) δ 8.58 – 8.54 (m, 1H), 8.30 – 8.25 (m, 1H), 7.99 – 7.92 (m, 2H), 7.70 (d, *J* = 7.2 Hz, 1H), 7.64 (ddd, *J* = 8.7, 7.2, 1.7 Hz, 1H), 7.59 (dd, *J* = 8.2, 7.3 Hz, 1H), 7.57 – 7.49 (m, 2H), 7.44 (dd, *J* = 7.9, 1.7 Hz, 1H), 7.04 – 6.95 (m, 2H), 6.08 (q, *J* = 6.8 Hz, 1H), 1.98 (d, *J* = 6.8 Hz, 3H). **^{13}C NMR** (151 MHz, CD_3CN) δ 167.7, 159.0, 139.9, 134.9, 134.5, 133.3, 131.2, 130.5, 129.6, 127.5, 126.9, 126.6, 125.9, 123.7, 123.6 (d, $^{1}J_{C\text{-}F}$ = 287.5 Hz), 121.5, 119.0, 116.7, 90.6 (q, $^{2}J_{C\text{-}F}$ = 32.7 Hz), 56.9, 20.9. **^{19}F NMR** (565 MHz, CD_3CN) δ -67.7 – -68.0 (m, *J* = 7.4, 6.9 Hz), -68.9 (ttd, *J* = 26.0, 19.1, 12.8 Hz), -69.3 – -69.5 (m). **^{11}B**

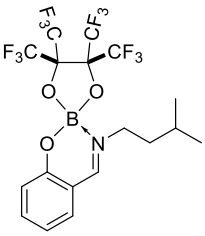
NMR (193 MHz, CD_3CN) δ 7.2. **HRMS** (ESI): m/z $[M+H]^+$Calcd for $[C_{25}H_{17}BF_{12}NO_3]^+$ required 618.1992, found: 618.4490.

3-cyclohexyl-4',4',5',5'-tetrakis(trifluoromethyl)-2λ⁴,3λ⁴-spiro[benzo[*e*][1,3,2]oxazaborinine-2,2'-[1,3,2]dioxaborolane] (5h)



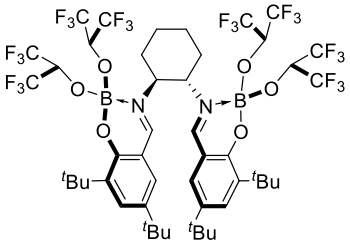
Yield: 37.3 mg (70%). White solid. **^{1}H NMR** (600 MHz, CD_3CN) δ 8.87 (d, J = 6.5 Hz, 1H), 7.68 (ddd, J = 7.2, 4.1, 2.4 Hz, 2H), 7.14 – 7.08 (m, 1H), 7.02 (d, J = 8.8 Hz, 1H), 3.91 (tt, J = 12.3, 3.5 Hz, 1H), 2.02 – 1.96 (m, 2H), 1.91 (dt, J = 13.6, 3.3 Hz, 3H), 1.75 – 1.68 (m, 1H), 1.61 (qd, J = 12.3, 3.5 Hz, 2H), 1.35 (qt, J = 13.0, 3.4 Hz, 2H), 1.30 – 1.19 (m, 2H). **^{13}C NMR** (151 MHz, CD_3CN) δ 166.7, 158.6, 139.4, 133.0, 123.5 (d, $^1J_{C\text{-}F}$ = 292.4 Hz), 121.4, 119.0, 117.0, 90.1 (q, $^2J_{C\text{-}F}$ = 32.7 Hz), 59.5, 34.1, 26.1, 25.4. **^{19}F NMR** (565 MHz, CD_3CN) δ -68.4 (hept, J = 8.2 Hz), -69.5 (hept, J = 8.1 Hz). **^{11}B NMR** (193 MHz, CD_3CN) δ 6.89. **HRMS** (ESI): m/z $[M+Na]^+$Calcd for $[C_{19}H_{16}BF12NO_3Na]^+$ required 568.1168, found: 568.7789.

3-isopentyl-4',4',5',5'-tetrakis(trifluoromethyl)-2λ⁴,3λ⁴-spiro[benzo[*e*][1,3,2]oxazaborinine-2,2'-[1,3,2]dioxaborolane] (5i)



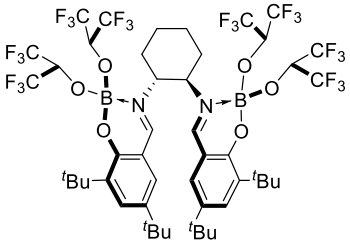
Yield: 40.3 mg (76%). White solid. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 8.4 (s, 1H), 7.6 (ddd, J = 8.6, 7.2, 1.7 Hz, 1H), 7.4 (dd, J = 7.9, 1.7 Hz, 1H), 7.1 (d, J = 8.4 Hz, 1H), 7.0 (t, J = 7.5 Hz, 1H), 3.8 – 3.8 (m, 2H), 1.7 – 1.6 (m, 3H), 1.0 (d, J = 6.2 Hz, 6H). **^{13}C NMR** (151 MHz, $CDCl_3$) δ 166.2, 159.4, 138.9, 131.1, 122.8 (q, $^1J_{C\text{-}F}$ = 284.6 Hz), 120.6, 119.6, 115.9, 89.2 (q, $^2J_{C\text{-}F}$ = 30.6 Hz), 52.1, 39.9, 26.2, 22.2. **^{19}F NMR** (565 MHz, $CDCl_3$) δ -67.8 (hept, J = 8.0 Hz), -68.8 (hept, J = 7.9 Hz). **^{11}B NMR** (193 MHz, $CDCl_3$) δ 6.7.

1,2-bis(6,8-di-*tert*-butyl-2,2-bis((1,1,1,3,3,3-hexafluoropropan-2-yl)oxy)-2*H*-2λ⁴,3λ⁴-benzo[*e*][1,3,2]oxazaborinin-3-yl)cyclohexane (6a)



Yield: 44.8 mg (73%). Light green solid. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 8.30 (d, J = 45.6 Hz, 2H), 7.55 (d, J = 23.6 Hz, 2H), 7.13 (s, 1H), 6.86 (s, 1H), 4.86 (d, J = 57.7 Hz, 2H), 4.55 (s, 1H), 4.34 (s, 1H), 4.09 (d, J = 62.2 Hz, 2H), 2.68 (s, 1H), 2.23 (s, 2H), 1.95 (s, 2H), 1.49 (s, 2H), 1.37 (d, J = 16.8 Hz, 1H), 1.18 (d, J = 45.0 Hz, 36H).**^{13}C NMR** (151 MHz, $CDCl_3$) δ 168.7, 164.7, 154.3, 143.1, 134.7, 126.5, 121.2 (q, $^1J_{C\text{-}F}$ = 285.3 Hz), 114.9, 70.3 (q, $^2J_{C\text{-}F}$ = 31.2 Hz), 35.1, 34.8, 30.9, 28.9, 25.2. **^{19}F NMR** (565 MHz, $CDCl_3$) δ -72.8 (t, J = 10.8 Hz), -73.0 (t, J = 10.8 Hz), -73.6 (dd, J = 84.5, 11.1 Hz), -73.9, -74.4 (d, J = 11.5 Hz), -74.6 (d, J = 11.3 Hz). **^{11}B NMR** (193 MHz, CDCl3) δ 2.1 (d, J = 64.5 Hz). **HRMS** (ESI): m/z $[M+Na]^+$Calcd for $[C_{48}H_{56}B_2F_{24}N_2O_6Na]^+$ required 1257.5414, found: 1257.5897.

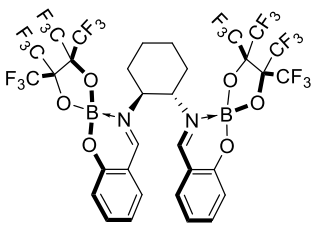
(1R,2R)-1,2-bis(6,8-di-*tert*-butyl-2,2-bis((1,1,1,3,3,3-hexafluoropropan-2-yl)oxy)-2*H*-2λ⁴,3λ⁴-benzo[*e*][1,3,2]oxazaborinin-3-yl)cyclohexane (6b)



Yield: 34.4 (56%). Light green solid. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 8.31 (d, J = 45.5 Hz, 2H), 7.55 (d, J = 24.9 Hz, 2H), 7.13 (s, 1H), 6.86 (s, 1H), 4.87 (d, J = 57.4 Hz, 2H), 4.55 (s, 1H), 4.34 (s, 1H), 4.09 (d, J = 62.2 Hz, 2H), 2.69 (s, 1H), 2.23 (s, 2H), 1.95 (s, 2H), 1.50 (s, 2H), 1.35 – 1.32 (m, 1H), 1.28 – 1.14 (m, 36H).**^{13}C NMR** (151 MHz, $CDCl_3$) δ 168.6, 164.7, 154.2, 143.2, 134.7, 126.5, 123.0 (q, $^1J_{C\text{-}F}$ = 282.1 Hz), 115.5, 70.1 (q, $^2J_{C\text{-}F}$ = 30.1 Hz), 35.1, 34.7, 30.8, 28.9, 24.6. **^{19}F NMR** (565 MHz, CDCl3) δ -72.7 (q, J = 10.3 Hz), -73.0 (q, J = 10.4 Hz), -73.5 (dq, J =

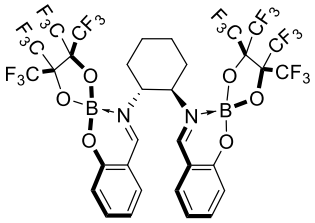
83.3, 9.4 Hz), -73.9, -74.4 (q, J = 9.9 Hz), -74.6 (q, J = 10.2 Hz). **^{11}B NMR** (193 MHz, $CDCl_3$) δ 2.1 (d, J = 64.4 Hz). **HRMS** (ESI): m/z $[M+Na]^+$Calcd for $[C_{48}H_{56}B_2F_{24}N_2O_6Na]^+$ required 1257.5414, found: 1257.3813.

1,2-bis(4',4',5',5'-tetrakis(trifluoromethyl)-2λ^4,3λ^4-spiro[benzo[*e*][1,3,2]oxazaborinine-2,2'-[1,3,2]dioxaborolan]-3-yl)cyclohexane (6c)



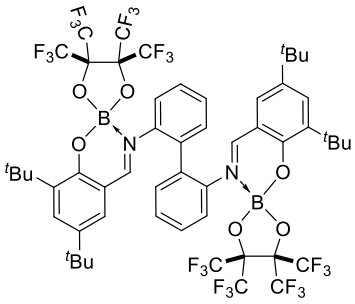
Yield:30.4 mg (60%). White solid. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 8.57 (s, 2H), 7.63 – 7.58 (m, 2H), 7.42 (d, J = 7.9 Hz, 2H), 7.01 (t, J = 7.5 Hz, 2H), 6.94 (d, J = 8.5 Hz, 2H), 4.20 (d, J = 8.9 Hz, 2H), 2.41 (d, J = 12.8 Hz, 2H), 2.05 – 2.01 (m, 2H), 1.75 – 1.70 (m, 2H), 1.52 (d, J = 10.0 Hz, 2H). **^{13}C NMR** (151 MHz, $CDCl_3$) δ 166.5, 159.3, 139.8, 132.0, 122.2 (q, $^1J_{C\text{-}F}$ = 291.5 Hz), 120.7, 119.3, 115.7, 89.2 (q, $^2J_{C\text{-}F}$ = 32.3 Hz), 61.2, 34.4, 24.8. **^{19}F NMR** (565 MHz, $CDCl_3$) δ -67.0 (qd, J = 23.1, 11.1 Hz), -67.4 – -67.7 (m), -68.1 (tt, J = 26.4, 13.4 Hz), -70.2 (qt, J = 29.0, 11.6 Hz). **^{11}B NMR** (193 MHz, $CDCl_3$) δ 6.4. **HRMS** (ESI): m/z $[M+Na]^+$Calcd for $[C_{32}H_{20}B_2F_{24}N_2O_6Na]^+$ required 1029.0844, found: 1029.6969.

(1R,2R)-1,2-bis(4',4',5',5'-tetrakis(trifluoromethyl)-2λ^4,3λ^4-spiro[benzo[*e*][1,3,2]oxazaborinine-2,2'-[1,3,2]dioxaborolan]-3-yl)cyclohexane (6d)



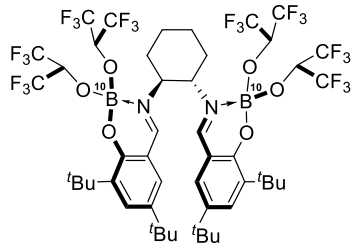
Yield:34.9 mg (96%). White solid. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 8.6 (s, 2H), 7.6 (ddd, J = 8.7, 7.2, 1.7 Hz, 2H), 7.4 (d, J = 7.9 Hz, 2H), 7.0 (t, J = 7.5 Hz, 2H), 6.9 (d, J = 8.5 Hz, 2H), 4.2 (d, J = 9.3 Hz, 2H), 2.4 (d, J = 12.9 Hz, 2H), 2.1 – 2.0 (m, 2H), 1.7 (d, J = 10.9 Hz, 2H), 1.5 (d, J = 10.0 Hz, 2H). **^{13}C NMR** (151 MHz, CDCl3) δ 166.5, 159.3, 139.8, 132.0, 121.1 (q, $^1J_{C\text{-}F}$ = 290.4 Hz), 120.7, 119.3, 115.7, 89.2 (q, $^2J_{C\text{-}F}$ = 32.2 Hz), 61.2, 34.4, 24.8. **^{19}F NMR** (565 MHz, $CDCl_3$) δ -67.0 (qd, J = 23.3, 11.4 Hz), -67.6 (qt, J = 24.9, 12.2 Hz), -68.1 (dqt, J = 37.4, 24.4, 13.8 Hz), -70.1 (qq, J = 23.3, 14.5 Hz). **^{11}B NMR** (193 MHz, $CDCl_3$) δ 6.4. **HRMS** (ESI): m/z $[M+Na]^+$Calcd for $[C_{32}H_{20}B_2F_{24}N_2O_6Na]^+$ required 1029.0844, found: 1029.5953.

2,2'-bis(6,8-di-*tert*-butyl-4',4',5',5'-tetrakis(trifluoromethyl)-2λ^4,3λ^4-spiro[benzo[*e*][1,3,2]oxazaborinine-2,2'-[1,3,2]dioxaborolan]-3-yl)-1,1'-biphenyl (6e)



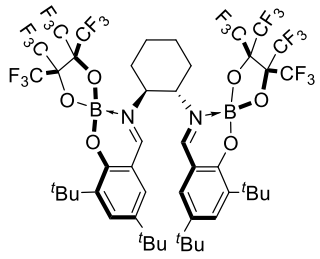
Yield:15.0 mg (23%). Light green solid. **^{1}H NMR** (600 MHz, Acetone) δ 9.06 (s, 2H), 7.97 (d, J = 2.5 Hz, 2H), 7.82 (dd, J = 8.1, 1.4 Hz, 2H), 7.76 (d, J = 2.5 Hz, 2H), 7.63 (dd, J = 8.0, 1.6 Hz, 2H), 7.53 (td, J = 7.7, 1.4 Hz, 2H), 7.44 (td, J = 7.8, 1.7 Hz, 2H), 1.49 (s, 18H), 1.36 (s, 18H). **^{13}C NMR** (151 MHz, Acetone) δ 175.1, 157.9, 144.5, 142.8, 140.0, 137.2, 134.5, 131.6, 130.4, 128.9, 128.6, 120.9, 116.1, 77.3, 35.9, 35.3, 31.5. **^{19}F NMR** (565 MHz, Acetone) δ -67.9 (dddd, J = 35.4, 27.7, 22.2, 13.8 Hz), -68.1 (qd, J = 23.3, 12.0 Hz), -68.3 (tq, J = 25.3, 13.6 Hz), -70.4 (dddd, J = 38.3, 23.5, 14.4, 8.4 Hz). **^{11}B NMR** (193 MHz, Acetone) δ 7.1. **HRMS** (ESI): m/z $[M+Na]^+$Calcd for $[C_{54}H_{50}B_2F_{24}N_2O_6Na]^+$ required 1323.5580, found: 1323.0671.

1,2-bis(6,8-di-*tert*-butyl-2,2-bis((1,1,1,3,3,3-hexafluoropropan-2-yl)oxy)-2*H*-2λ^4,3λ^4-benzo[*e*][1,3,2]oxazaborinin-3-yl-2-^{10}B)cyclohexane (6f)



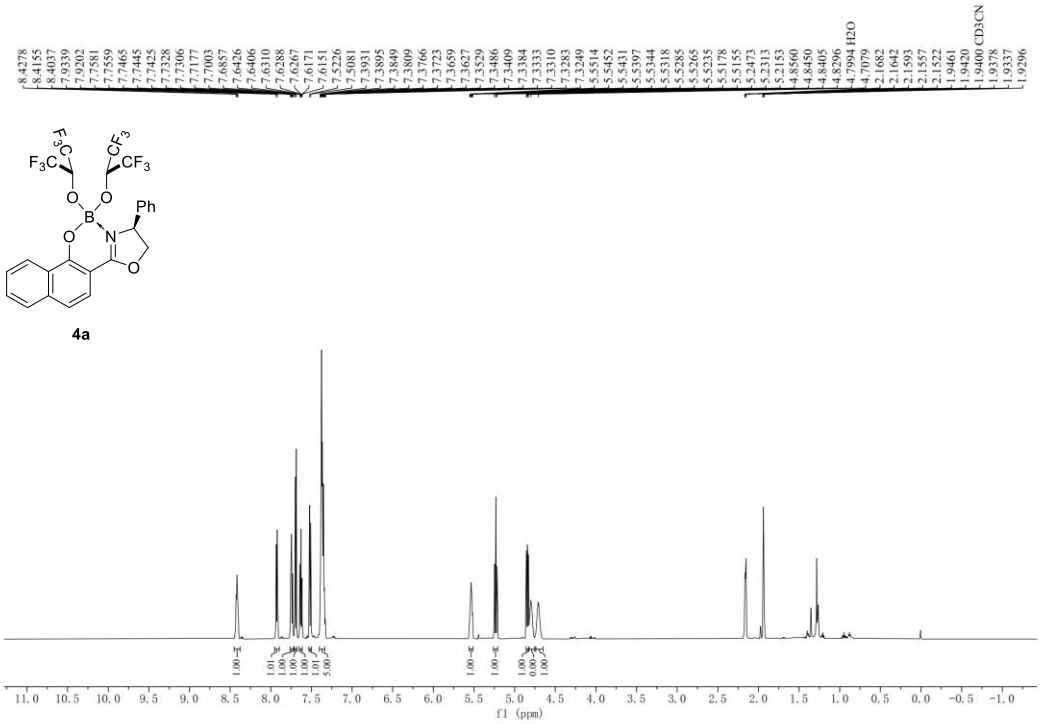
Yield:37.3 mg (60%). Light green solid. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 8.30 (d, *J* = 44.3 Hz, 2H), 7.58 – 7.51 (m, 2H), 7.13 (s, 1H), 6.86 (s, 1H), 4.86 (d, *J* = 57.1 Hz, 2H), 4.55 (s, 1H), 4.34 (s, 1H), 4.09 (d, *J* = 62.7 Hz, 2H), 2.68 (s, 1H), 2.30 – 2.20 (m, 2H), 1.94 (d, *J* = 7.7 Hz, 2H), 1.52 (d, *J* = 30.5 Hz, 3H), 1.27 – 1.13 (m, 36H). **^{13}C NMR** (151 MHz, $CDCl_3$) δ 169.0, 165.1, 154.6, 143.5, 135.1, 126.9, 121.6 (q, $^{1}J_{C\text{-}F}$ = 285.3 Hz), 115.3, 70.7 (q, $^{2}J_{C\text{-}F}$ = 30.5 Hz), 35.5, 35.2, 31.2, 29.3, 25.6. **^{19}F NMR** (565 MHz, $CDCl_3$) δ -72.7 (q, *J* = 10.7 Hz), -73.0 (d, *J* = 11.6 Hz), -73.4 – -73.7 (m), -73.9, -74.4 (q, *J* = 10.2 Hz), -74.6 (d, *J* = 10.9 Hz). **^{11}B NMR** (193 MHz, $CDCl_3$) δ 2.1 (d, *J* = 64.6 Hz). **HRMS** (ESI): m/z $[M+Na]^+$Calcd for $[C_{48}H_{56}{}^{10}B_2F_{24}N_2O_6Na]^+$ required 1255.5414, found: 1255.6181.

1,2-bis(6,8-di-*tert*-butyl-4',4',5',5'-tetrakis(trifluoromethyl)-2λ^4,3λ^4-spiro[benzo[*e*][1,3,2]oxazaborinine-2,2'-[1,3,2]dioxaborolan]-3-yl)cyclohexane (6g)

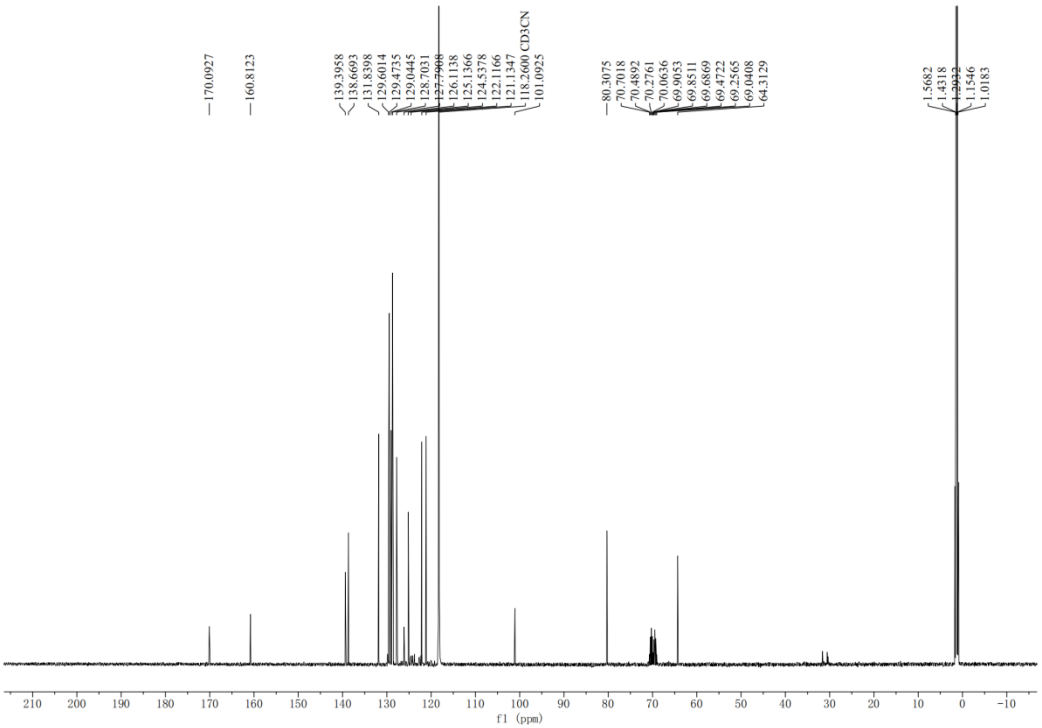


Yield:13.4 mg (22%). Light green solid. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 8.5 (s, 2H), 7.6 (d, *J* = 2.4 Hz, 2H), 7.1 (d, *J* = 2.5 Hz, 2H), 4.2 (d, *J* = 9.0 Hz, 2H), 2.4 (d, *J* = 12.8 Hz, 2H), 1.9 (d, *J* = 9.6 Hz, 2H), 1.7 – 1.6 (m, 2H), 1.5 (d, *J* = 9.7 Hz, 2H), 1.2 (s, 18H), 1.1 (s, 18H). **^{13}C NMR** (151 MHz, $CDCl_3$) δ 167.2, 156.2, 143.2, 139.3, 135.9, 126.2, 120.7 (q, $^{1}J_{C\text{-}F}$ = 291.9 Hz), 115.1, 89.7 (q, $^{2}J_{C\text{-}F}$ = 32.1 Hz), 61.0, 35.3, 34.9, 34.4, 30.9, 29.0, 25.1. **^{19}F NMR** (565 MHz, $CDCl_3$) δ -65.7 (qd, *J* = 23.9, 11.4 Hz), -67.0 (qt, *J* = 23.0, 11.7 Hz), -67.7 (qd, *J* = 22.5, 10.2 Hz), -69.8 (q, *J* = 23.8, 10.4 Hz). **^{11}B NMR** (193 MHz, $CDCl_3$) δ 7.0. **HRMS** (ESI): m/z $[M+Na]^+$Calcd for $[C_{48}H_{52}B_2F_{24}N_2O_6Na]^+$ required 1253.5097, found: 1253.3390.

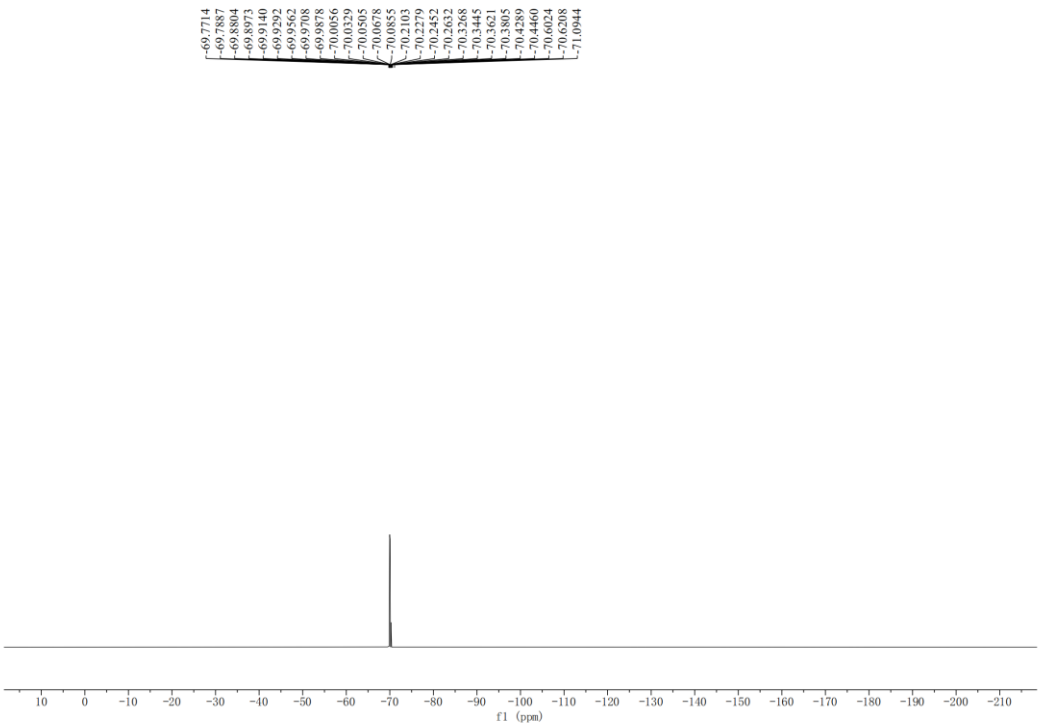
10. NMR spectra for new compounds



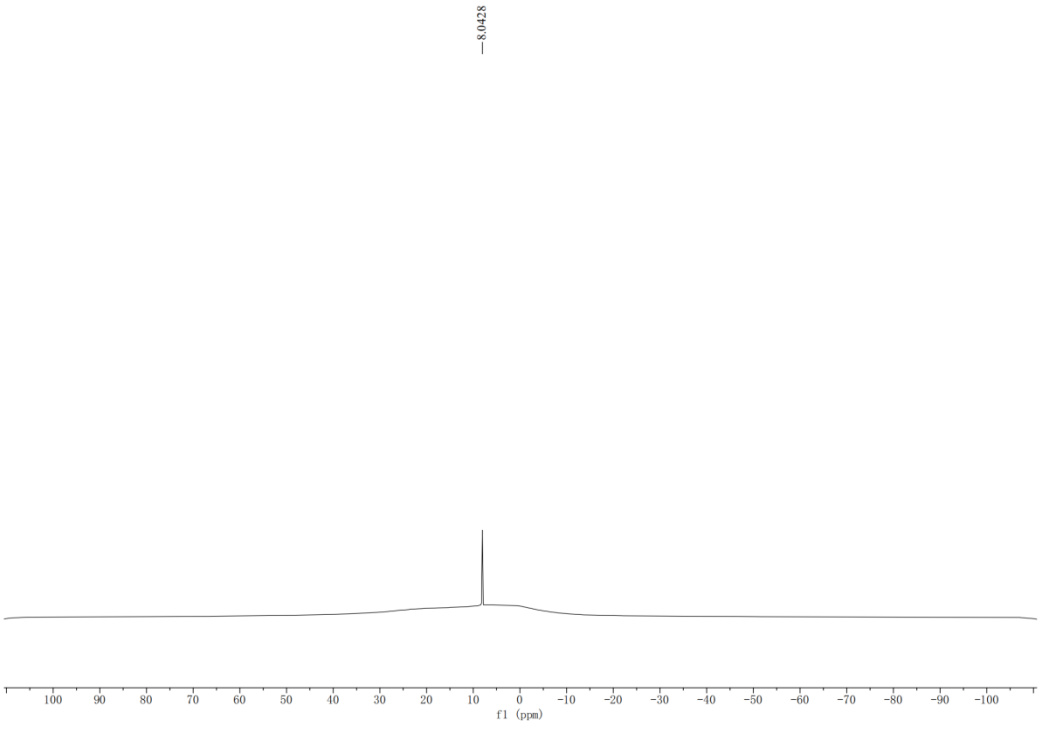
^{1}H NMR spectrum of compound **4a** (600 MHz, CD_3CN)



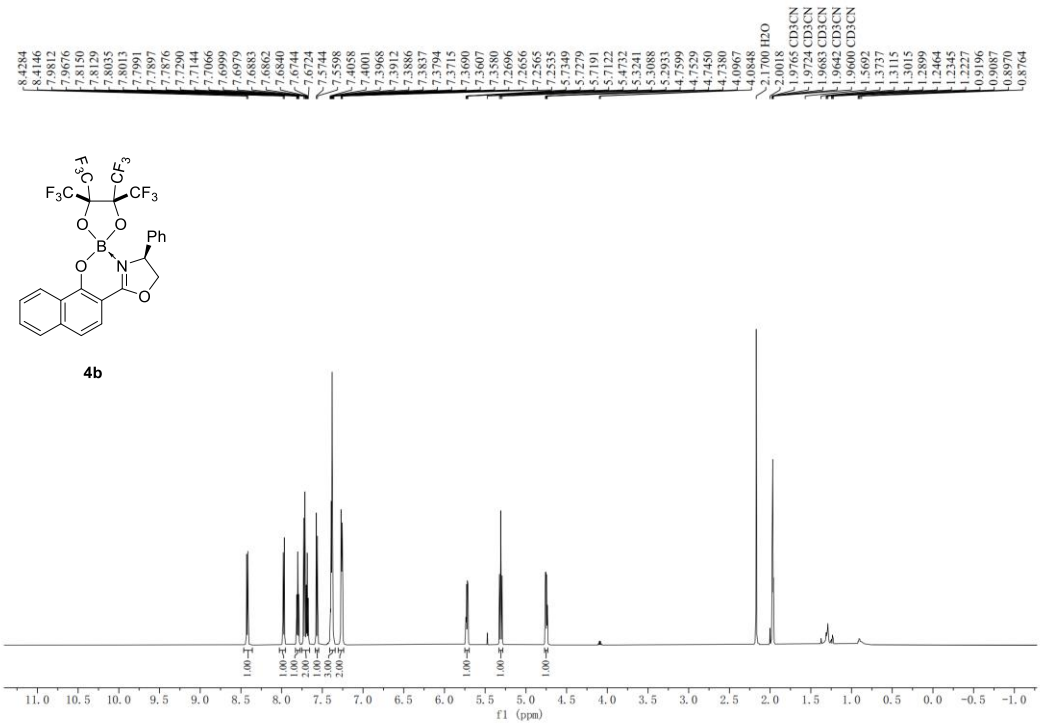
^{13}C NMR spectrum of compound **4a** (600 MHz, CD_3CN)



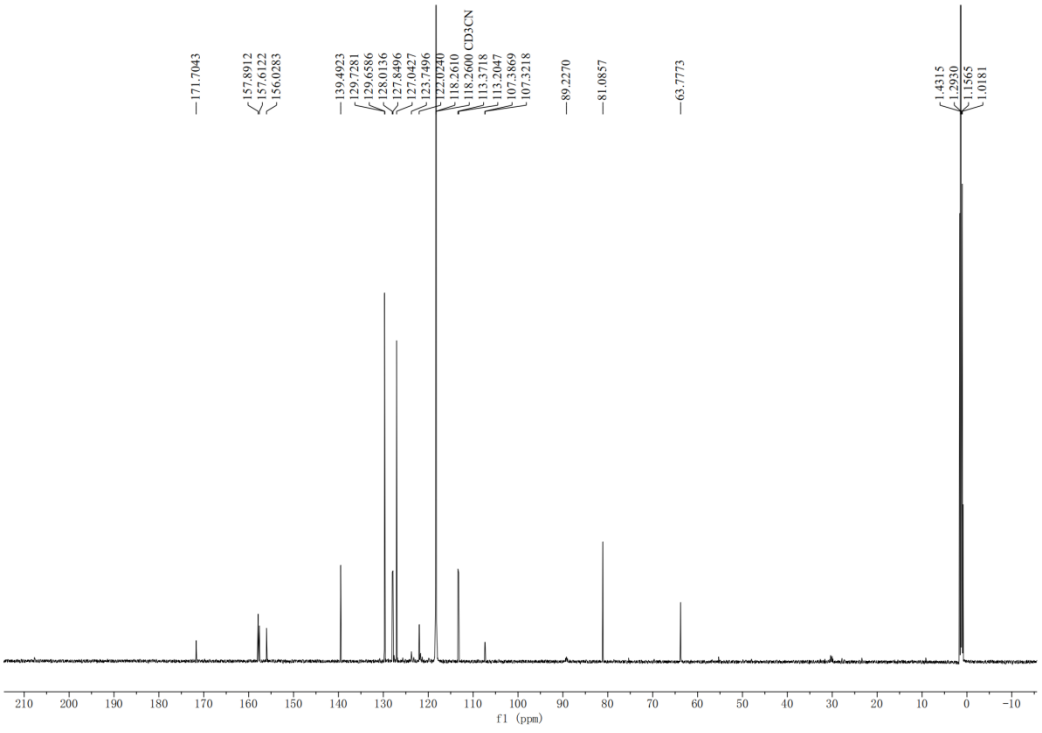
^{19}F NMR spectrum of compound **4a** (600 MHz, CD_3CN)



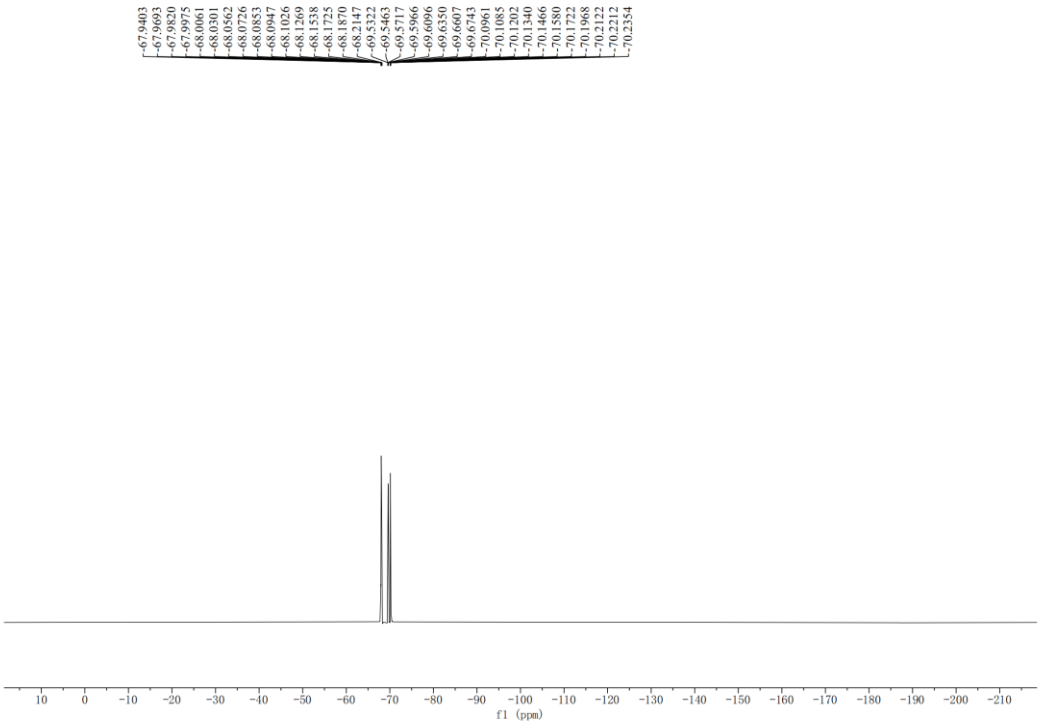
^{11}B NMR spectrum of compound **4a** (600 MHz, CD_3CN)



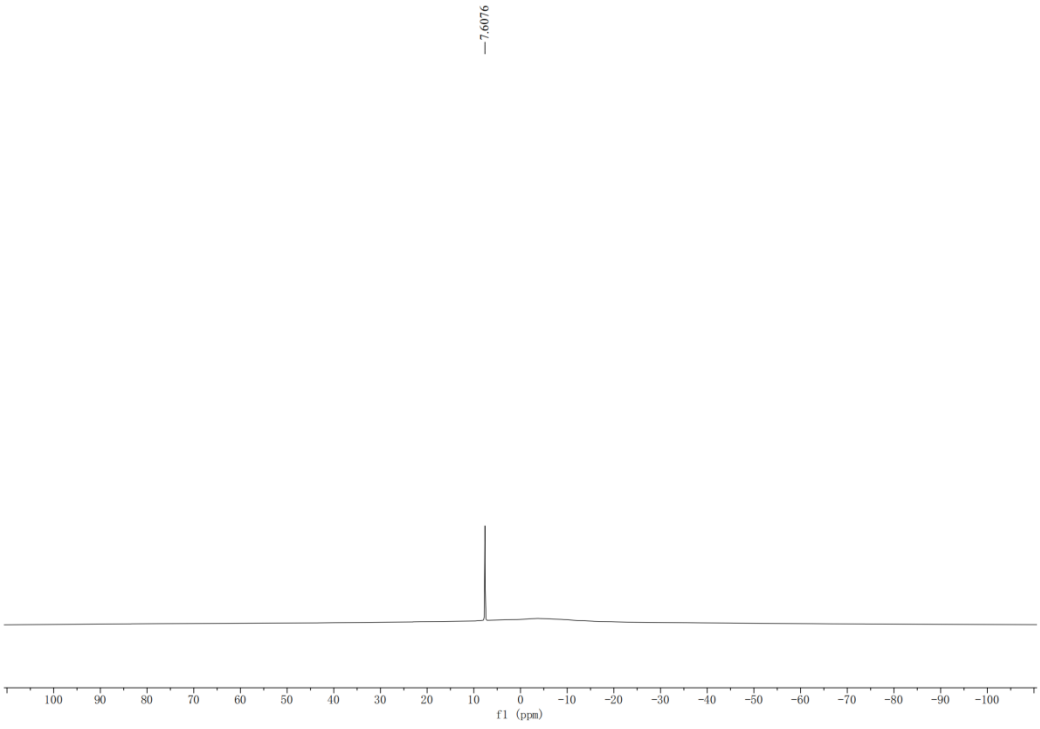
^{1}H NMR spectrum of compound **4b** (600 MHz, CD_3CN)



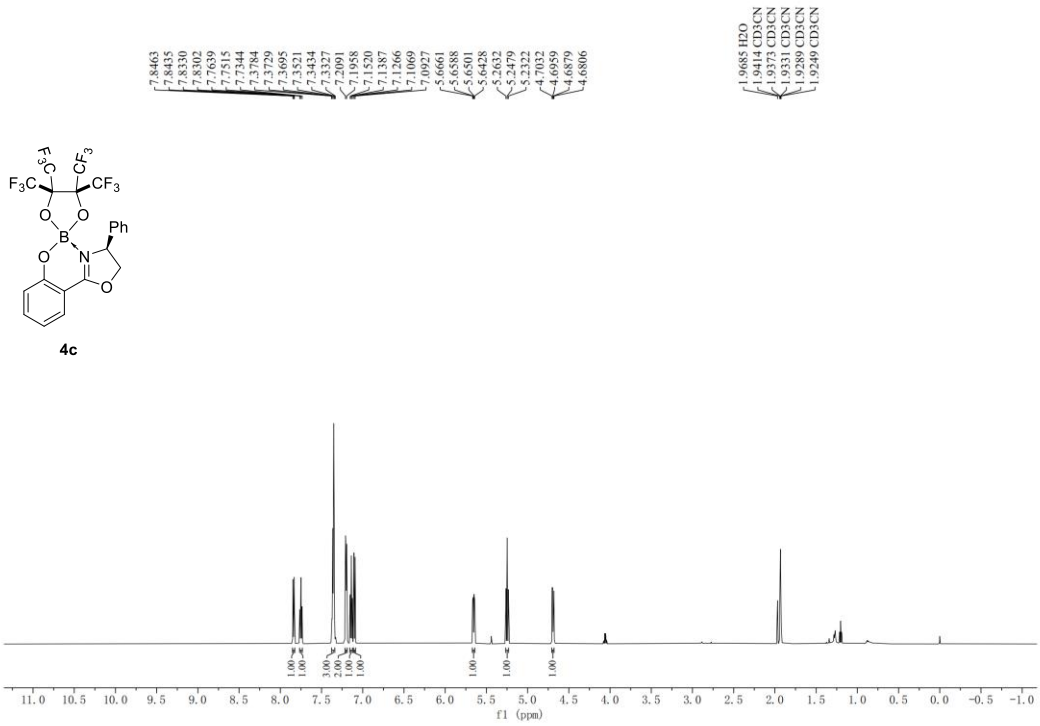
^{13}C NMR spectrum of compound **4b** (600 MHz, CD_3CN)



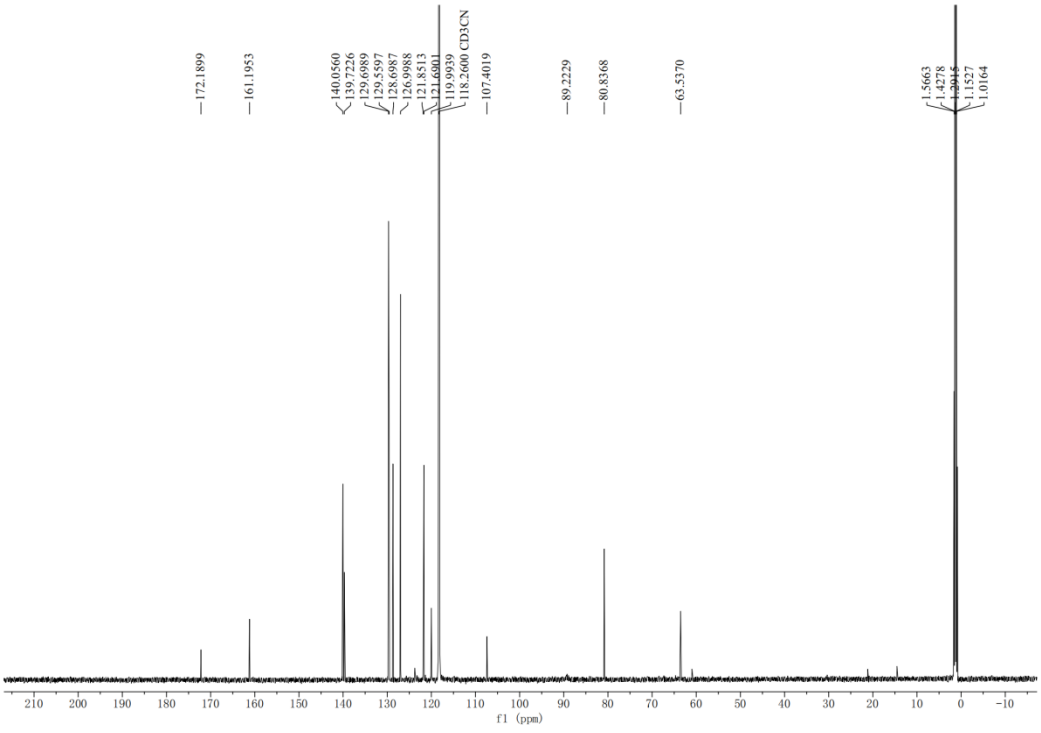
^{19}F NMR spectrum of compound **4b** (600 MHz, CD_3CN)



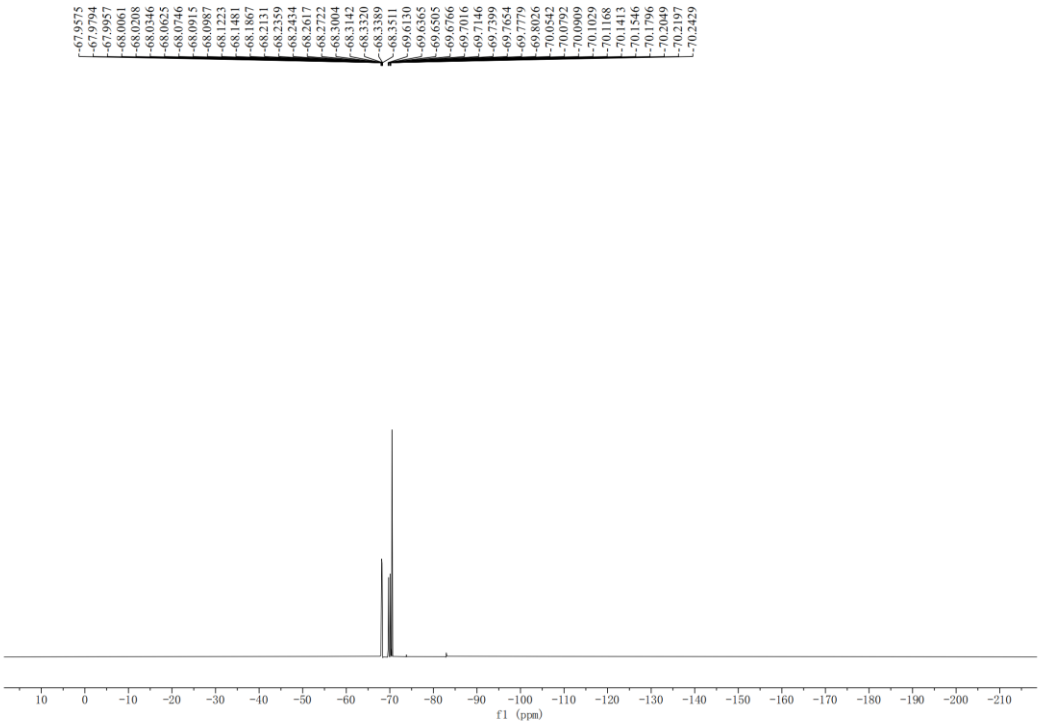
^{11}B NMR spectrum of compound **4b** (600 MHz, CD_3CN)



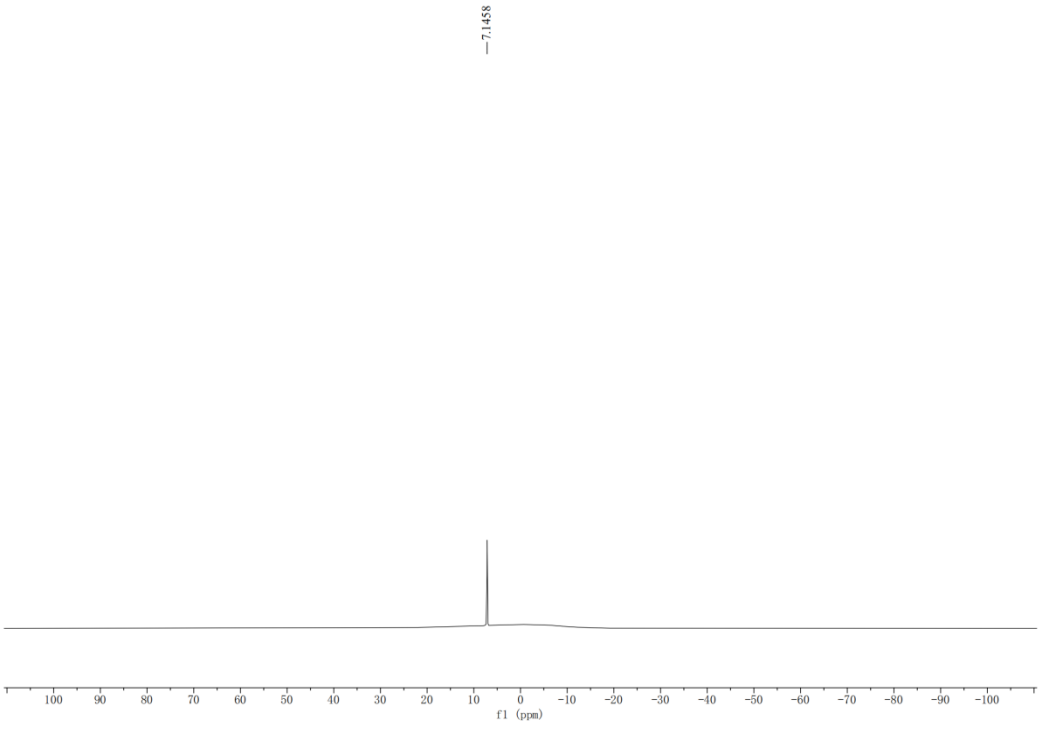
^{1}H NMR spectrum of compound **4c** (600 MHz, CD_3CN)



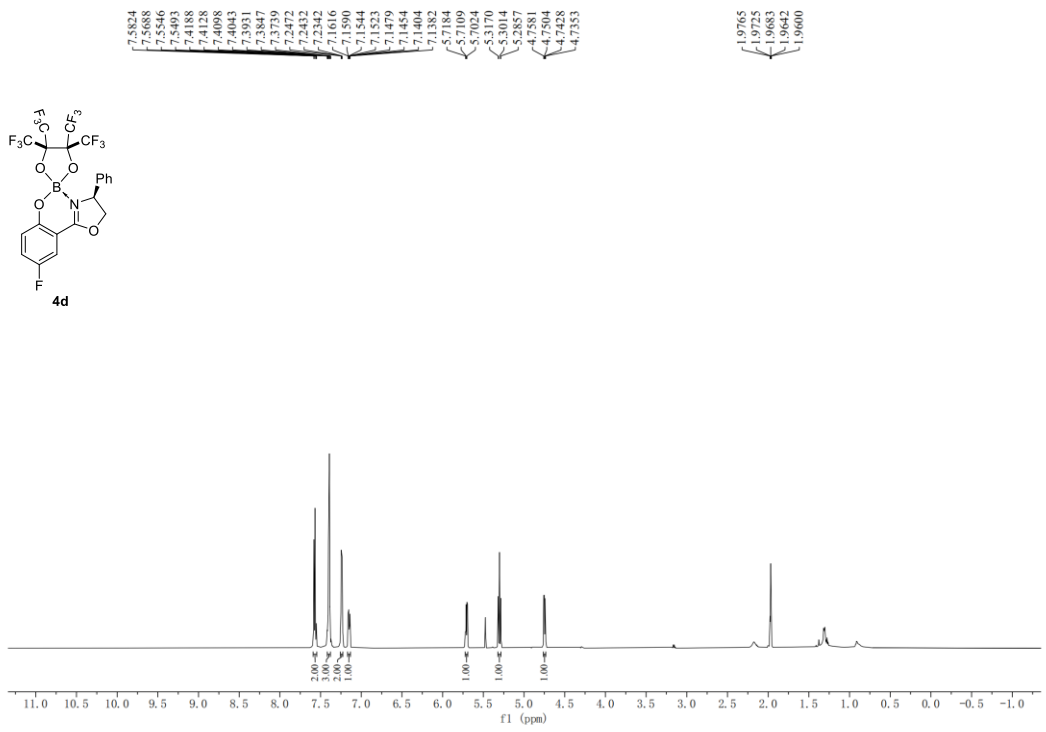
^{13}C NMR spectrum of compound **4c** (600 MHz, CD_3CN)



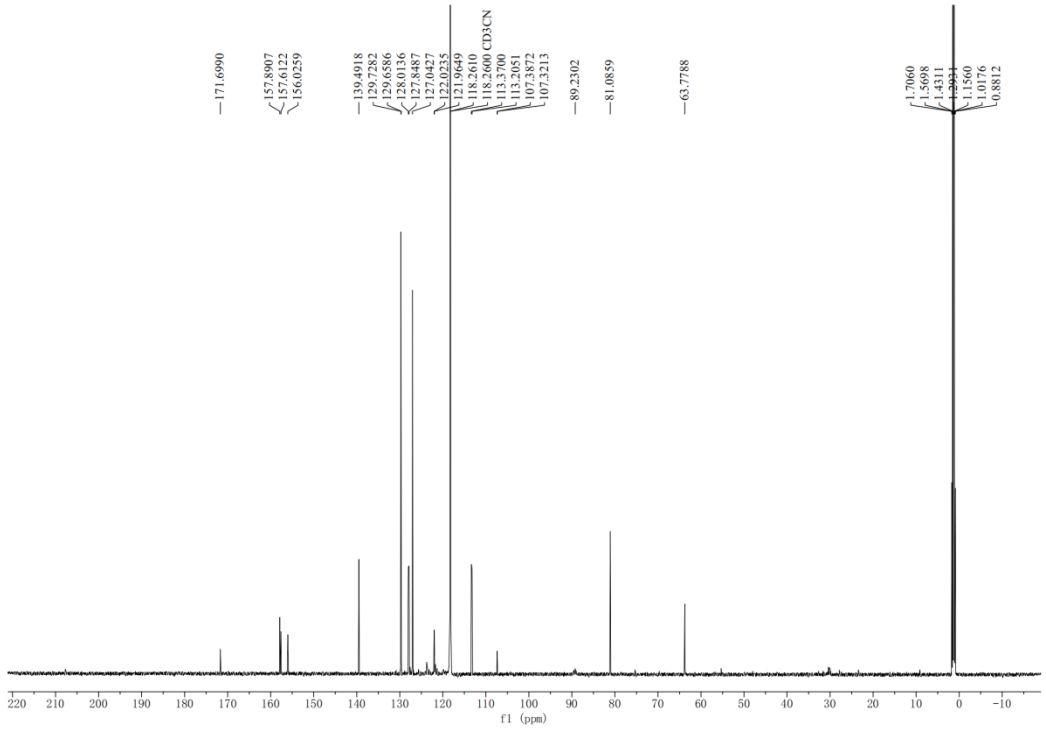
^{19}F NMR spectrum of compound **4c** (600 MHz, CD_3CN)



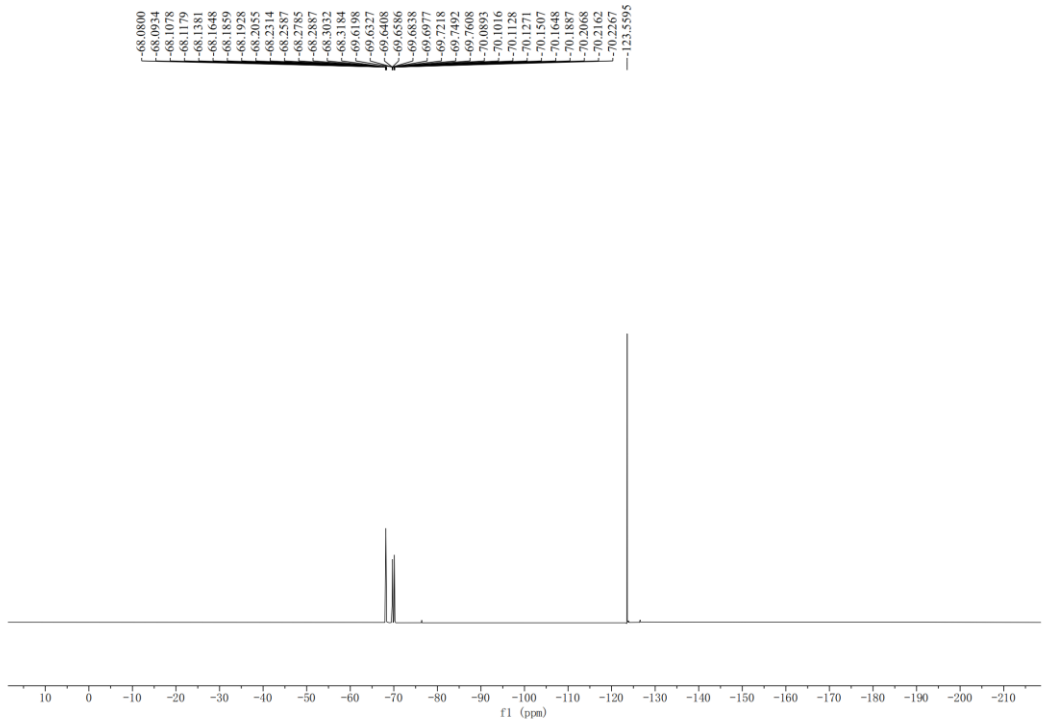
^{11}B NMR spectrum of compound **4c** (600 MHz, CD_3CN)



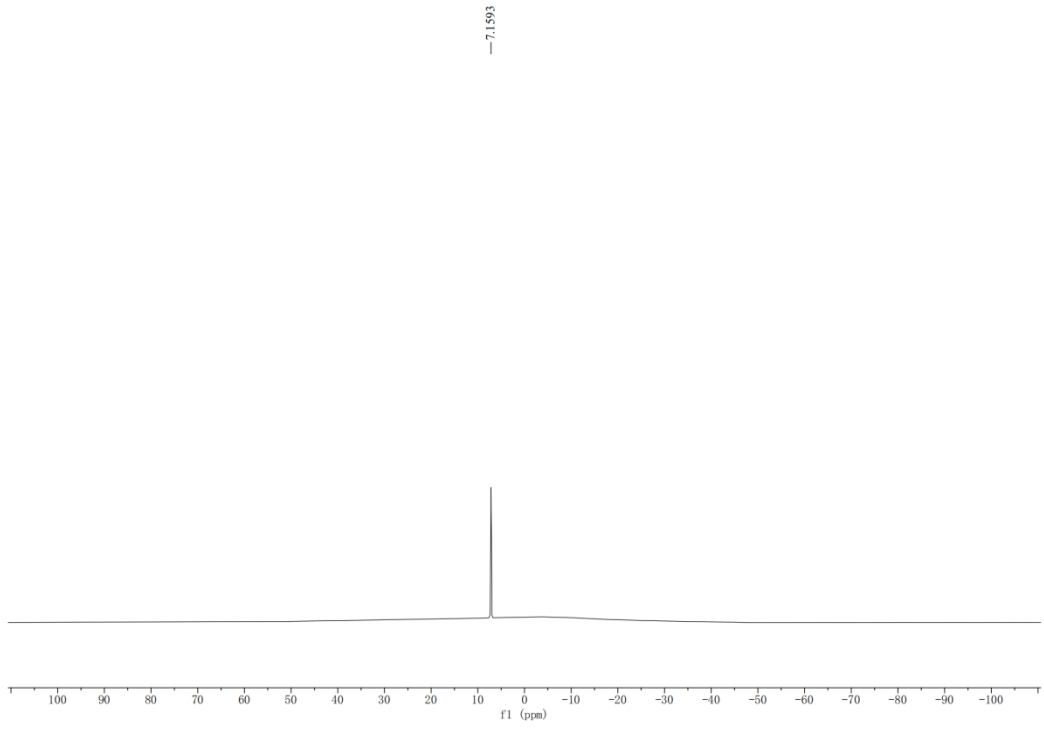
^{1}H NMR spectrum of compound **4d** (600 MHz, CD_3CN)



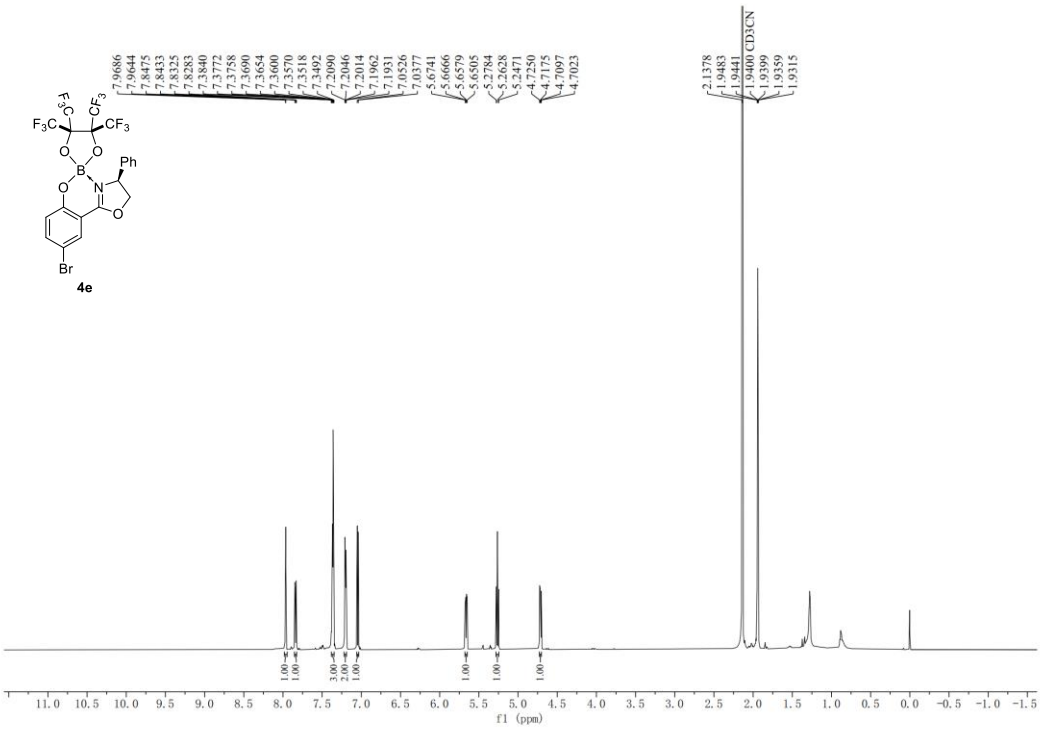
^{13}C NMR spectrum of compound **4d** (600 MHz, CD_3CN)



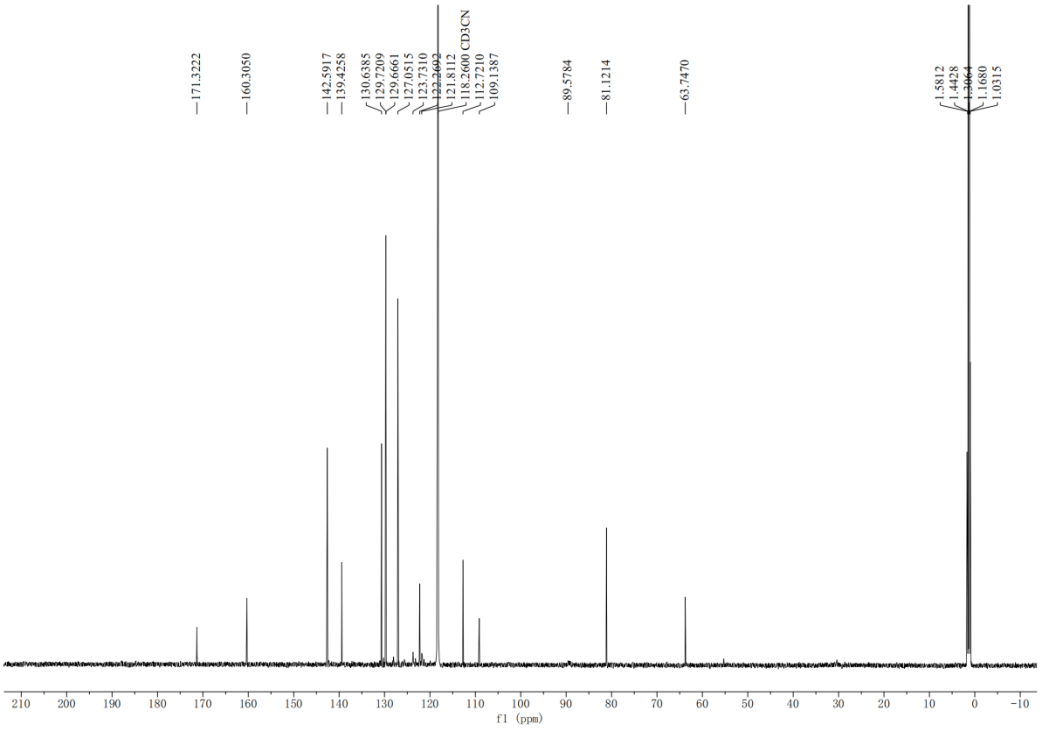
^{19}F NMR spectrum of compound **4d** (600 MHz, CD_3CN)



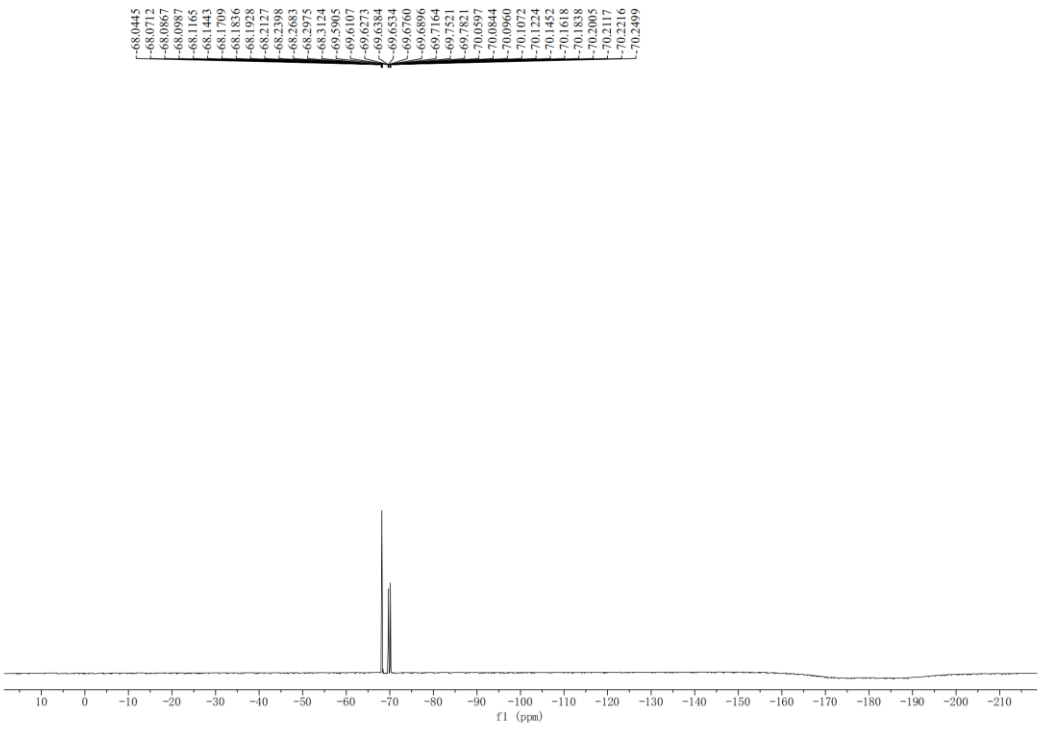
^{11}B NMR spectrum of compound **4d** (600 MHz, CD_3CN)



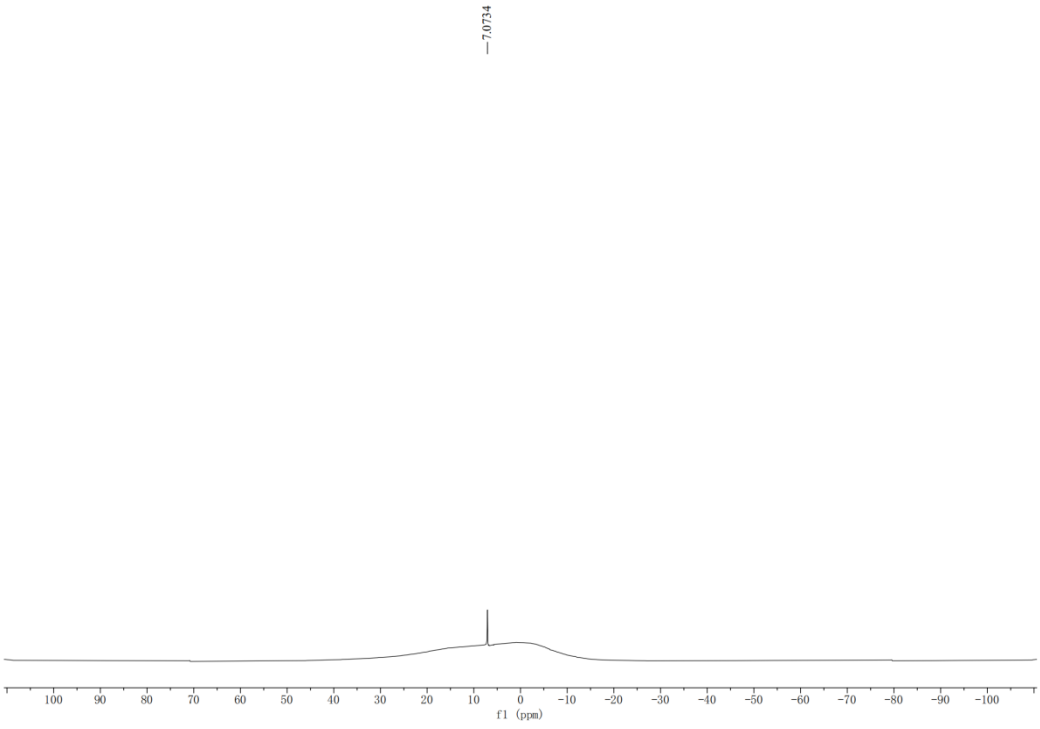
^{1}H NMR spectrum of compound **4e** (600 MHz, CD_3CN)



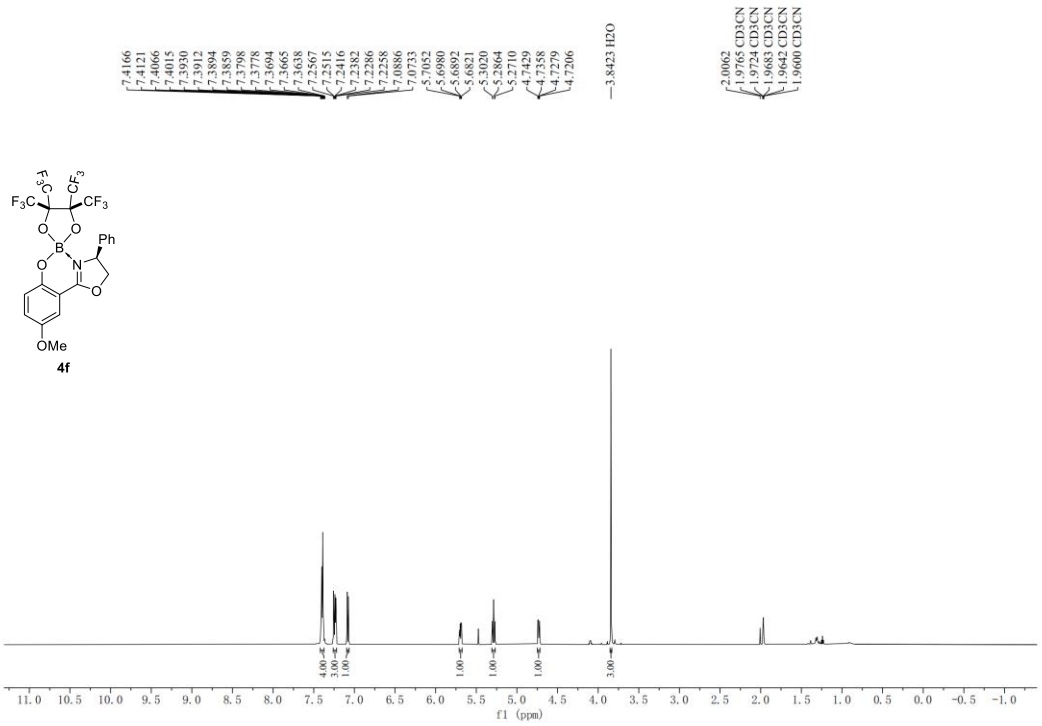
^{13}C NMR spectrum of compound **4e** (600 MHz, CD_3CN)



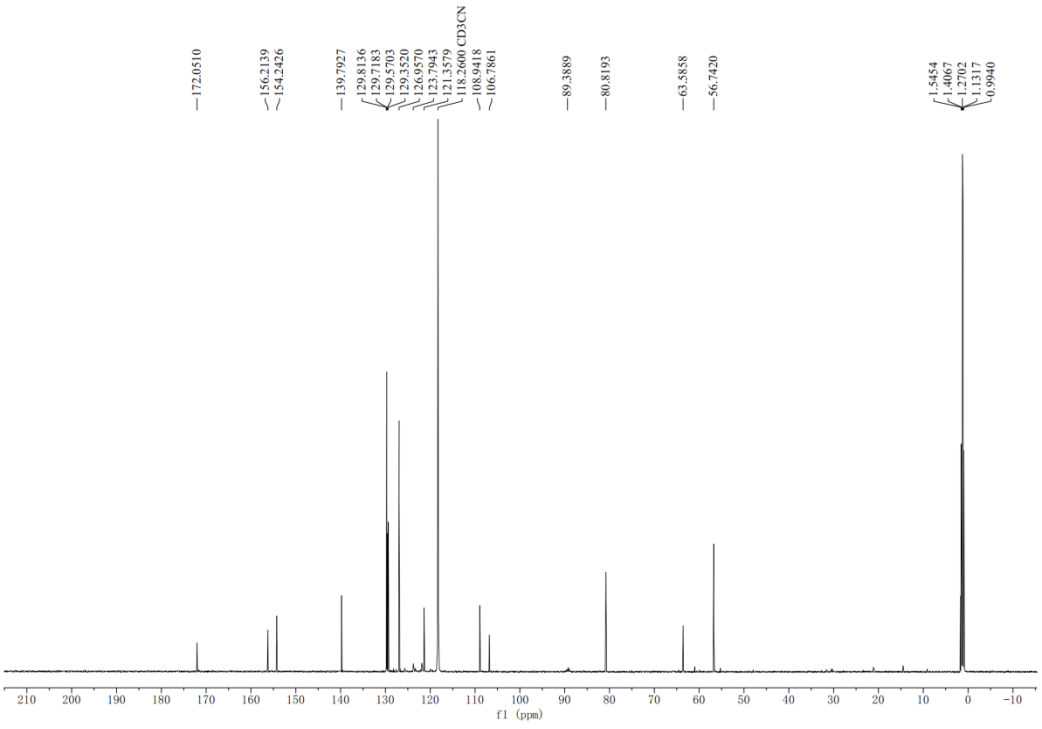
^{19}F NMR spectrum of compound **4e** (600 MHz, CD_3CN)



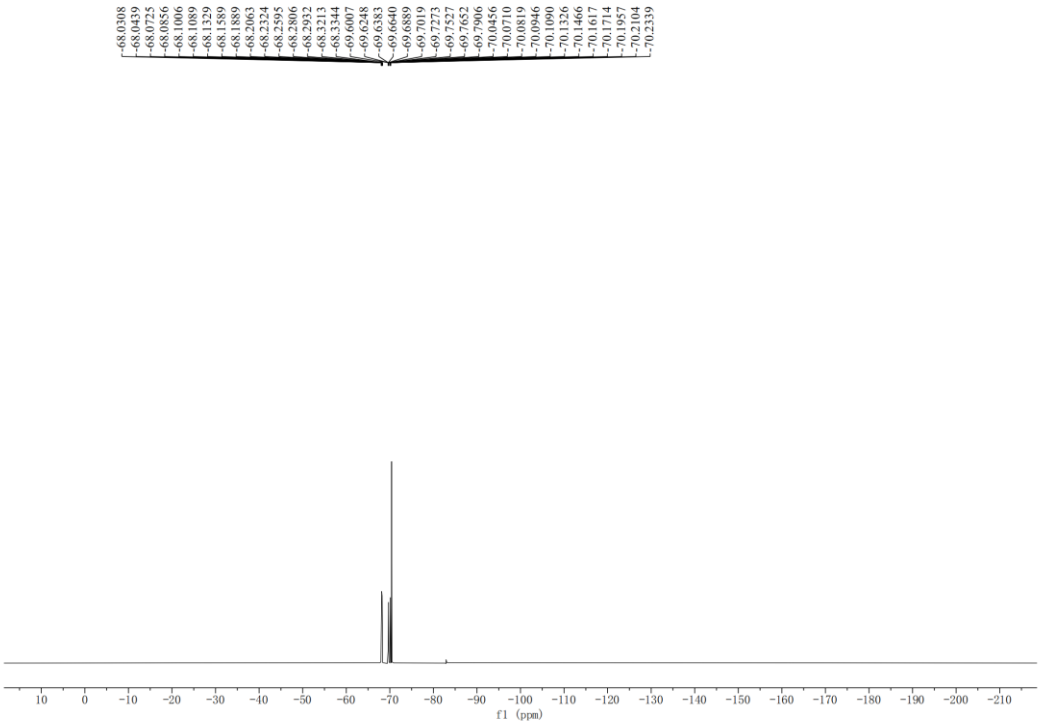
^{11}B NMR spectrum of compound **4e** (600 MHz, CD_3CN)



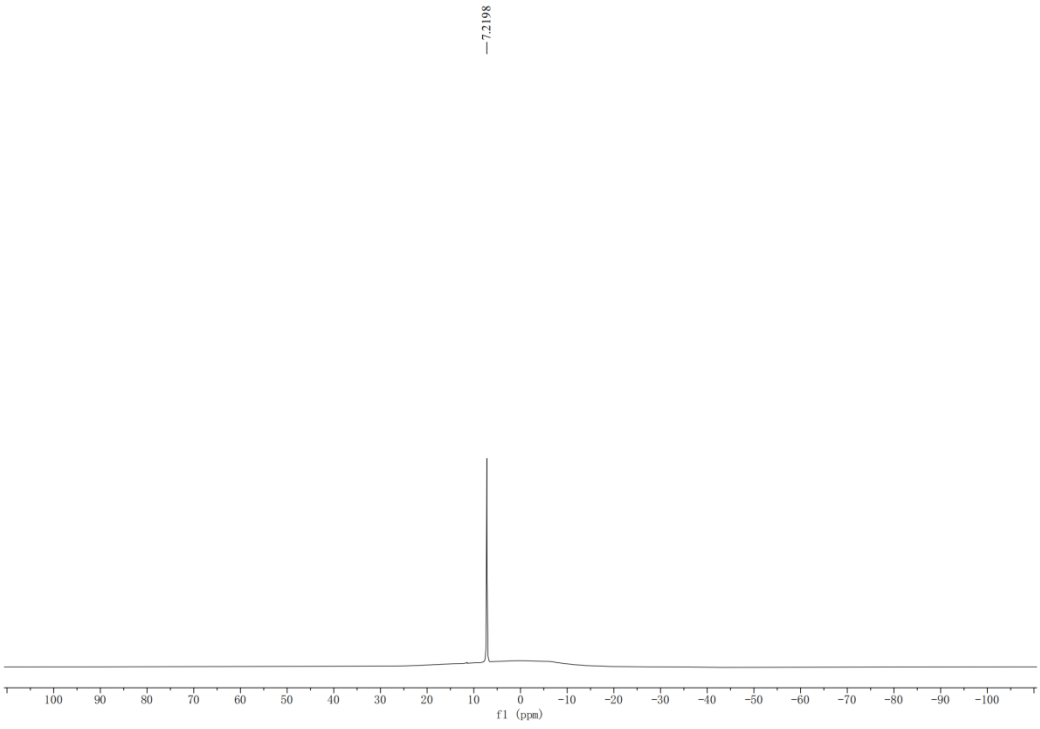
^{1}H NMR spectrum of compound **4f** (600 MHz, CD_3CN)



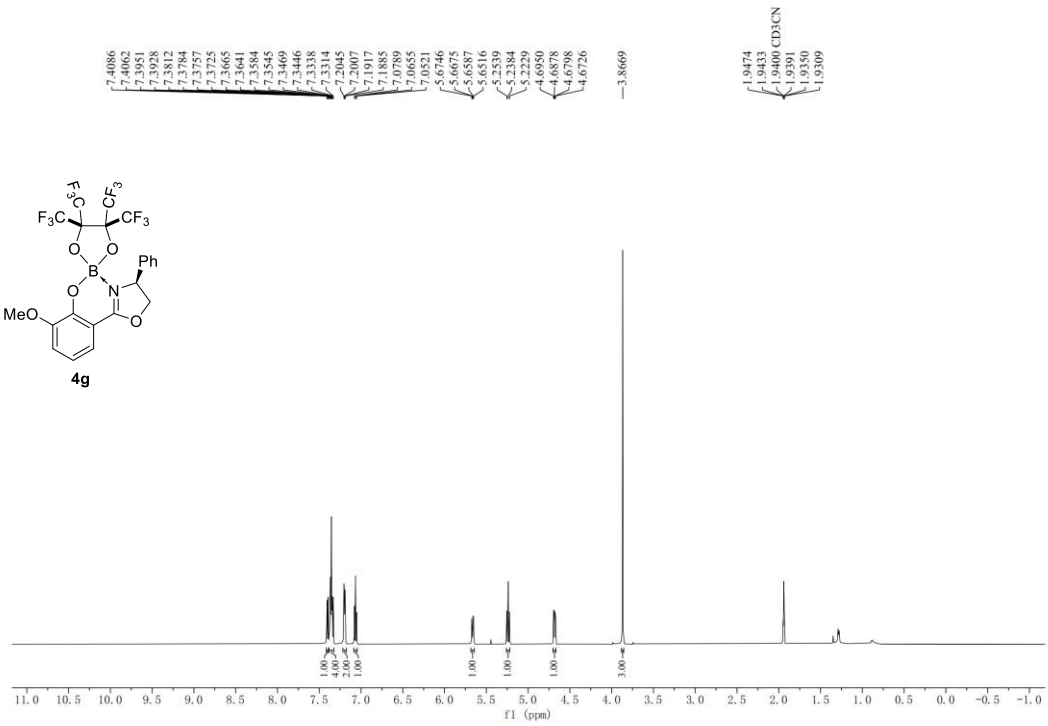
^{13}C NMR spectrum of compound **4f** (600 MHz, CD_3CN)



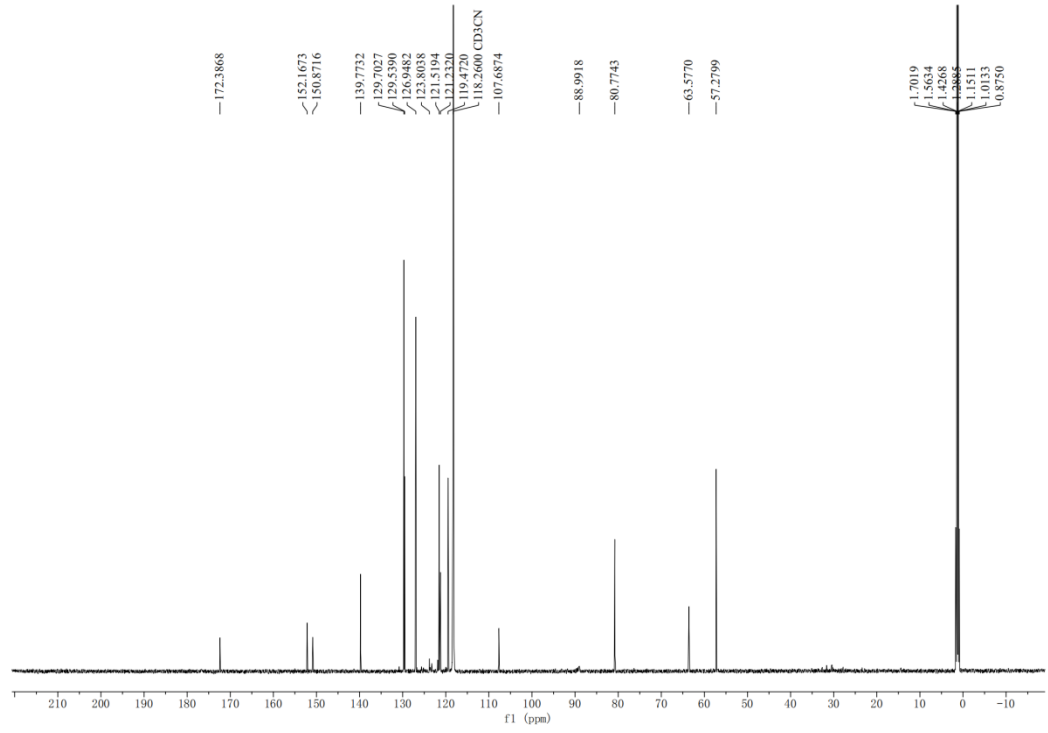
^{19}F NMR spectrum of compound **4f** (600 MHz, CD_3CN)



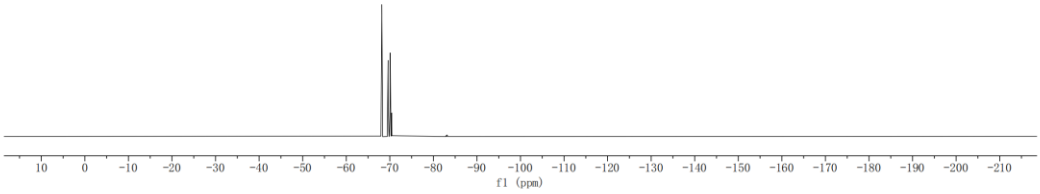
^{11}B NMR spectrum of compound **4f** (600 MHz, CD_3CN)



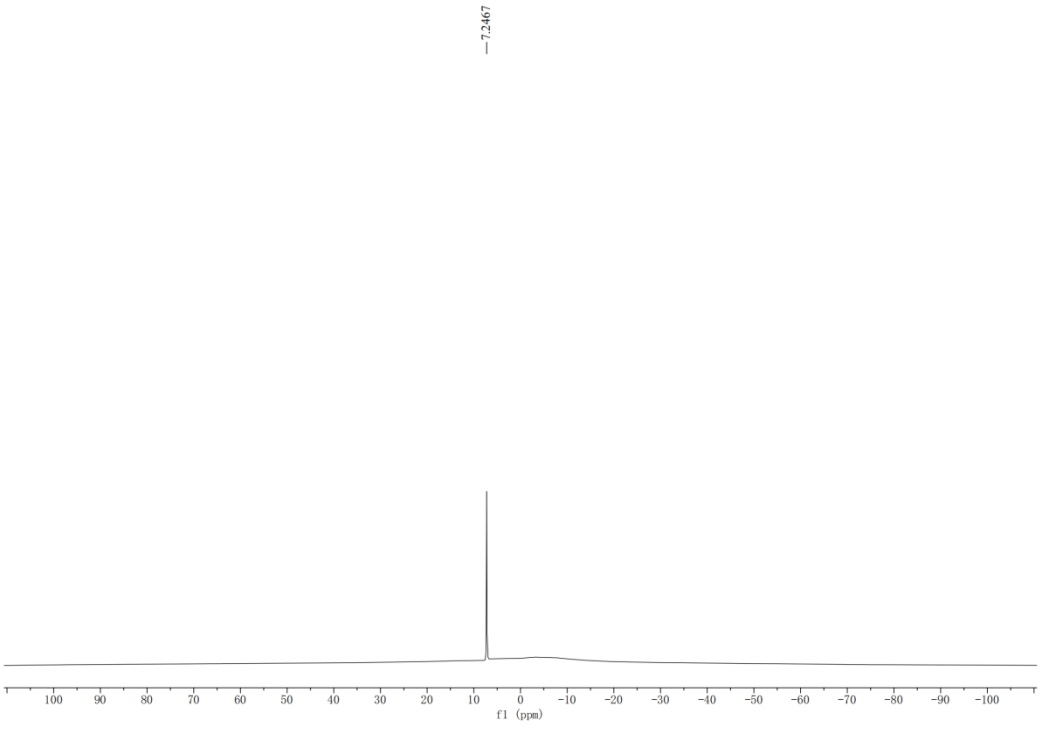
^{1}H NMR spectrum of compound **4g** (600 MHz, CD_3CN)



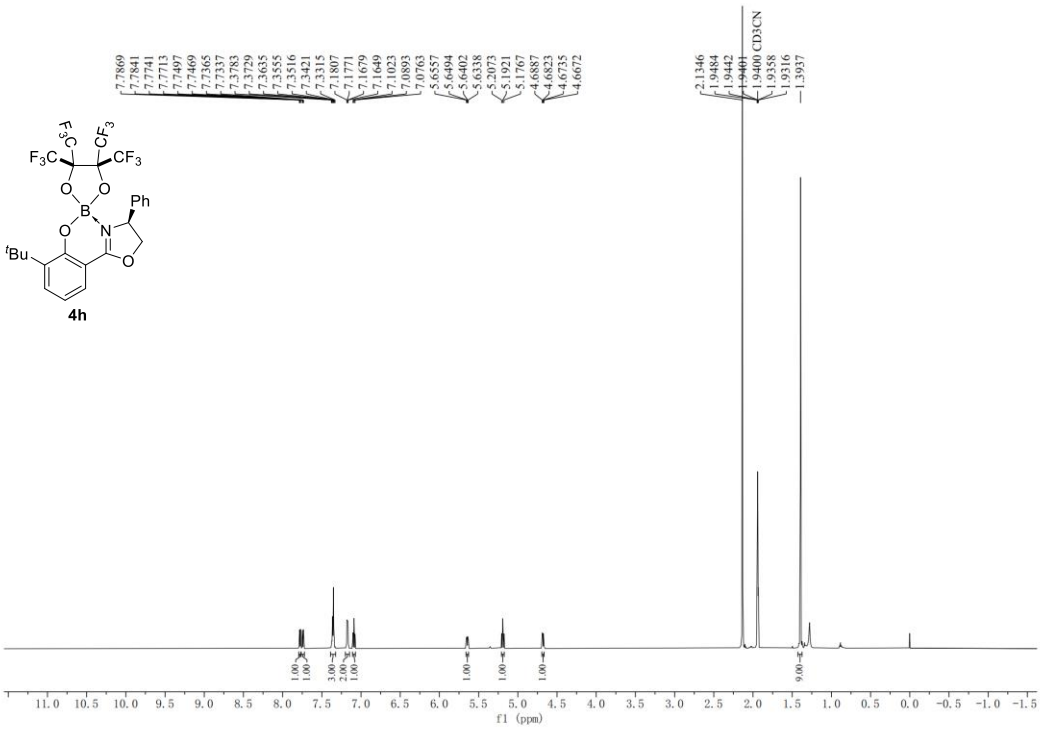
^{13}C NMR spectrum of compound **4g** (600 MHz, CD_3CN)



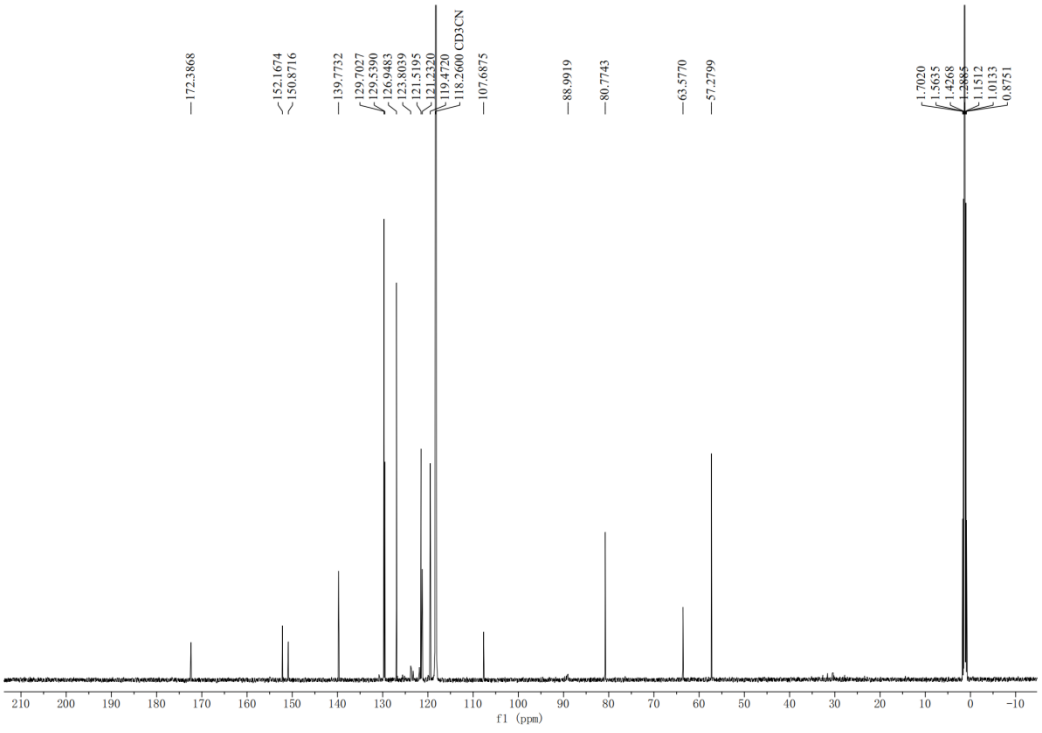
^{19}F NMR spectrum of compound **4g** (600 MHz, CD_3CN)



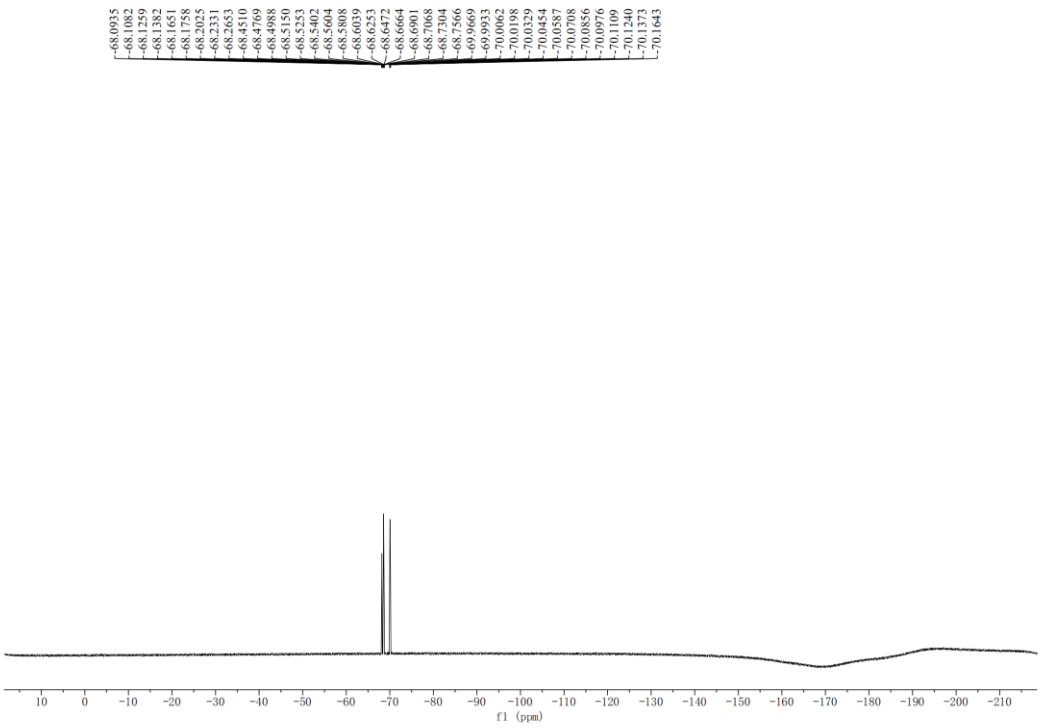
^{11}B NMR spectrum of compound **4g** (600 MHz, CD_3CN)



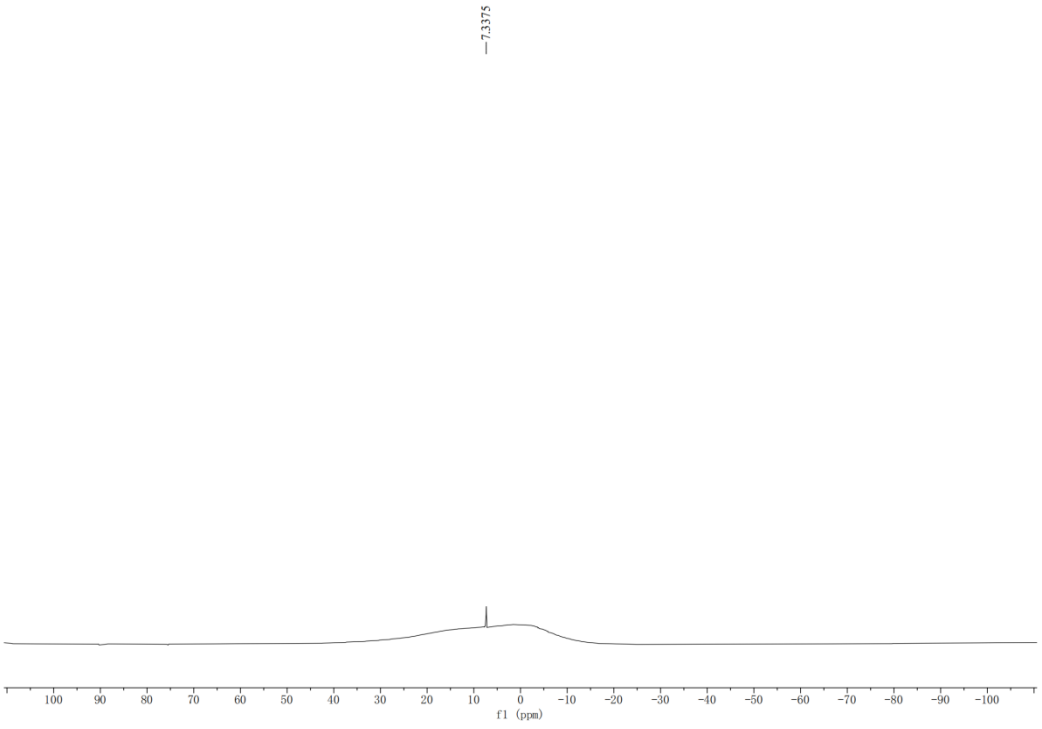
^{1}H NMR spectrum of compound **4h** (600 MHz, CD_3CN)



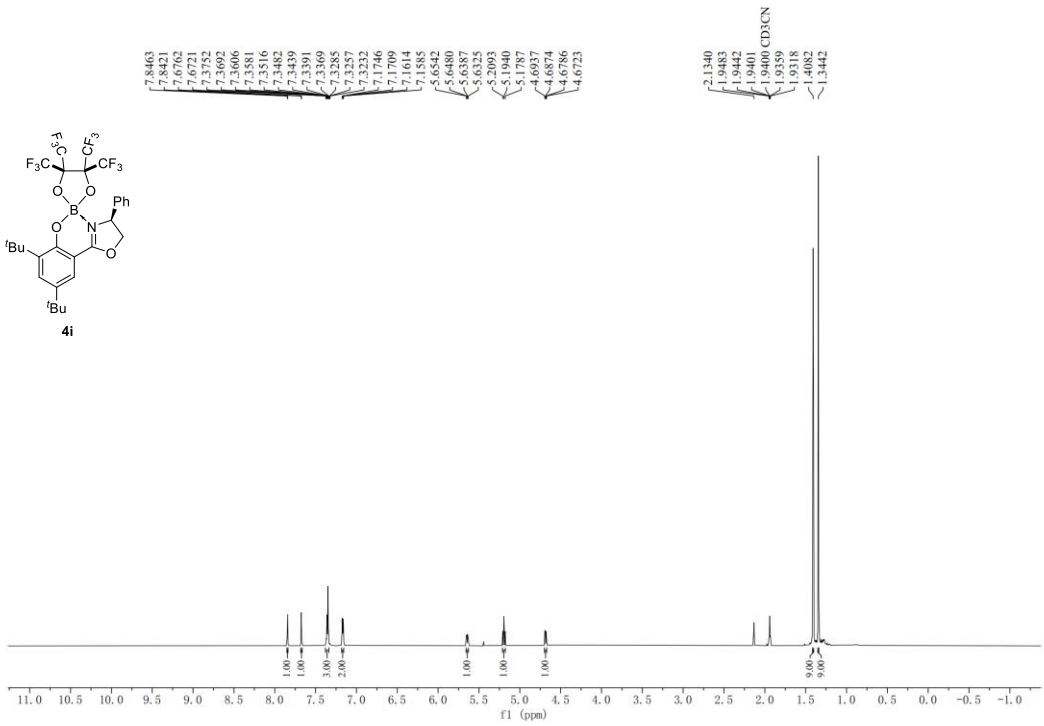
^{13}C NMR spectrum of compound **4h** (600 MHz, CD_3CN)



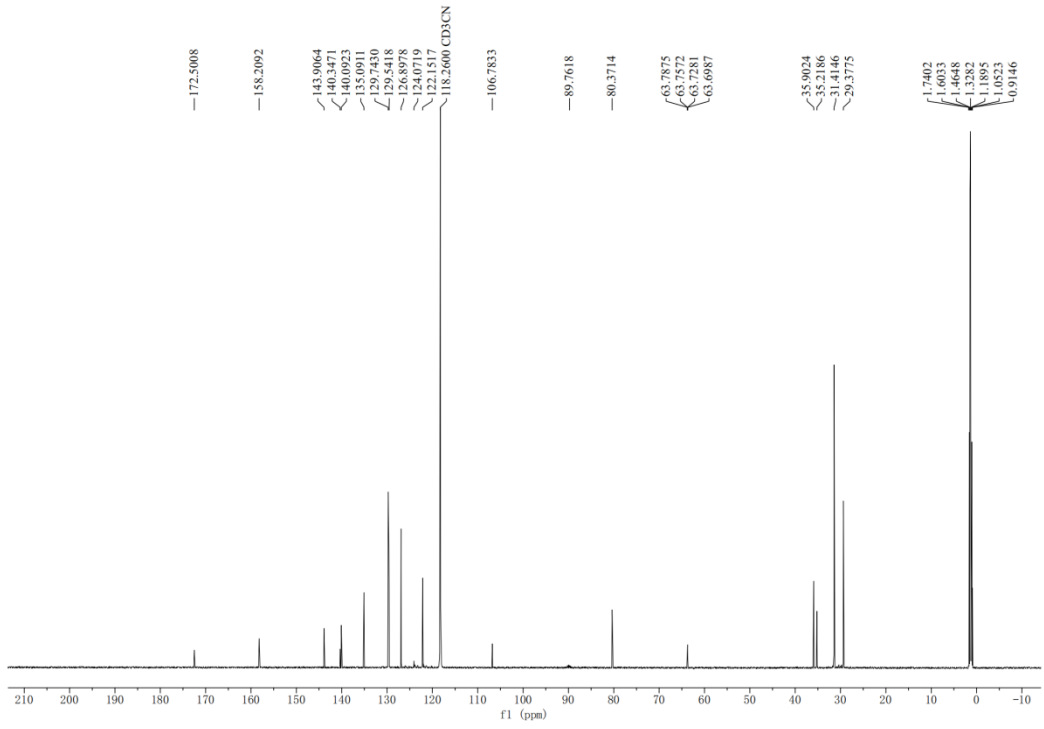
^{19}F NMR spectrum of compound **4h** (600 MHz, CD_3CN)



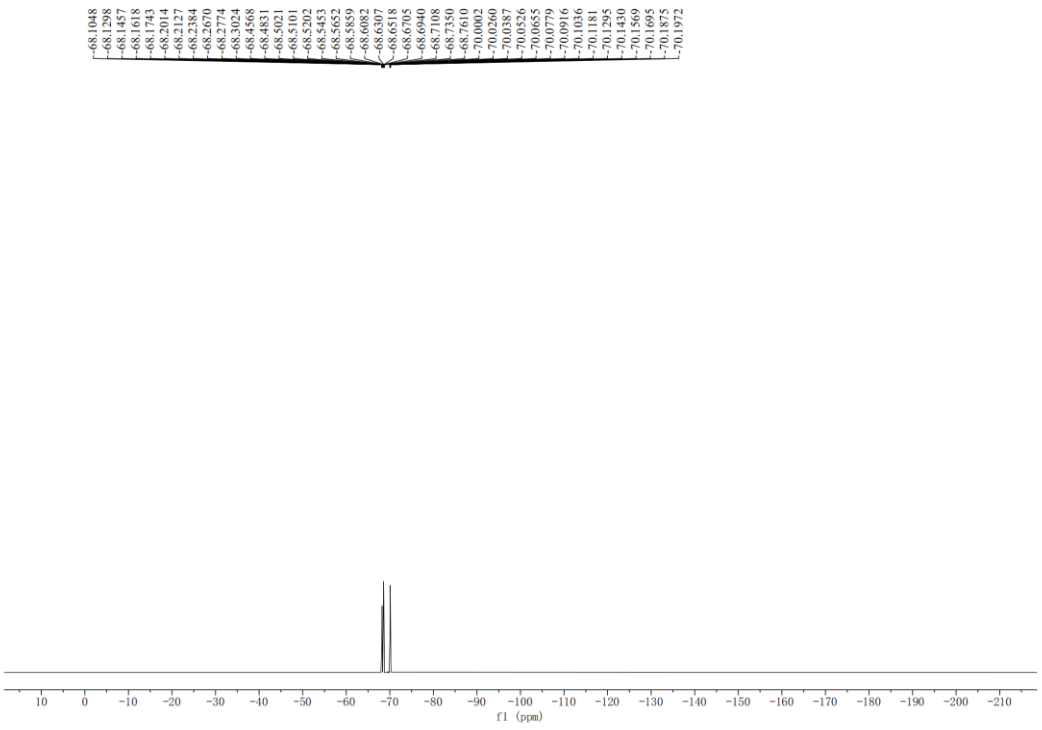
^{11}B NMR spectrum of compound **4h** (600 MHz, CD_3CN)



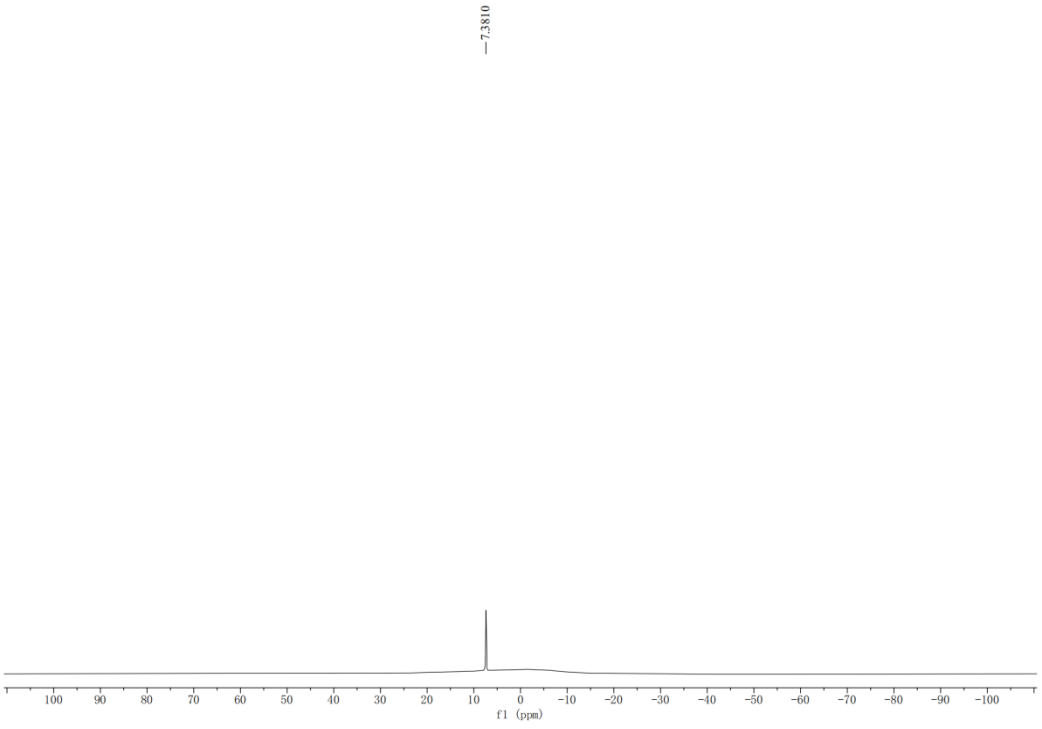
^{1}H NMR spectrum of compound **4i** (600 MHz, CD_3CN)



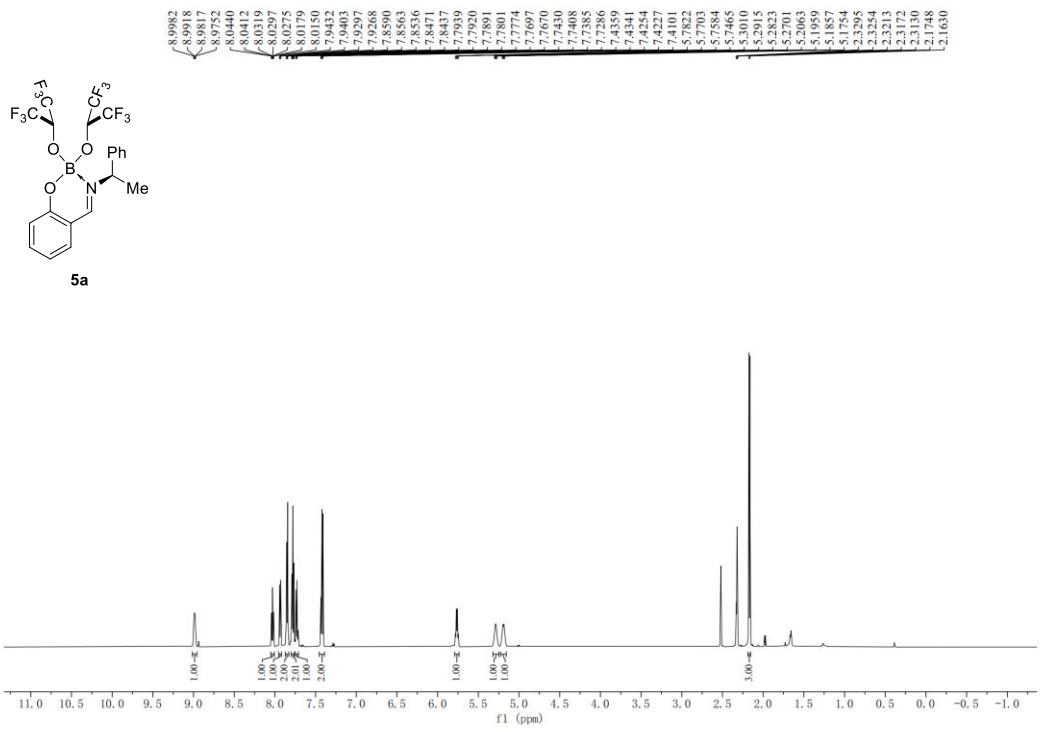
^{13}C NMR spectrum of compound **4i** (600 MHz, CD_3CN)



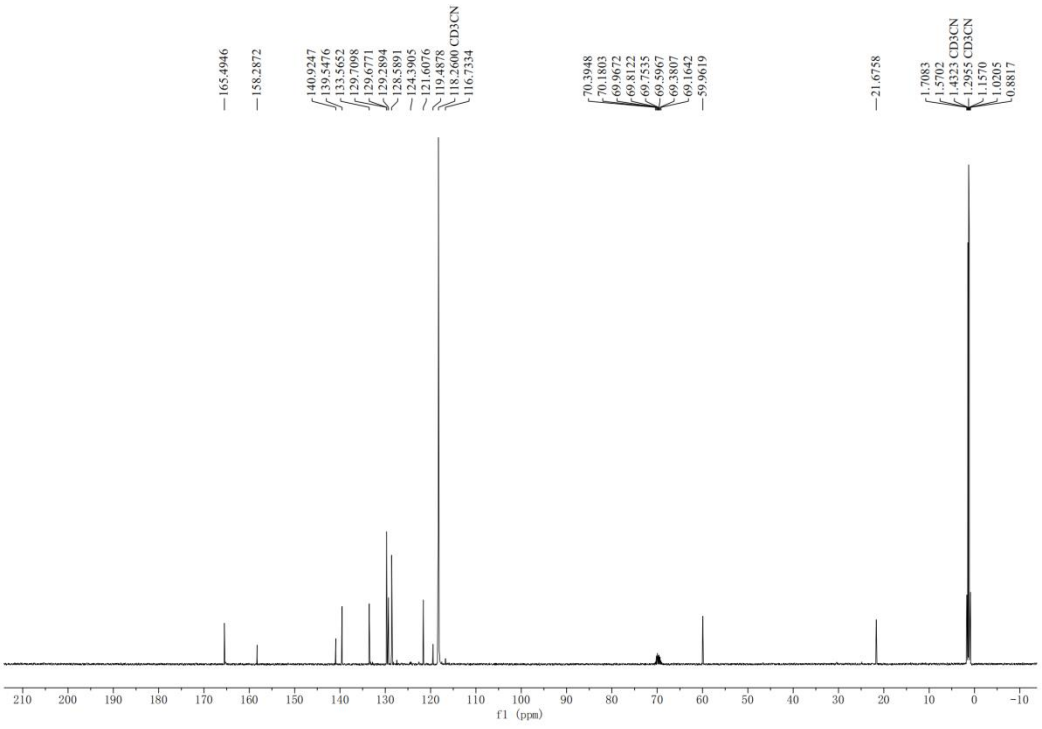
^{19}F NMR spectrum of compound **4i** (600 MHz, CD_3CN)



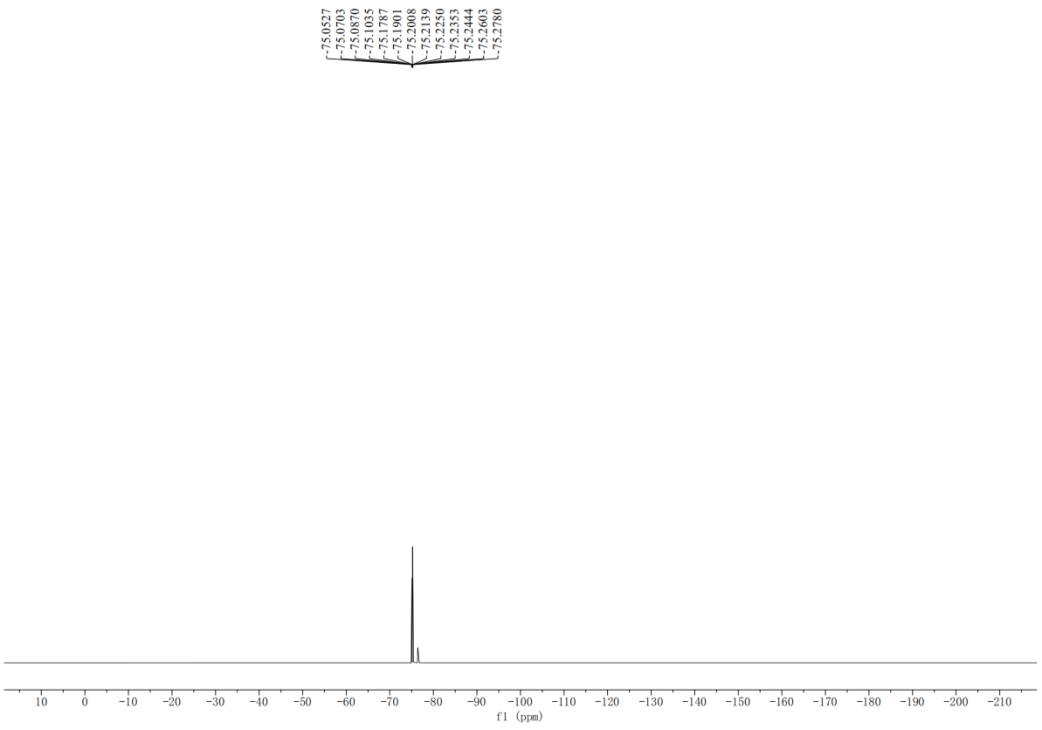
^{11}B NMR spectrum of compound **4i** (600 MHz, CD_3CN)



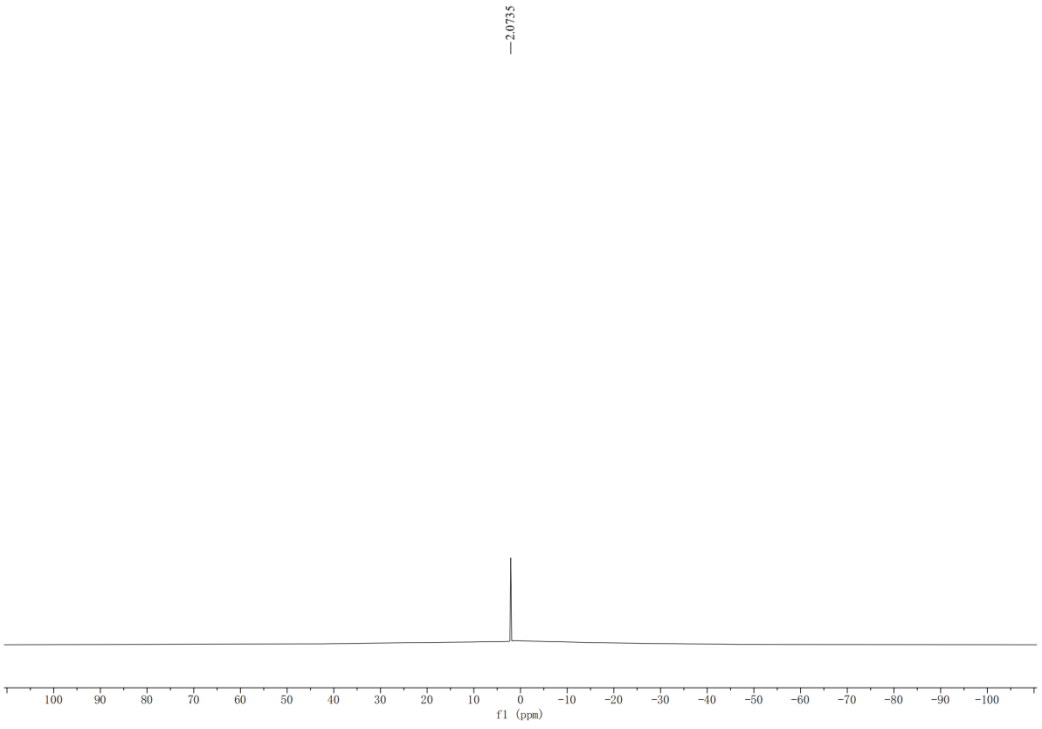
^{1}H NMR spectrum of compound **5a** (600 MHz, CD_3CN)



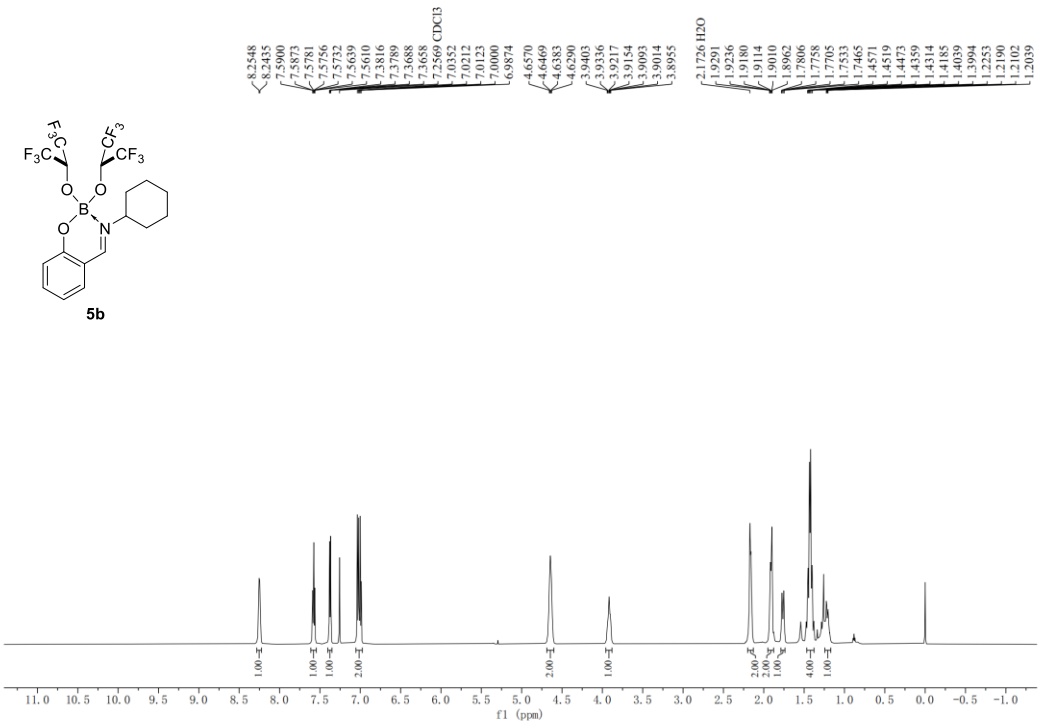
^{13}C NMR spectrum of compound **5a** (600 MHz, CD_3CN)



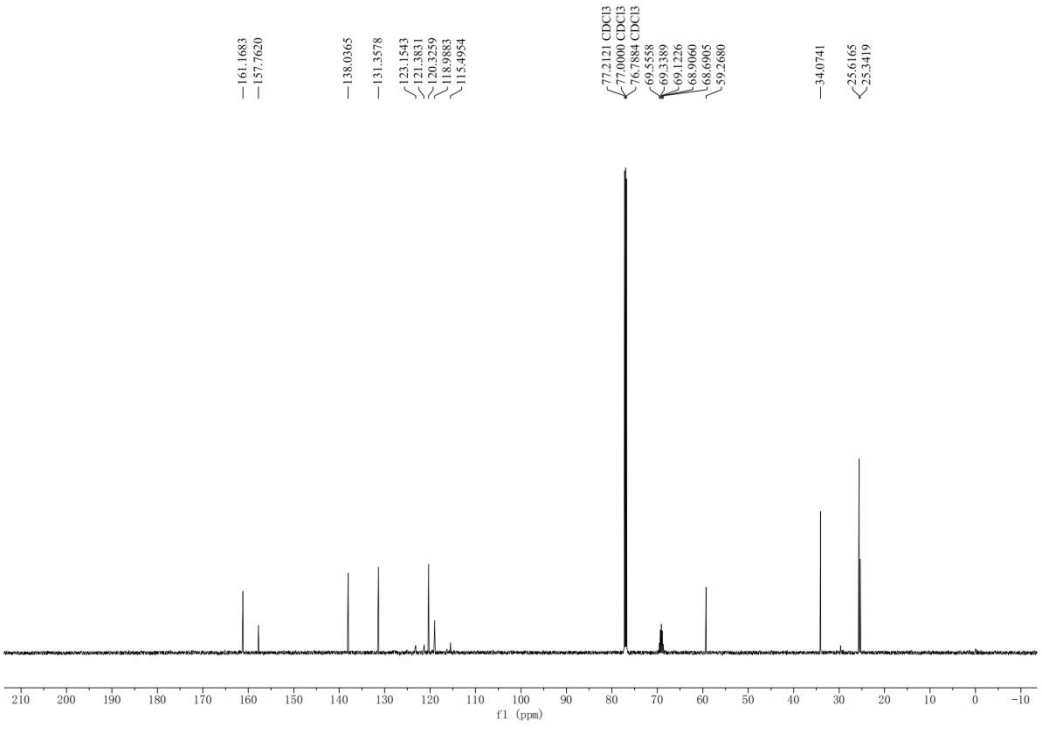
^{19}F NMR spectrum of compound **5a** (600 MHz, CD_3CN)



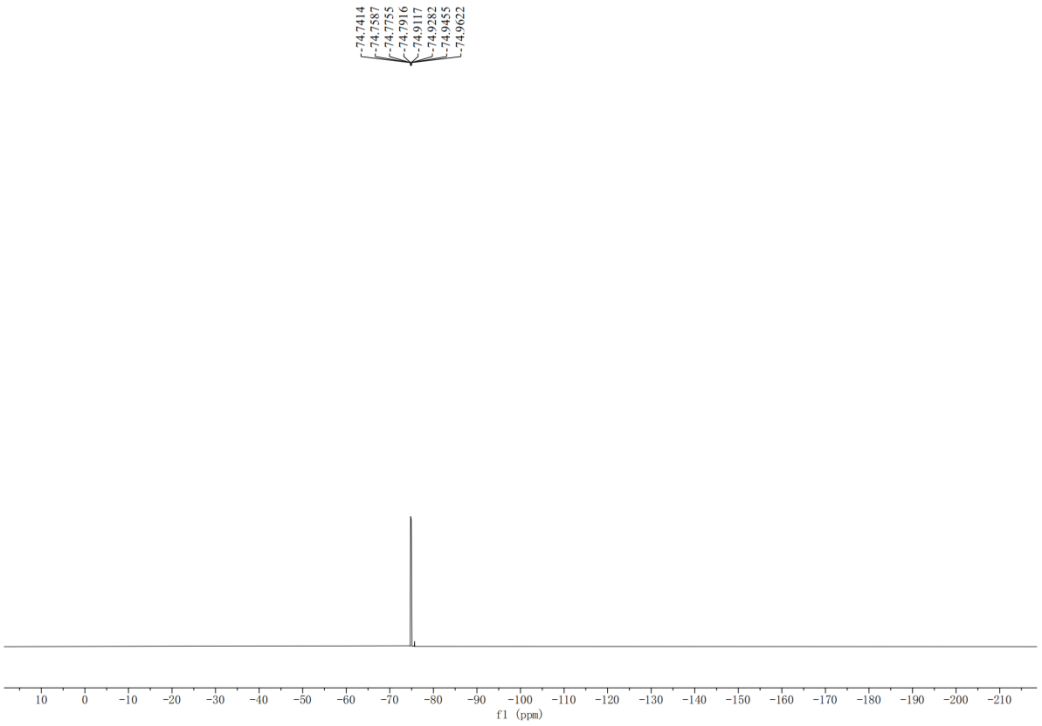
^{11}B NMR spectrum of compound **5a** (600 MHz, CD_3CN)



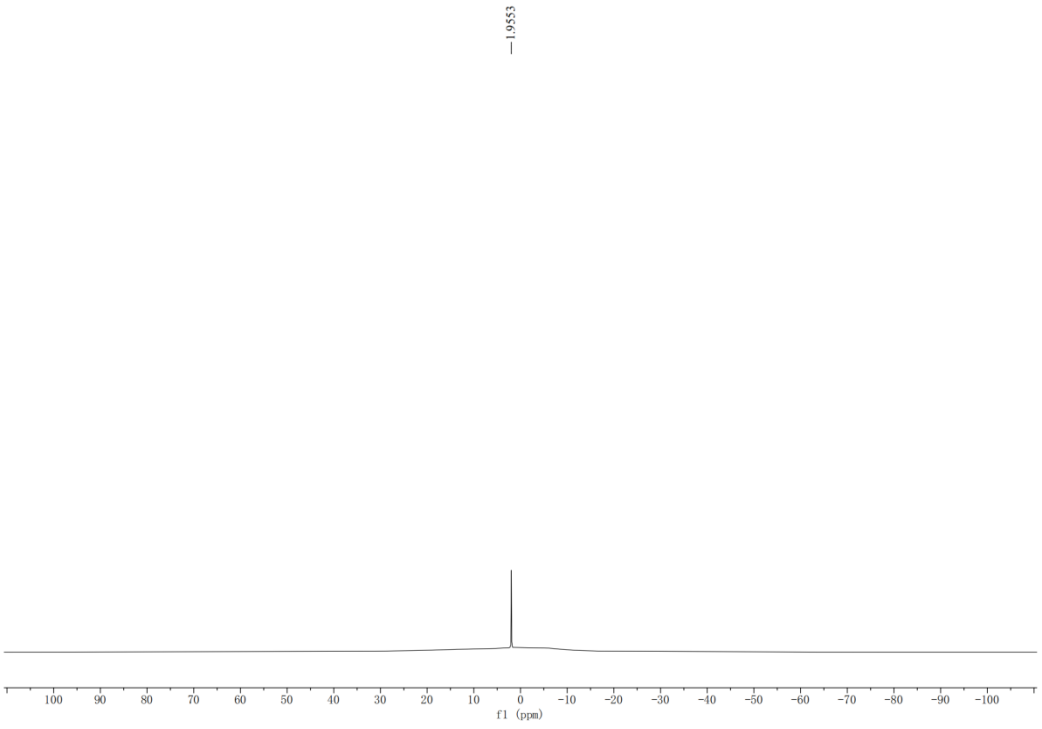
^{1}H NMR spectrum of compound **5b** (600 MHz, $CDCl_3$)



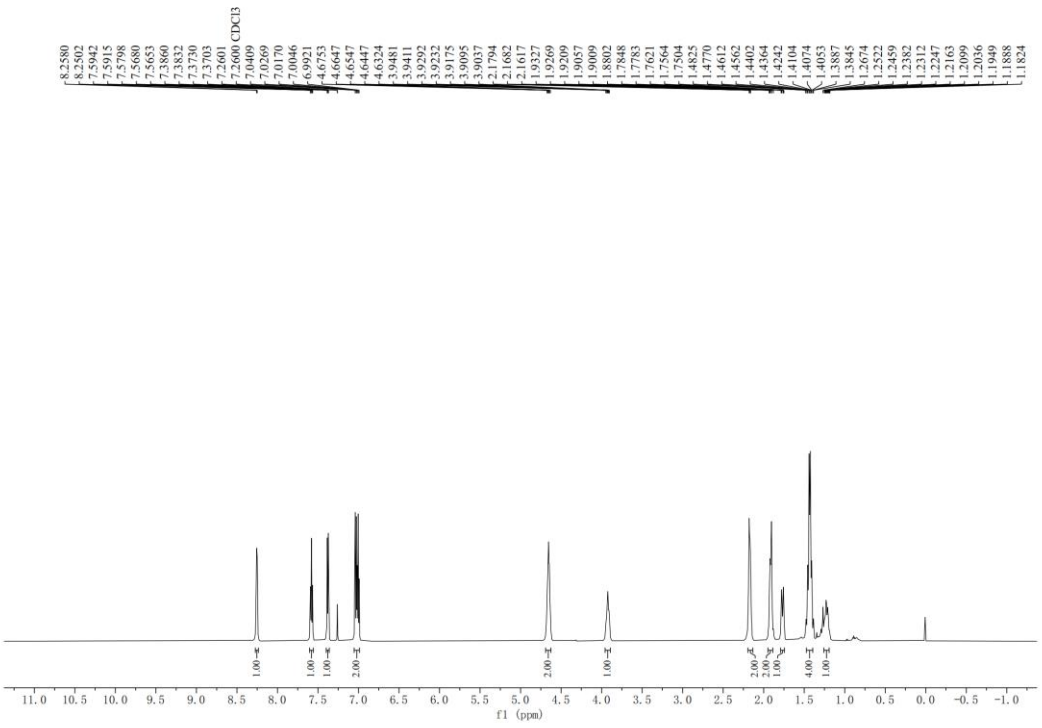
^{13}C NMR spectrum of compound **5b** (600 MHz, $CDCl_3$)



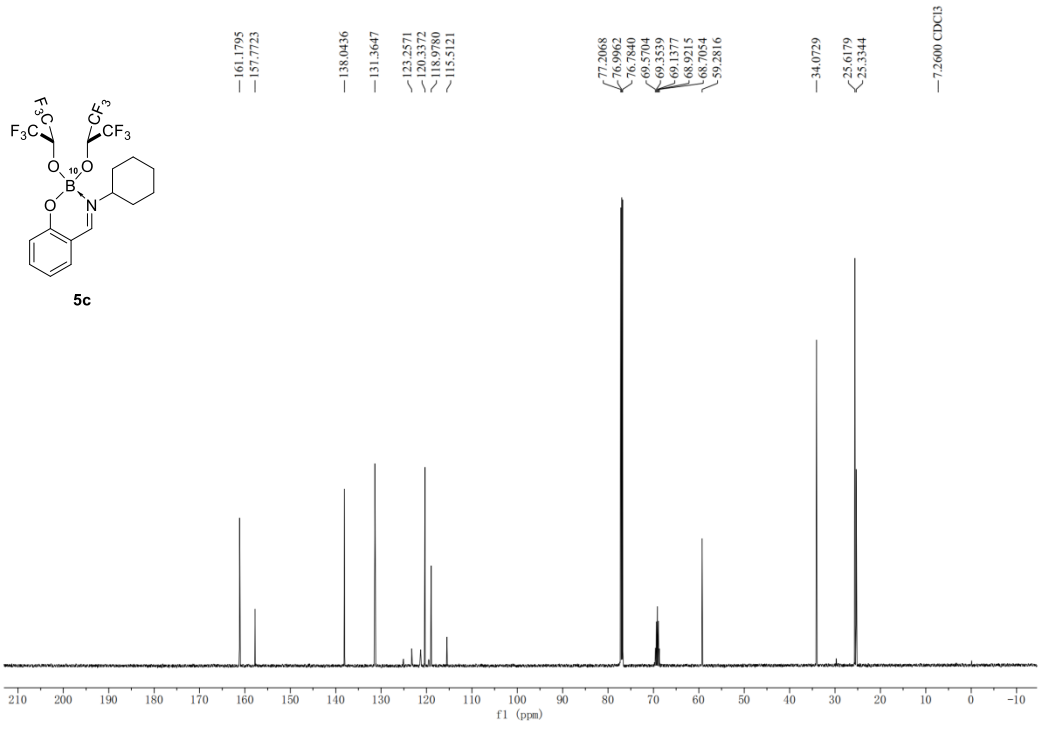
^{19}F NMR spectrum of compound **5b** (600 MHz, $CDCl_3$)



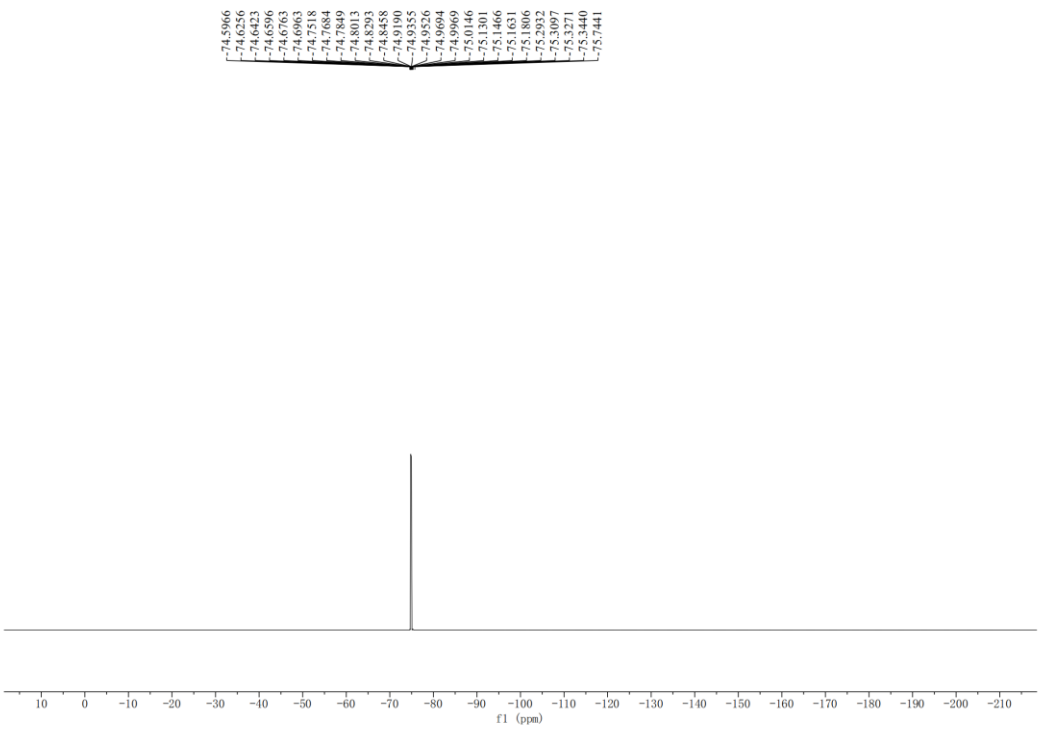
^{11}B NMR spectrum of compound **5b** (600 MHz, $CDCl_3$)



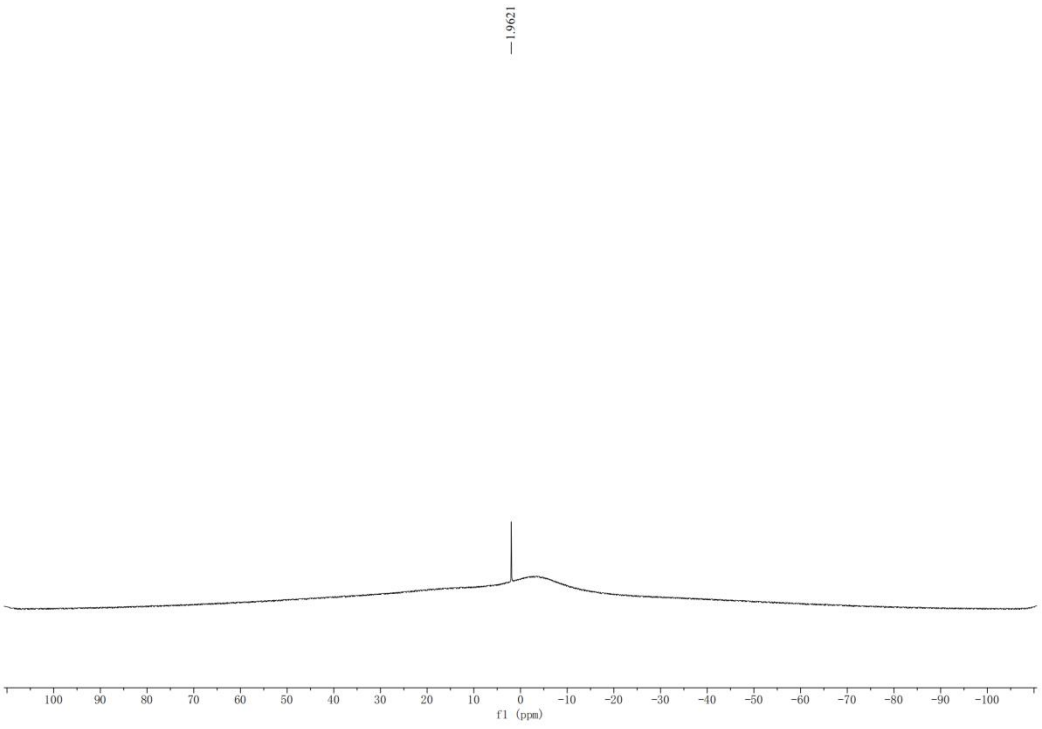
^{1}H NMR spectrum of compound **5c** (600 MHz, $CDCl_3$)



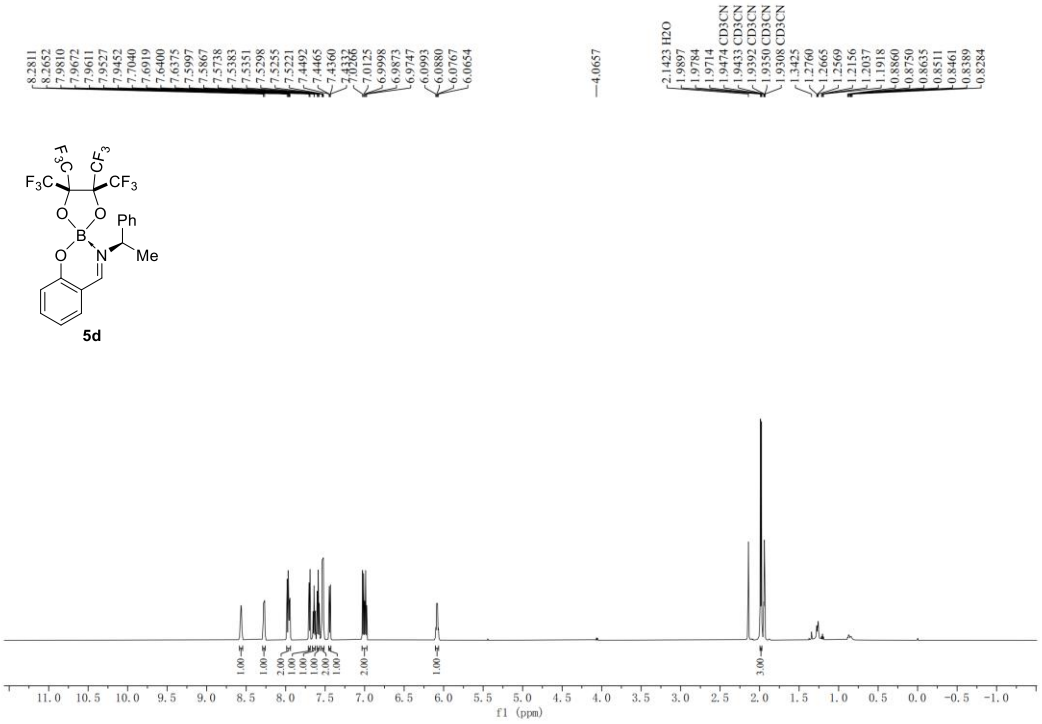
^{13}C NMR spectrum of compound **5c** (600 MHz, $CDCl_3$)



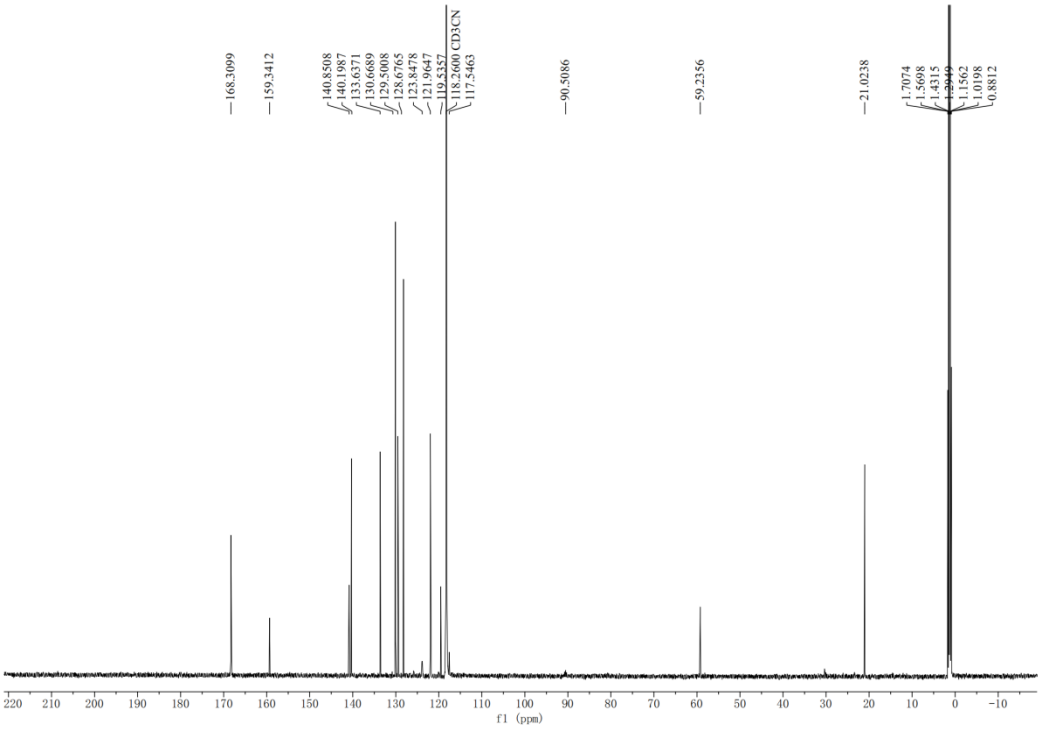
[19]F NMR spectrum of compound **5c** (600 MHz, $CDCl_3$)



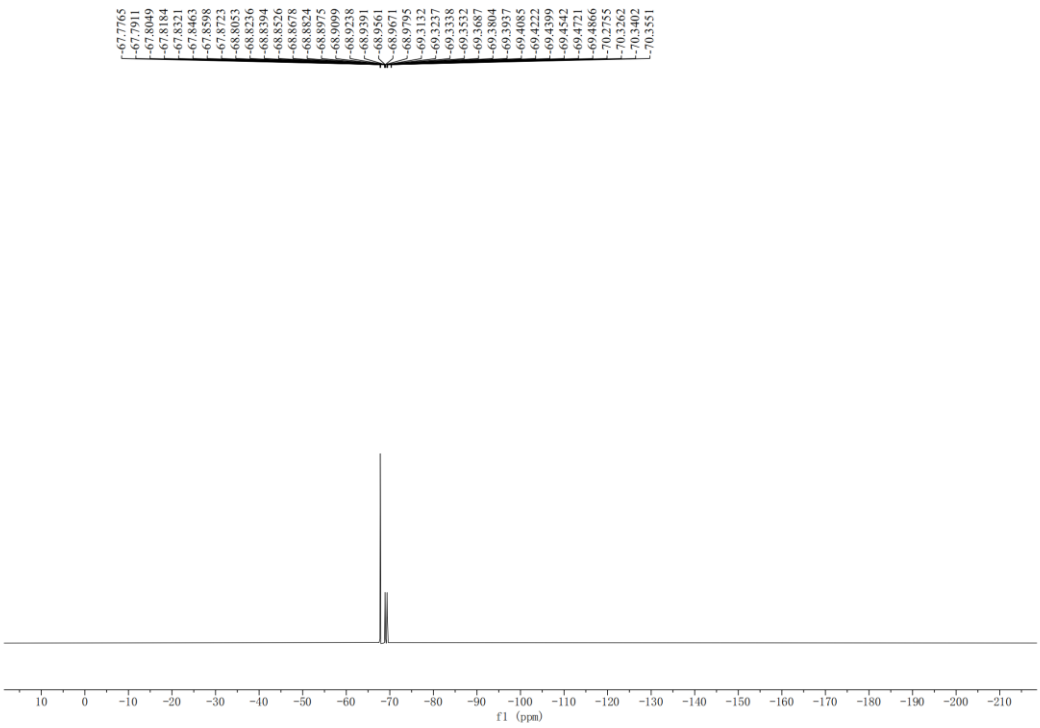
[11]B NMR spectrum of compound **5c** (600 MHz, $CDCl_3$)



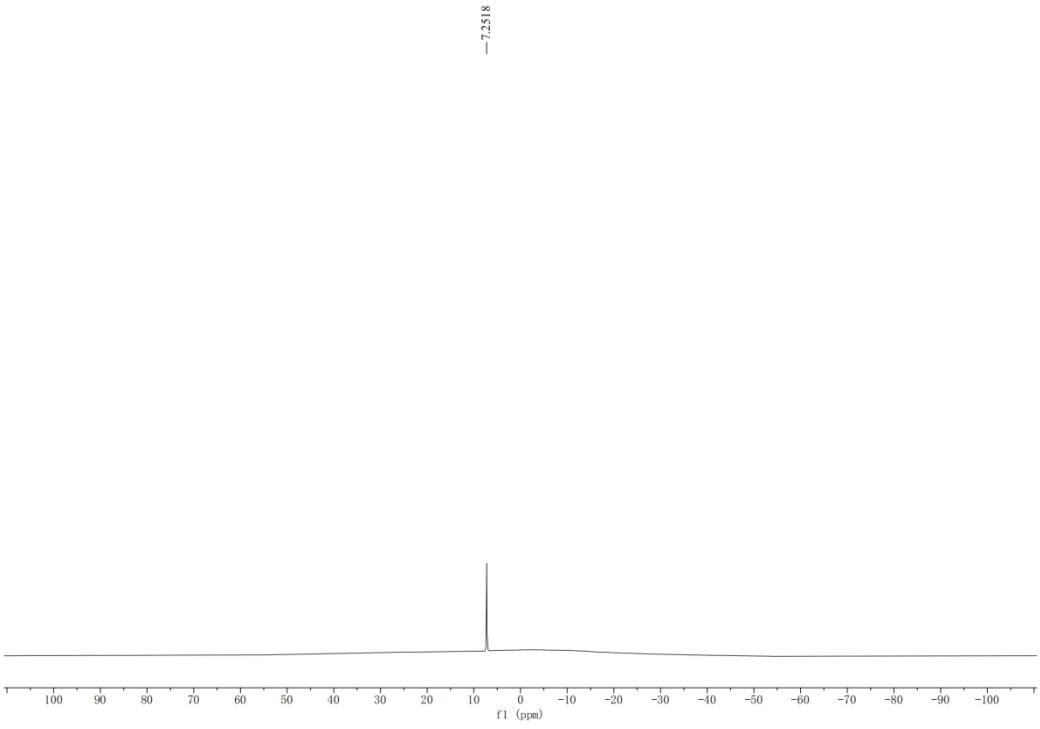
^{1}H NMR spectrum of compound **5d** (600 MHz, CD_3CN)



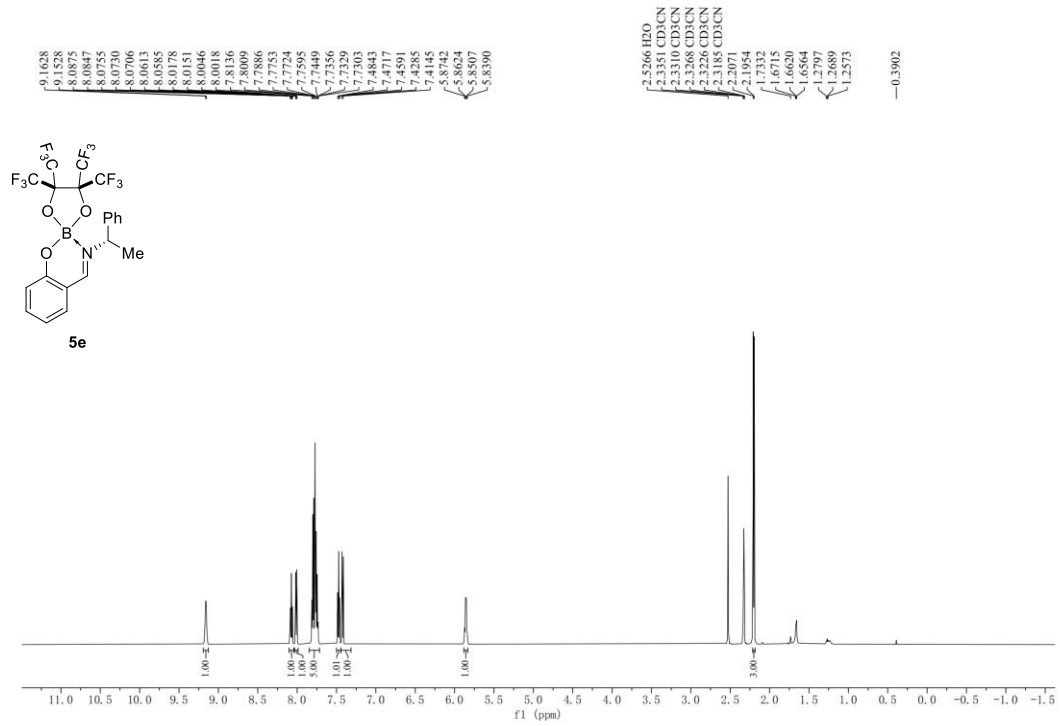
^{13}C NMR spectrum of compound **5d** (600 MHz, CD_3CN)



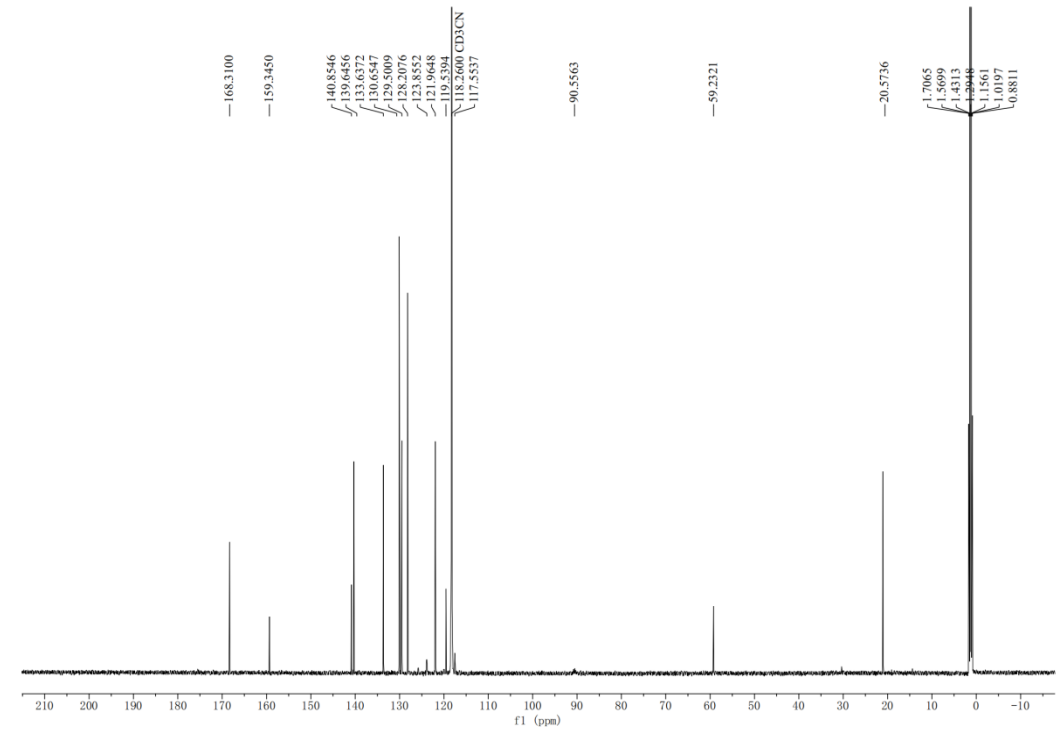
^{19}F NMR spectrum of compound **5d** (600 MHz, CD_3CN)



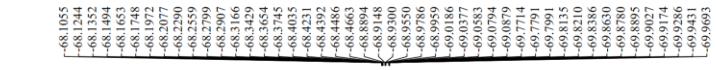
^{11}B NMR spectrum of compound **5d** (600 MHz, CD_3CN)

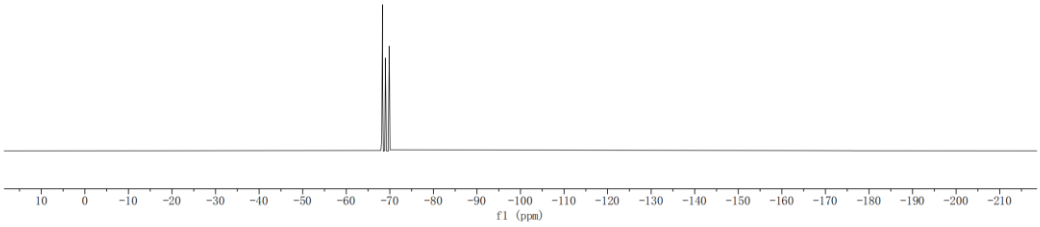


^{1}H NMR spectrum of compound **5e** (600 MHz, CD_3CN)

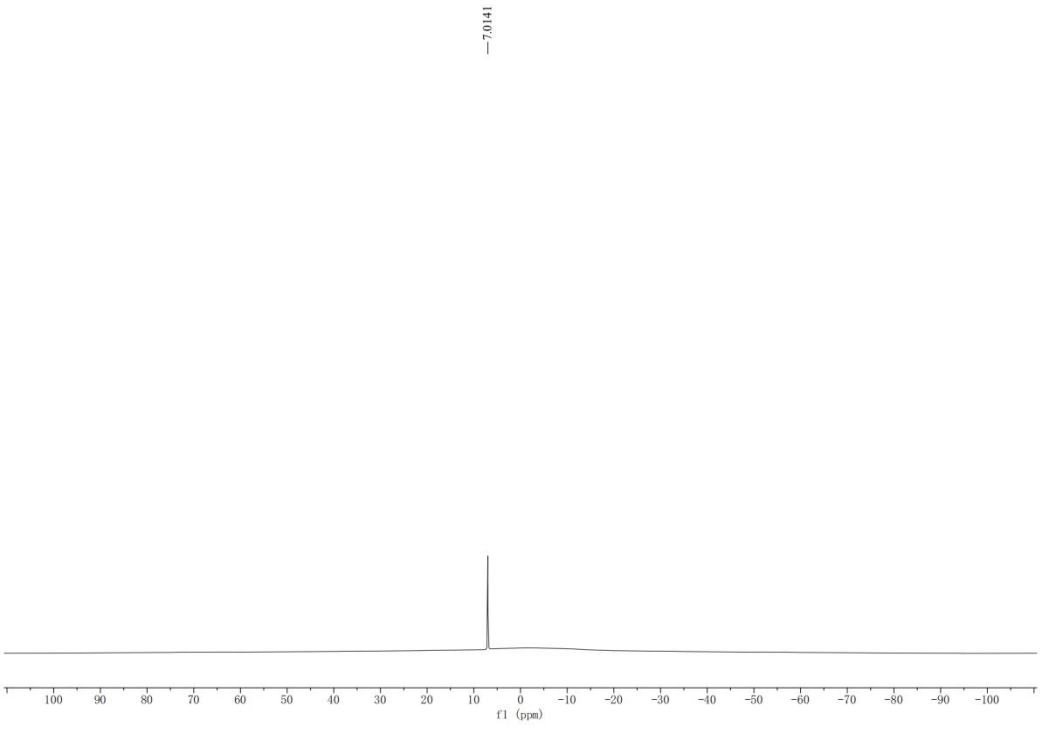


^{13}C NMR spectrum of compound **5e** (600 MHz, CD_3CN)

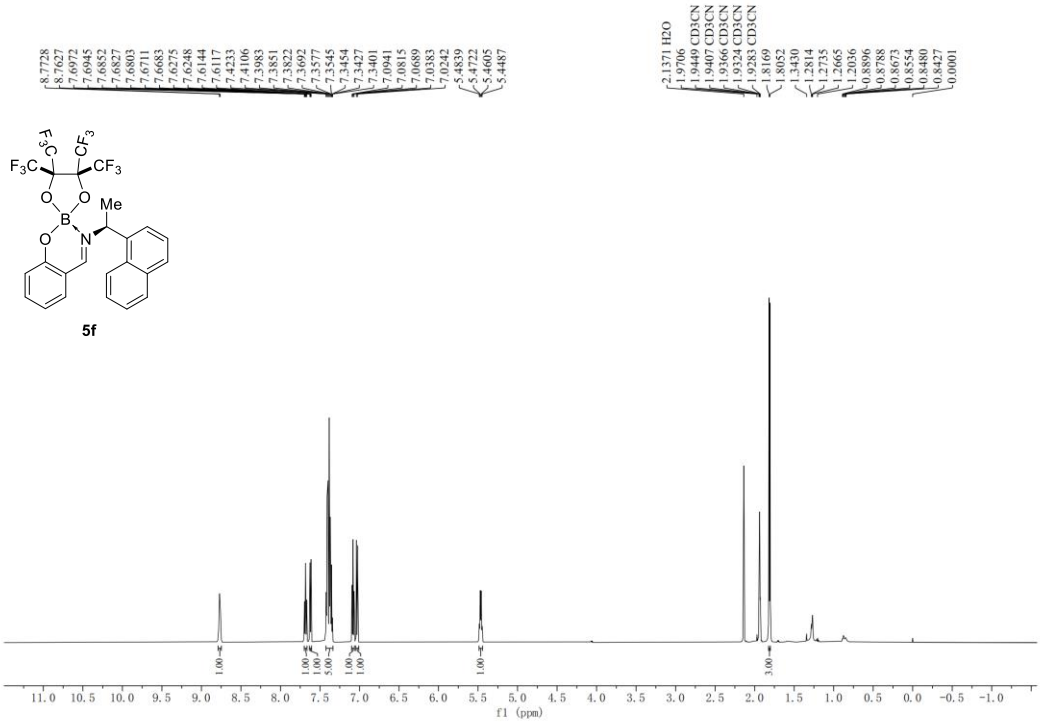




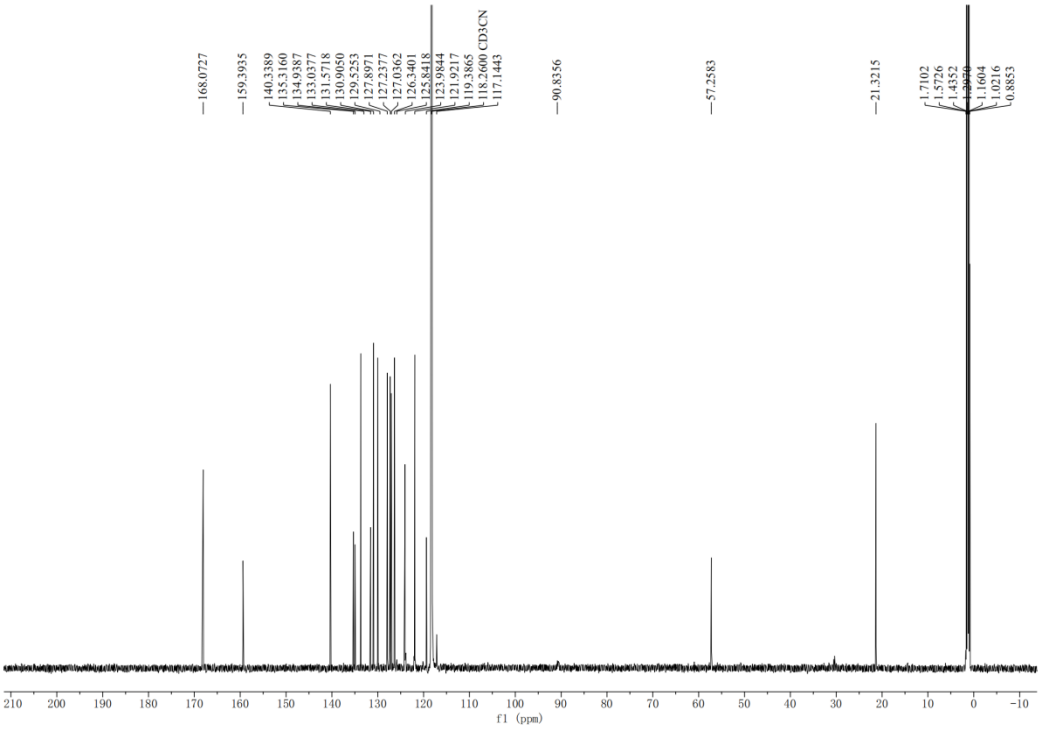
^{19}F NMR spectrum of compound **5e** (600 MHz, CD_3CN)



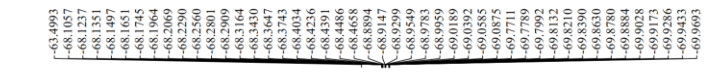
^{11}B NMR spectrum of compound **5e** (600 MHz, CD_3CN)

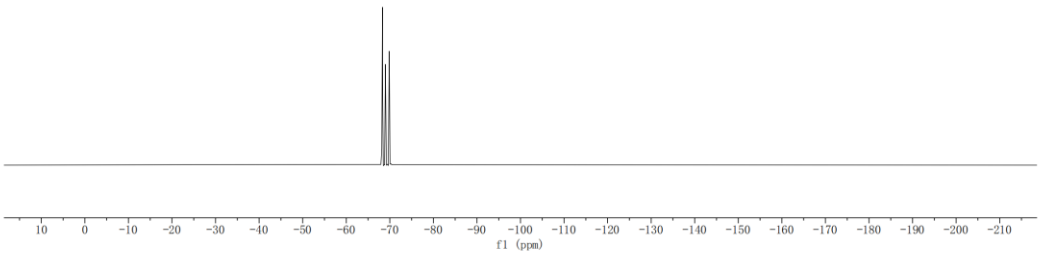


^{1}H NMR spectrum of compound **5f** (600 MHz, CD_3CN)

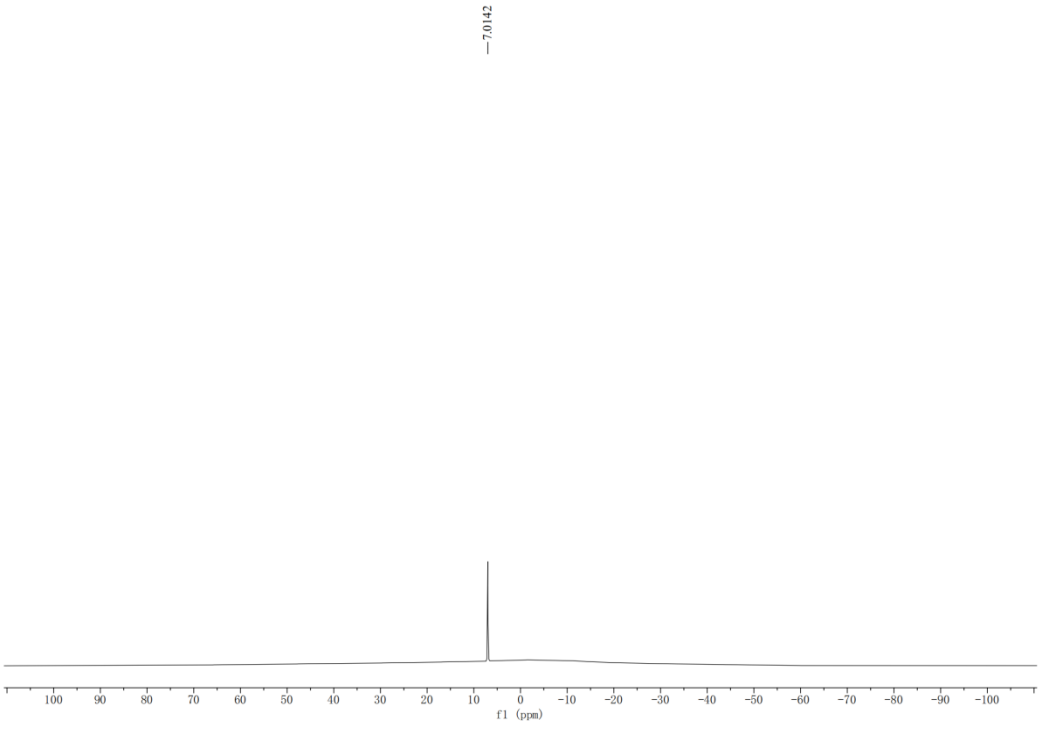


^{13}C NMR spectrum of compound **5f** (600 MHz, CD_3CN)

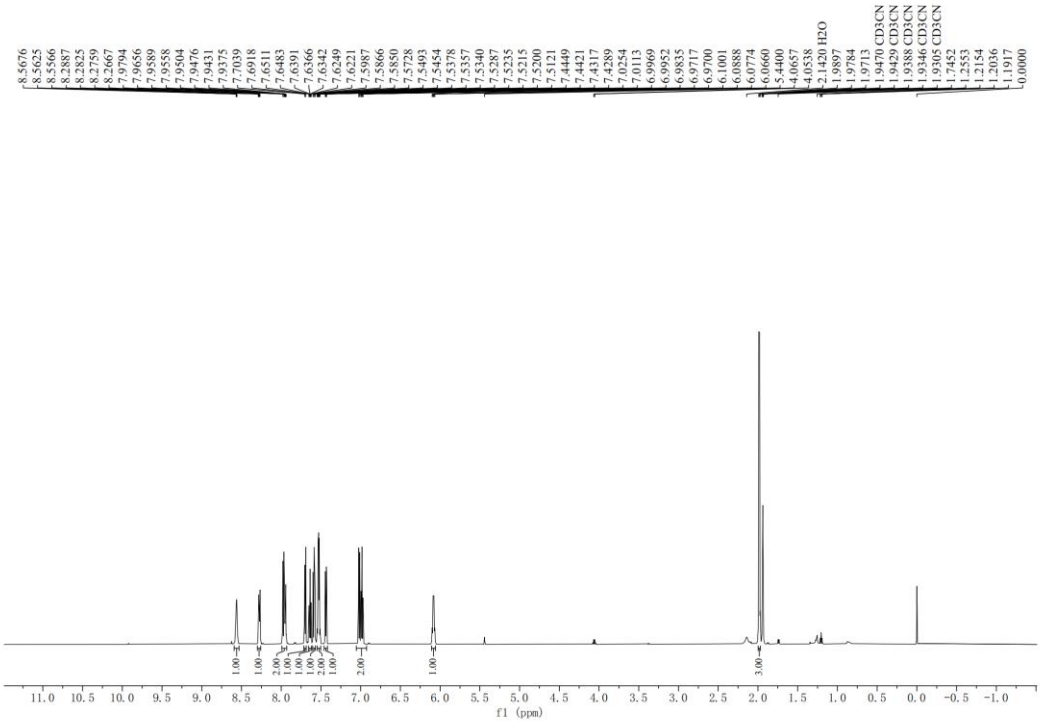




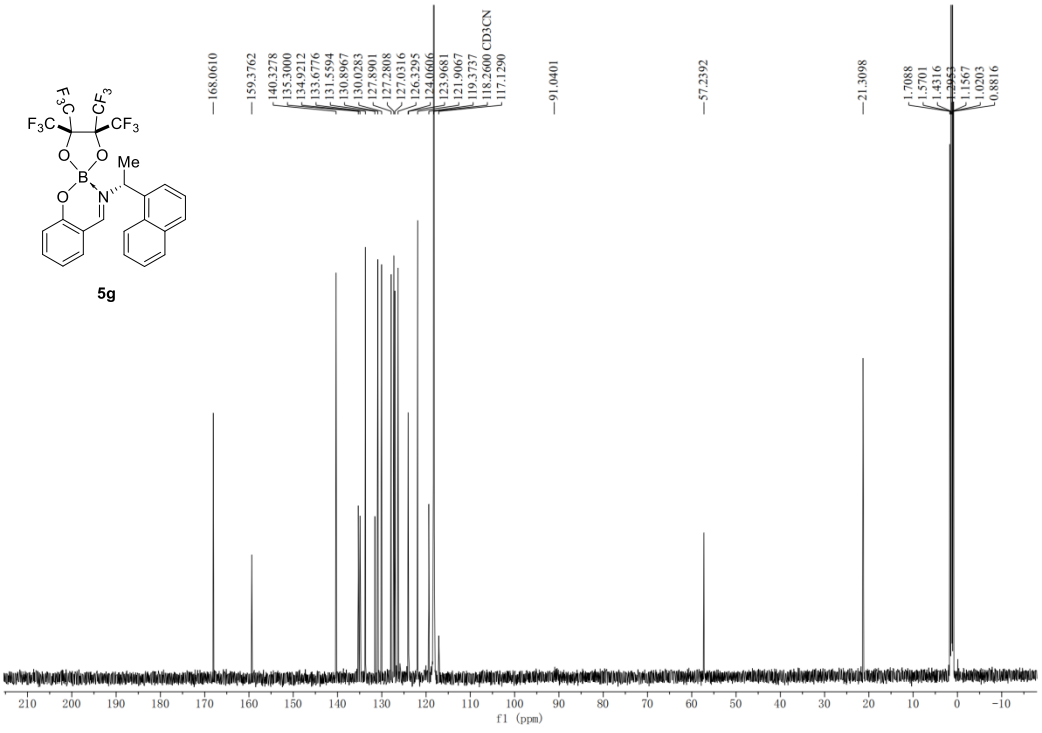
^{19}F NMR spectrum of compound **5f** (600 MHz, CD_3CN)



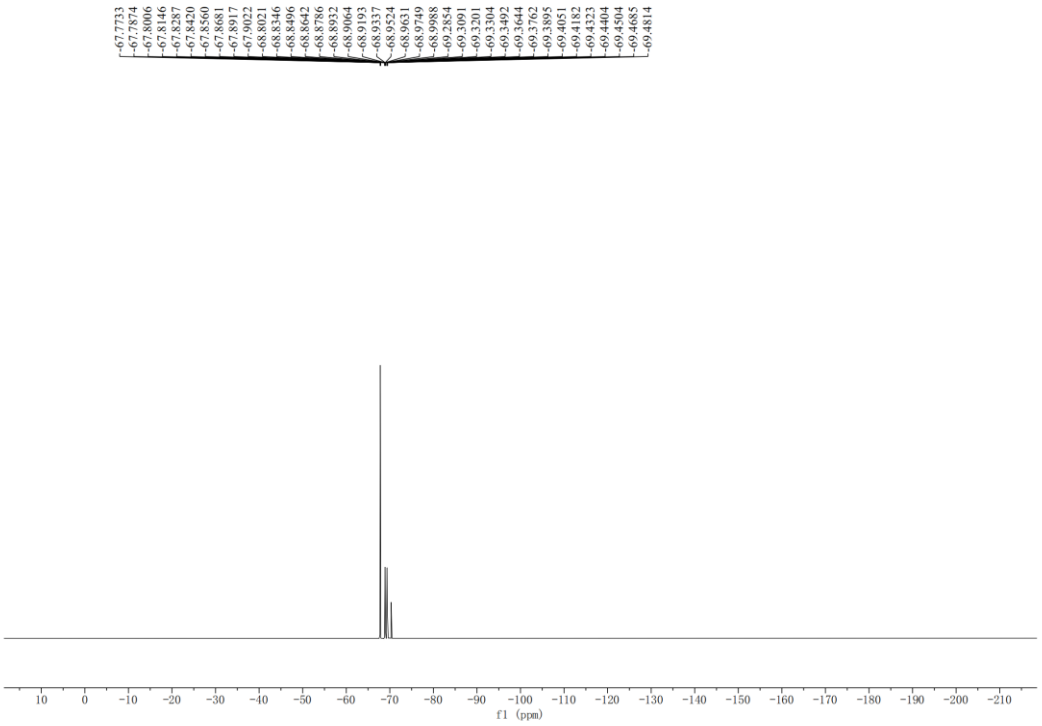
^{11}B NMR spectrum of compound **5f** (600 MHz, CD_3CN)



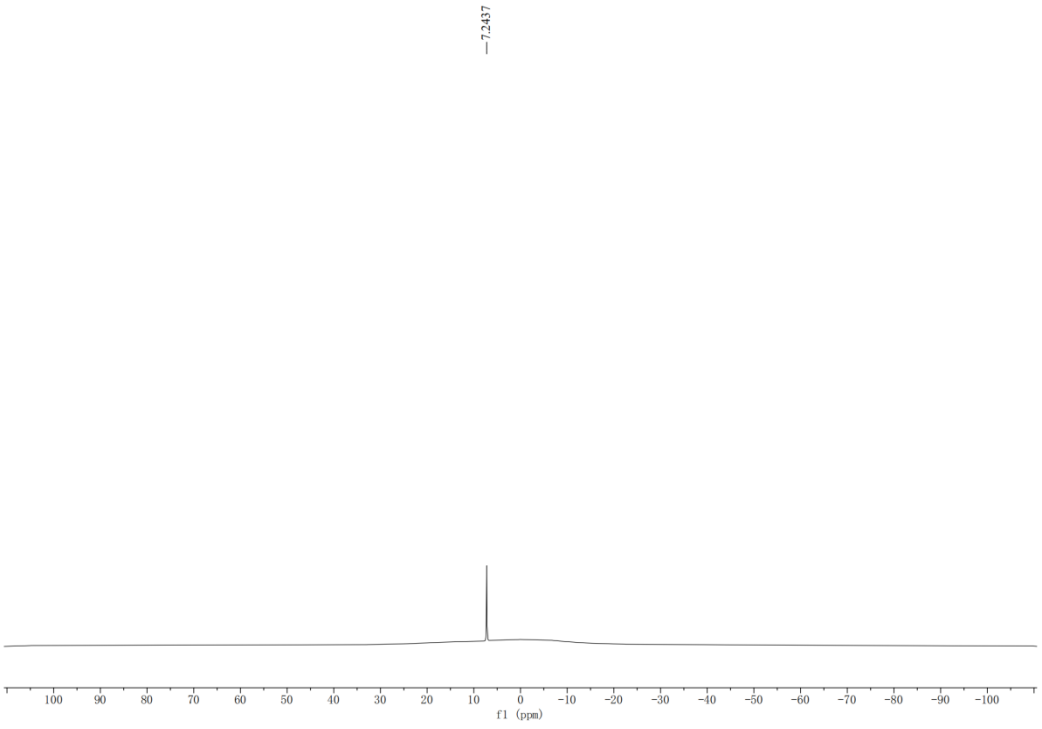
^{1}H NMR spectrum of compound **5g** (600 MHz, CD_3CN)



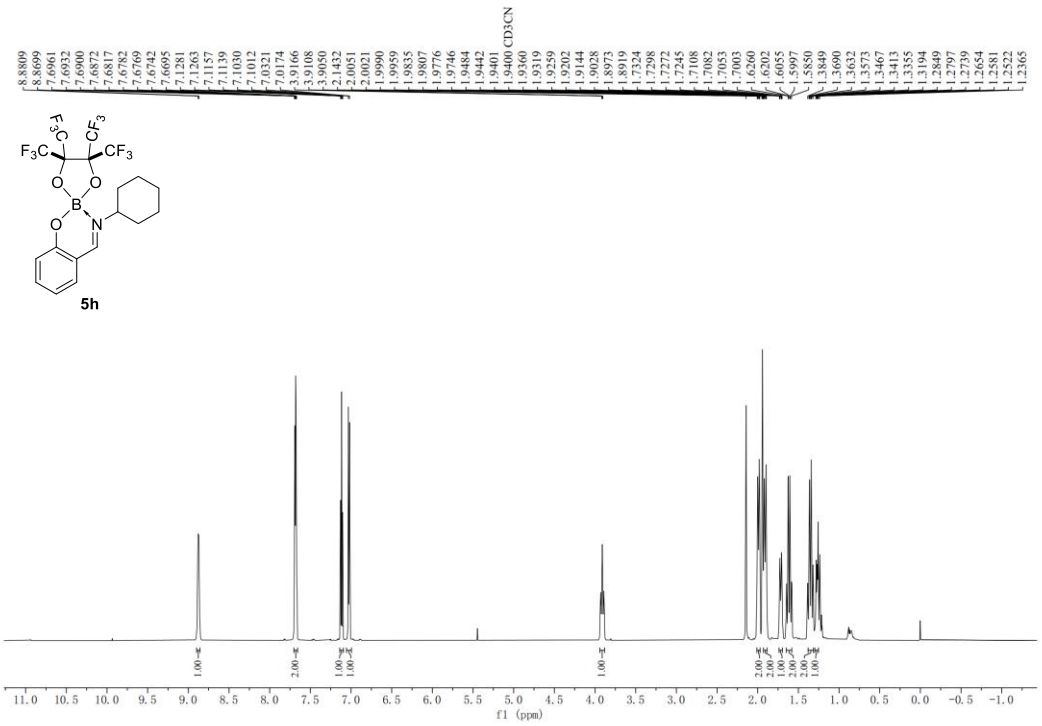
^{13}C NMR spectrum of compound **5g** (600 MHz, CD_3CN)



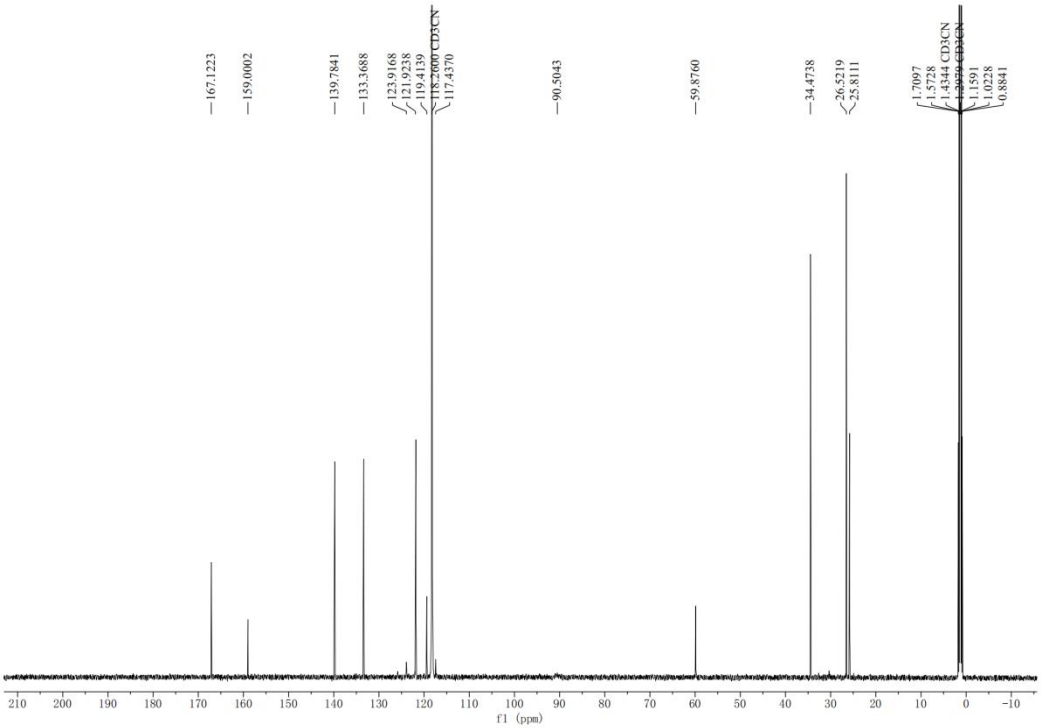
^{19}F NMR spectrum of compound **5g** (600 MHz, CD_3CN)



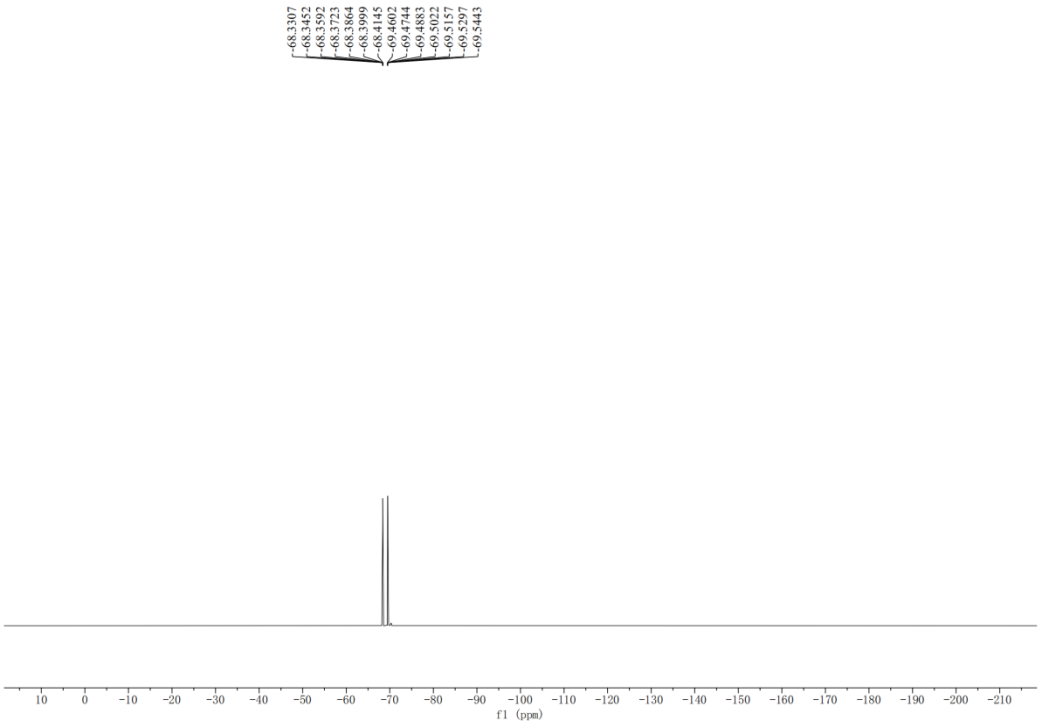
^{11}B NMR spectrum of compound **5g** (600 MHz, CD_3CN)



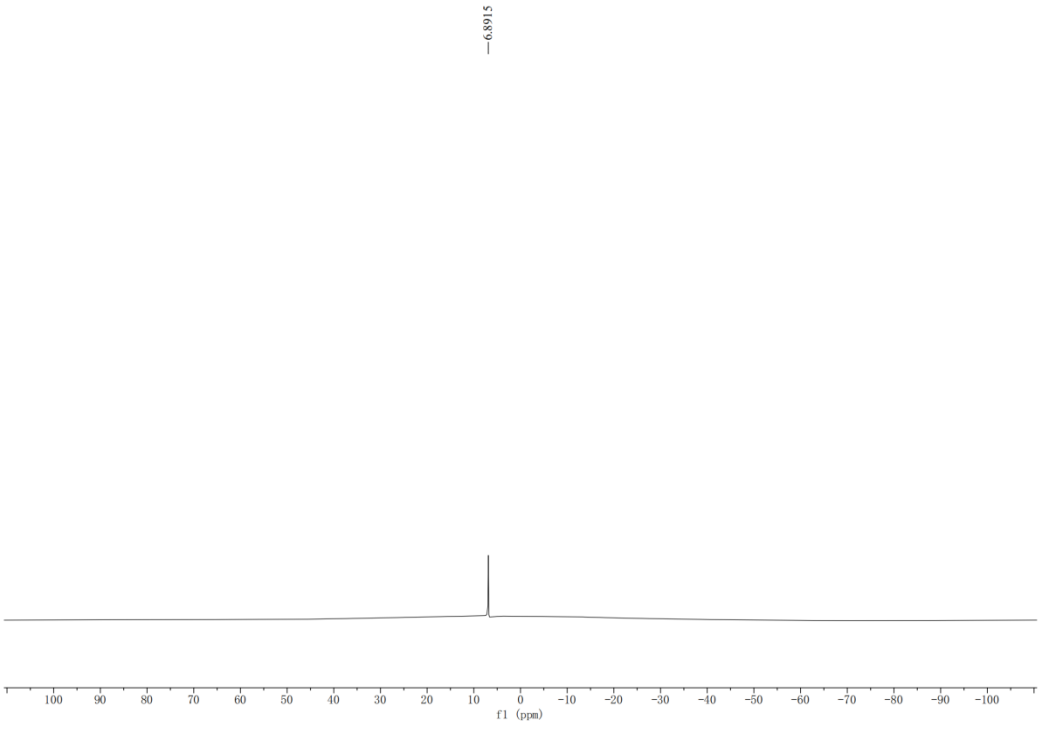
^{1}H NMR spectrum of compound **5h** (600 MHz, CD_3CN)



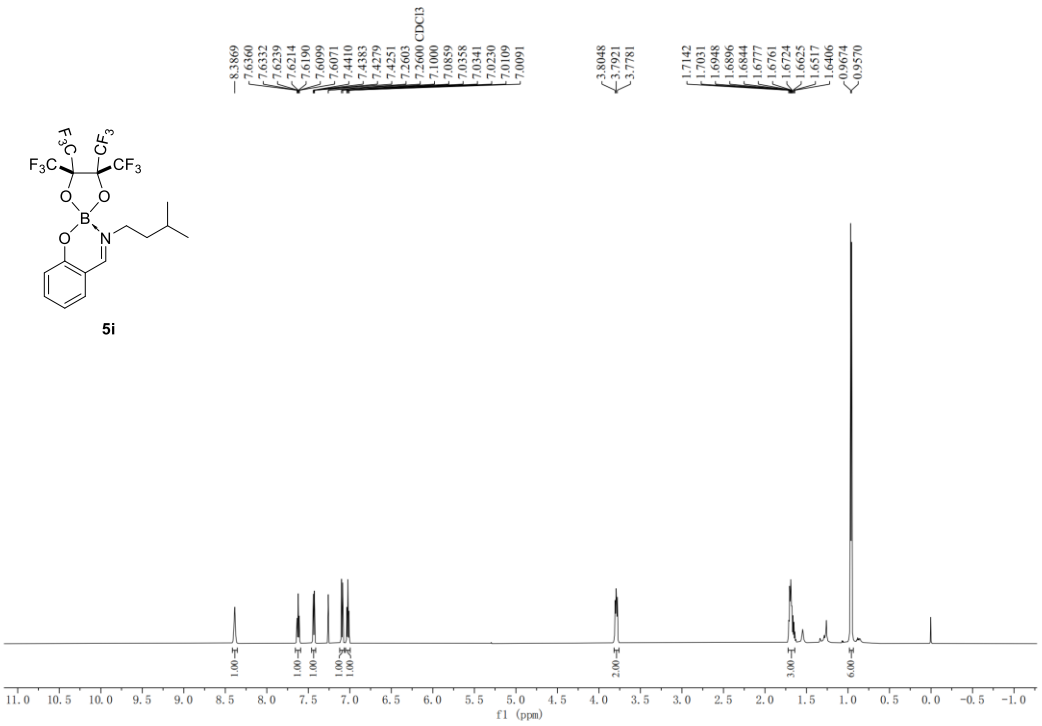
^{13}C NMR spectrum of compound **5h** (600 MHz, CD_3CN)



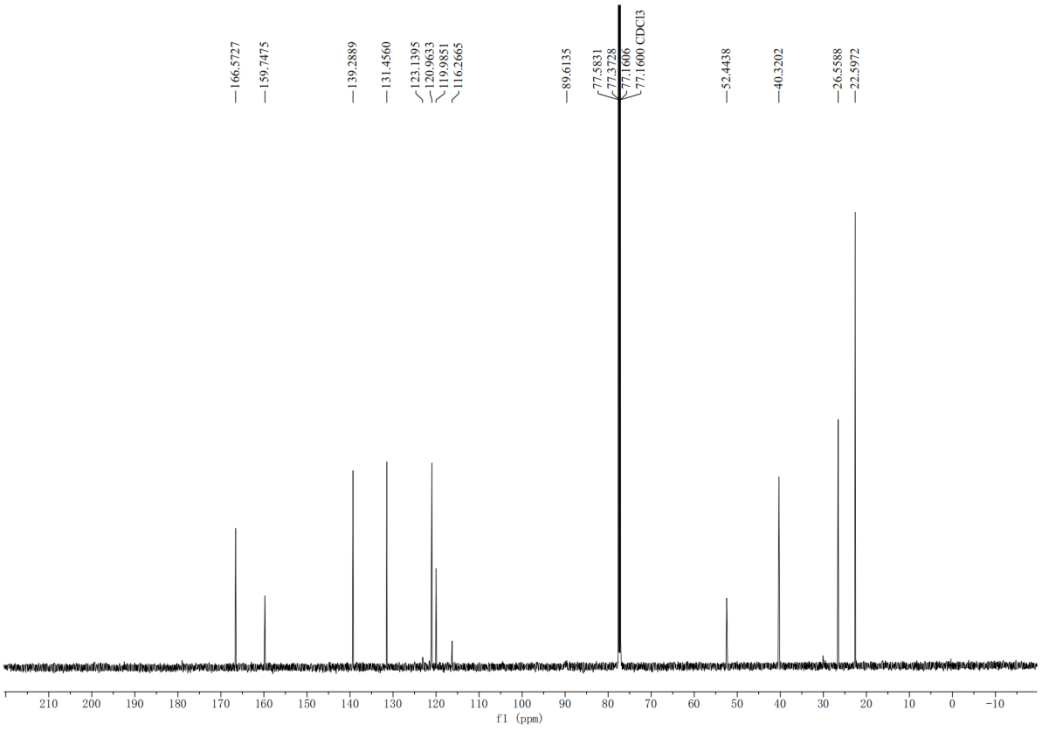
^{19}F NMR spectrum of compound **5h** (600 MHz, CD_3CN)



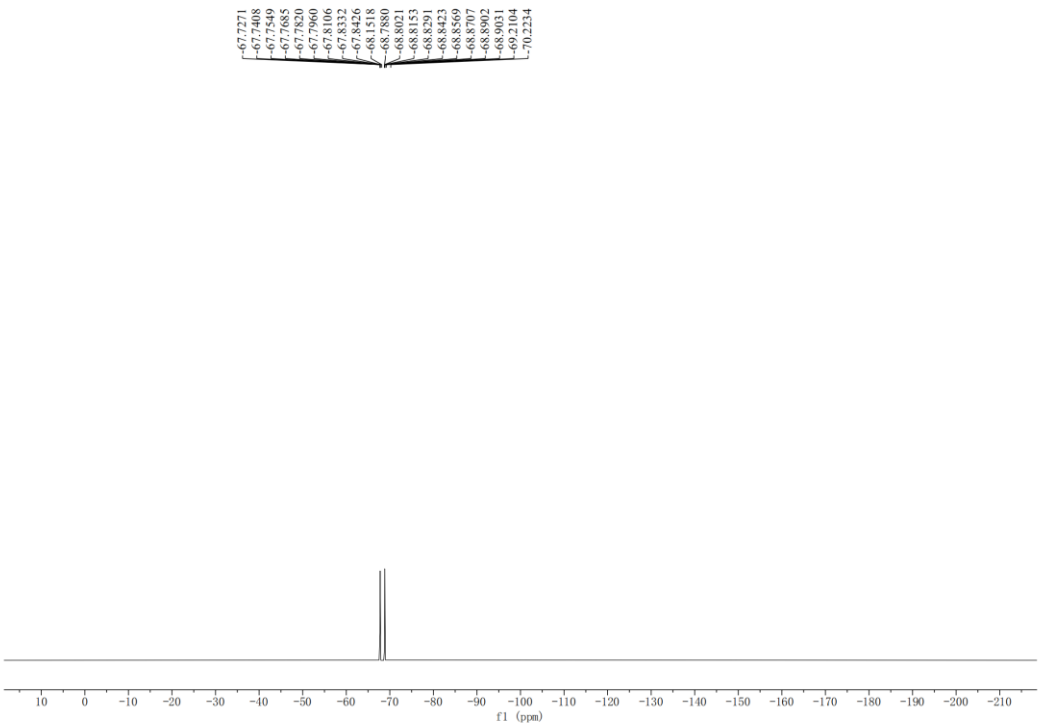
^{11}B NMR spectrum of compound **5h** (600 MHz, CD_3CN)



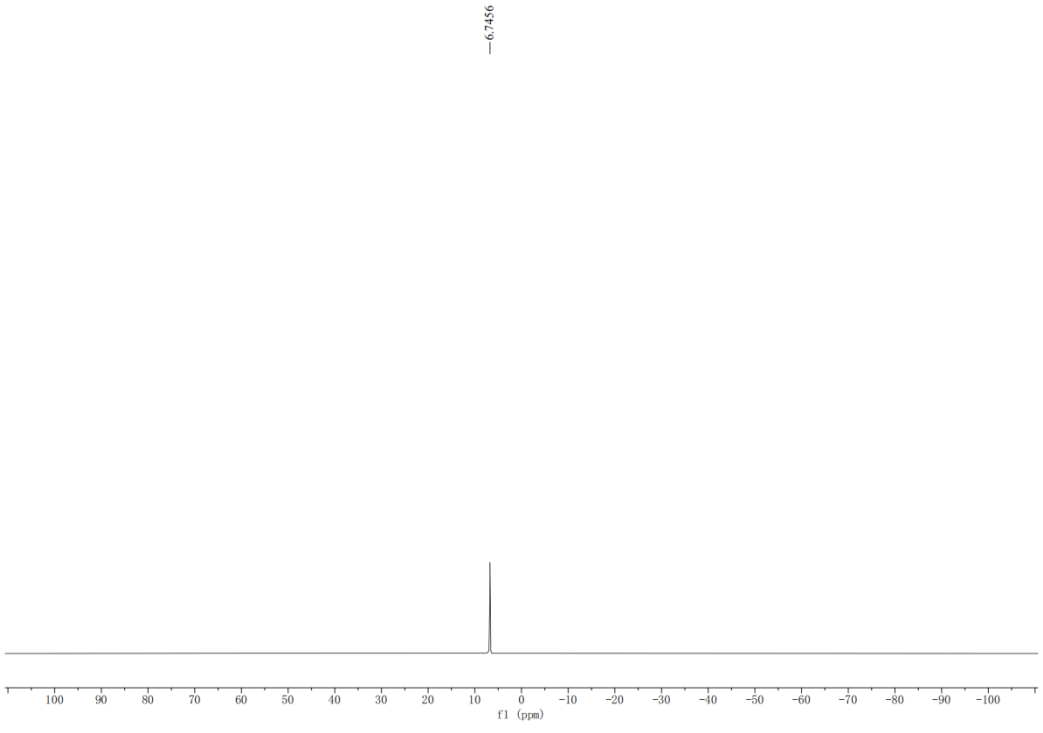
^{1}H NMR spectrum of compound **5i** (600 MHz, $CDCl_3$)



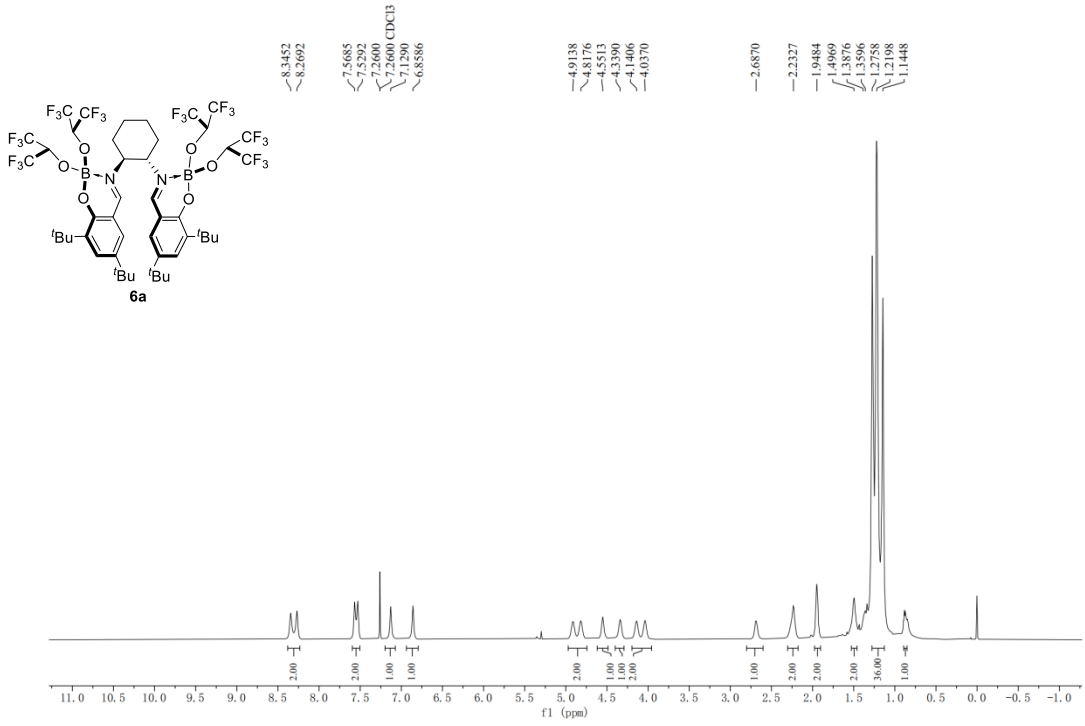
^{13}C NMR spectrum of compound **5i** (600 MHz, $CDCl_3$)



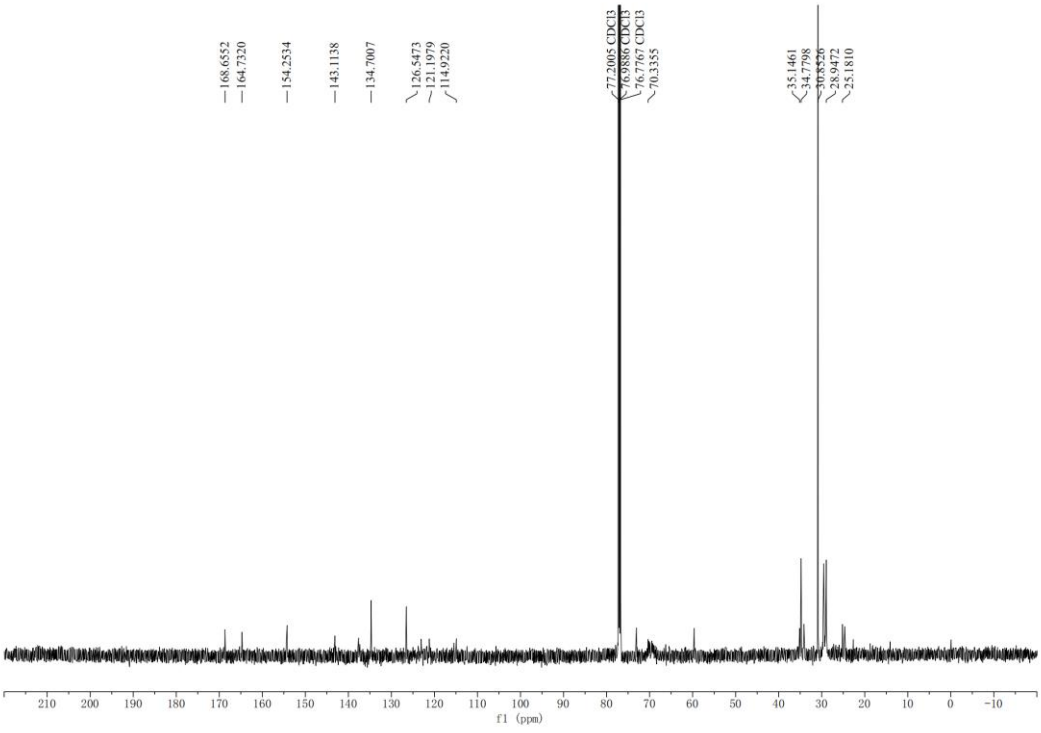
^{19}F NMR spectrum of compound **5i** (600 MHz, $CDCl_3$)



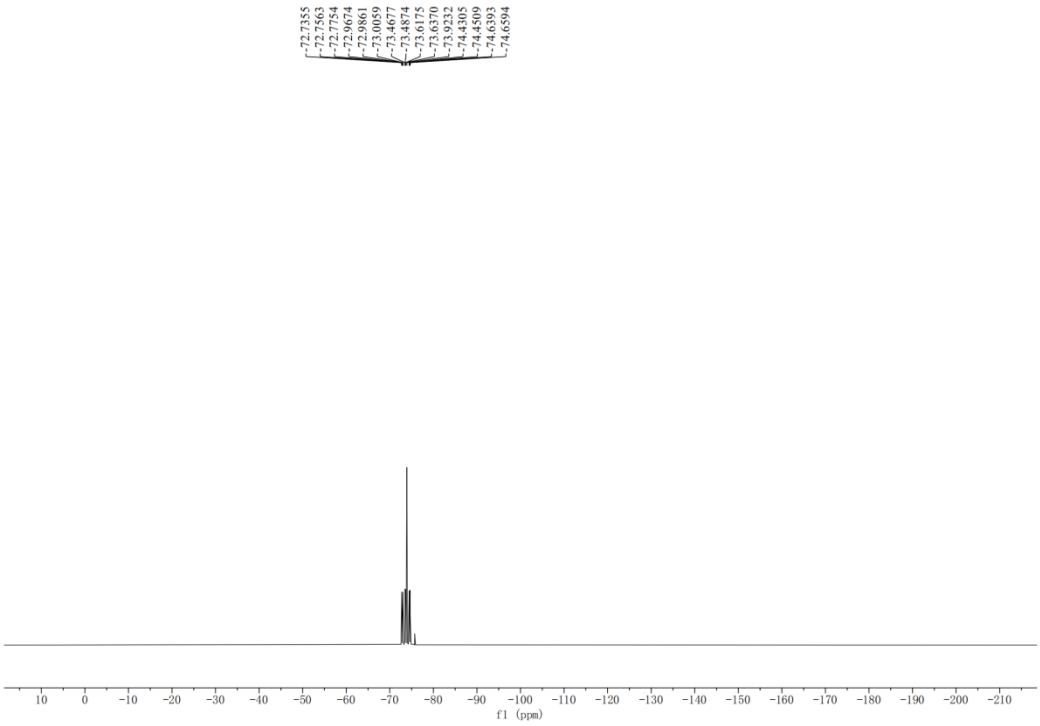
^{11}B NMR spectrum of compound **5i** (600 MHz, $CDCl_3$)



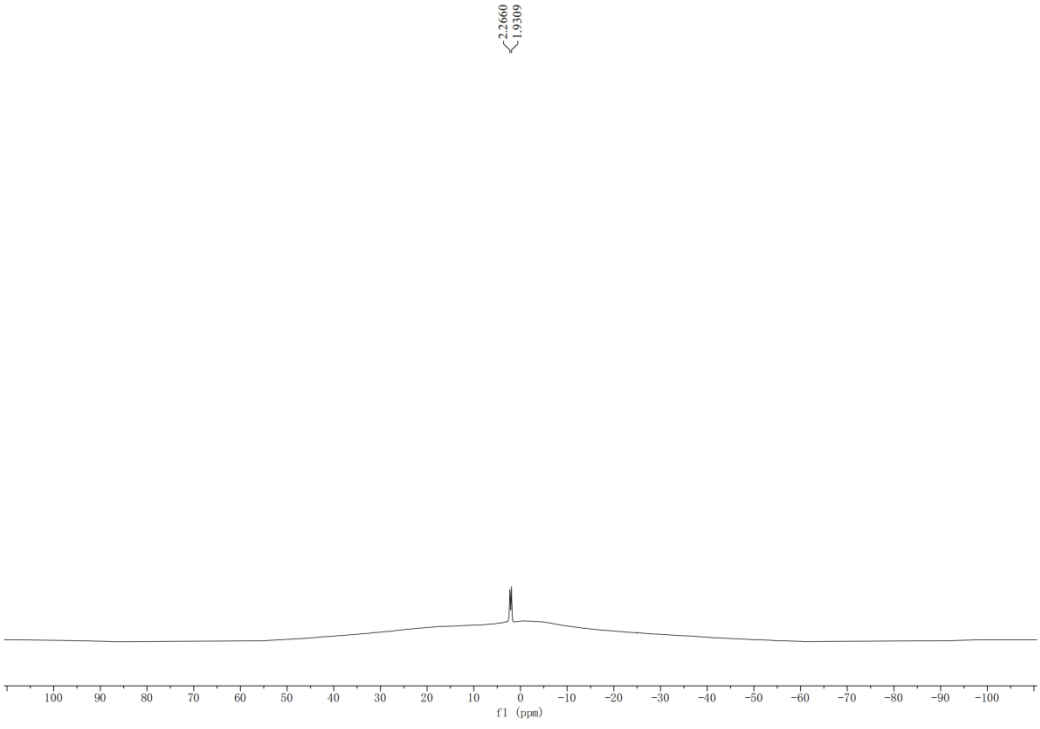
^{1}H NMR spectrum of compound **6a** (600 MHz, $CDCl_3$)



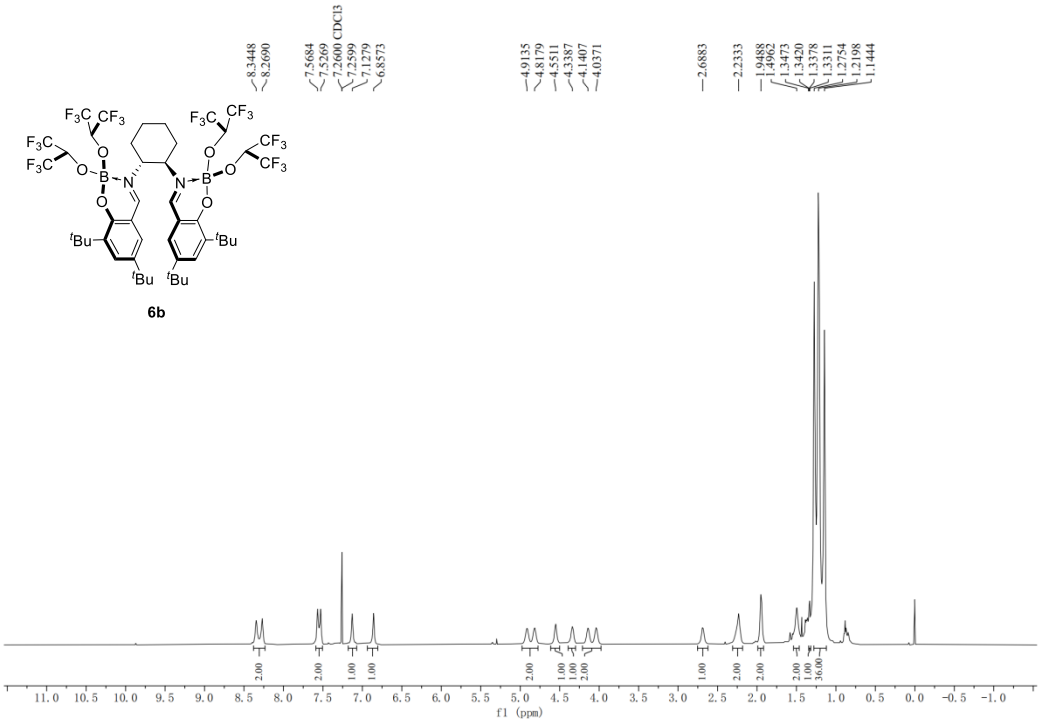
^{13}C NMR spectrum of compound **6a** (600 MHz, $CDCl_3$)



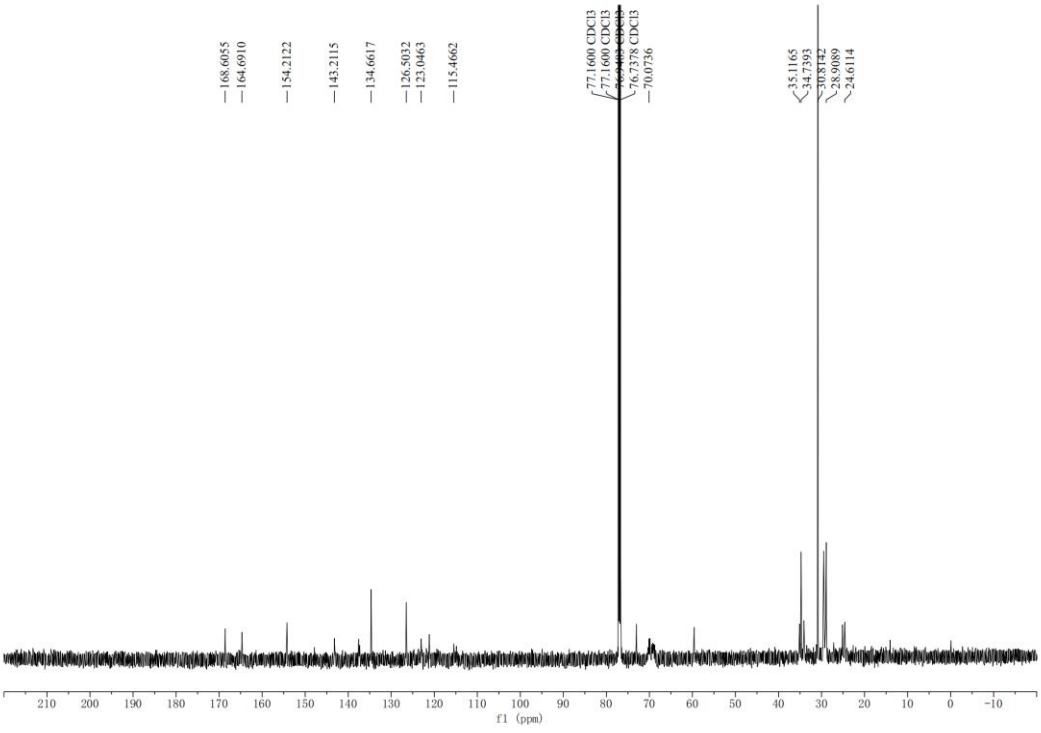
^{19}F NMR spectrum of compound **6a** (600 MHz, $CDCl_3$)



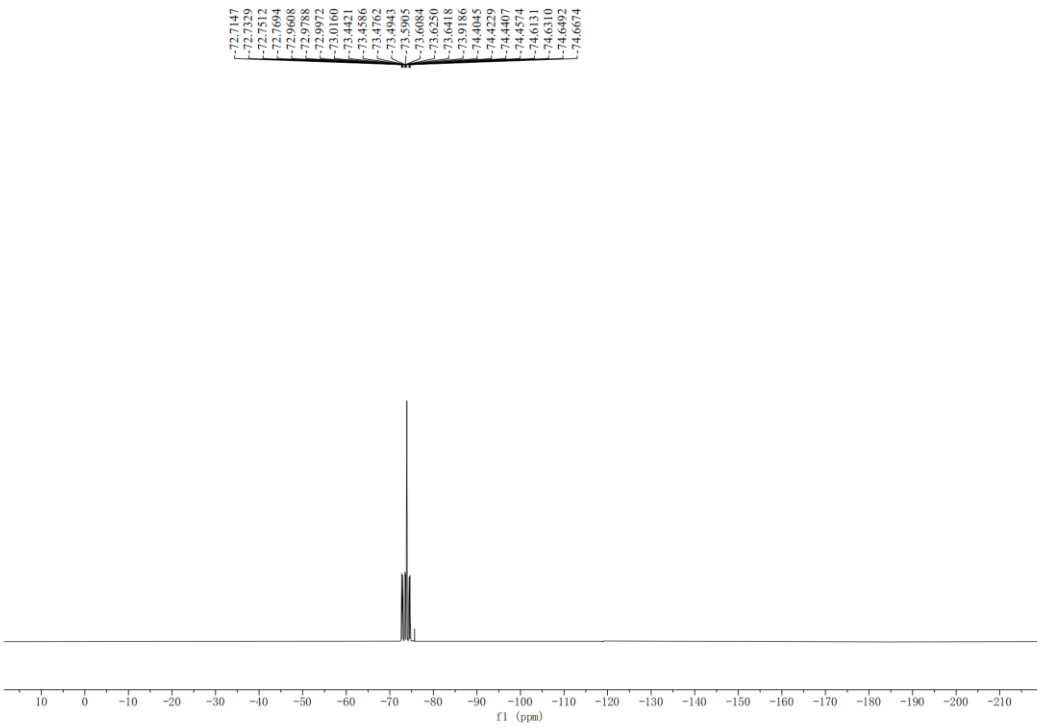
^{11}B NMR spectrum of compound **6a** (600 MHz, $CDCl_3$)



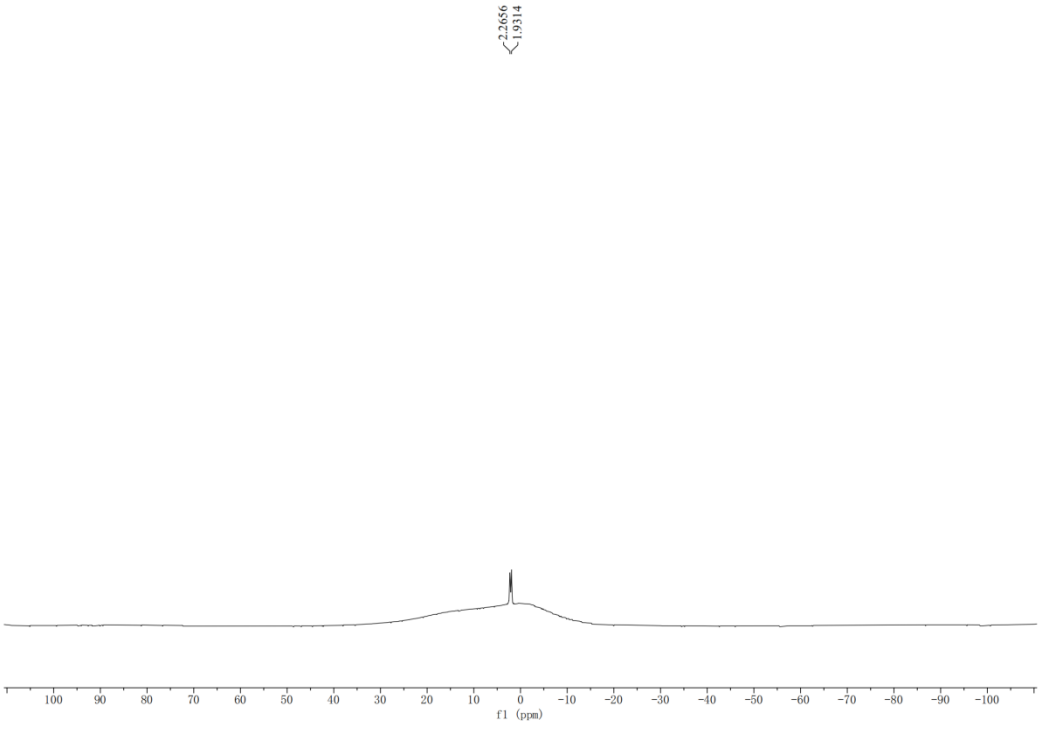
^{1}H NMR spectrum of compound **6b** (600 MHz, $CDCl_3$)



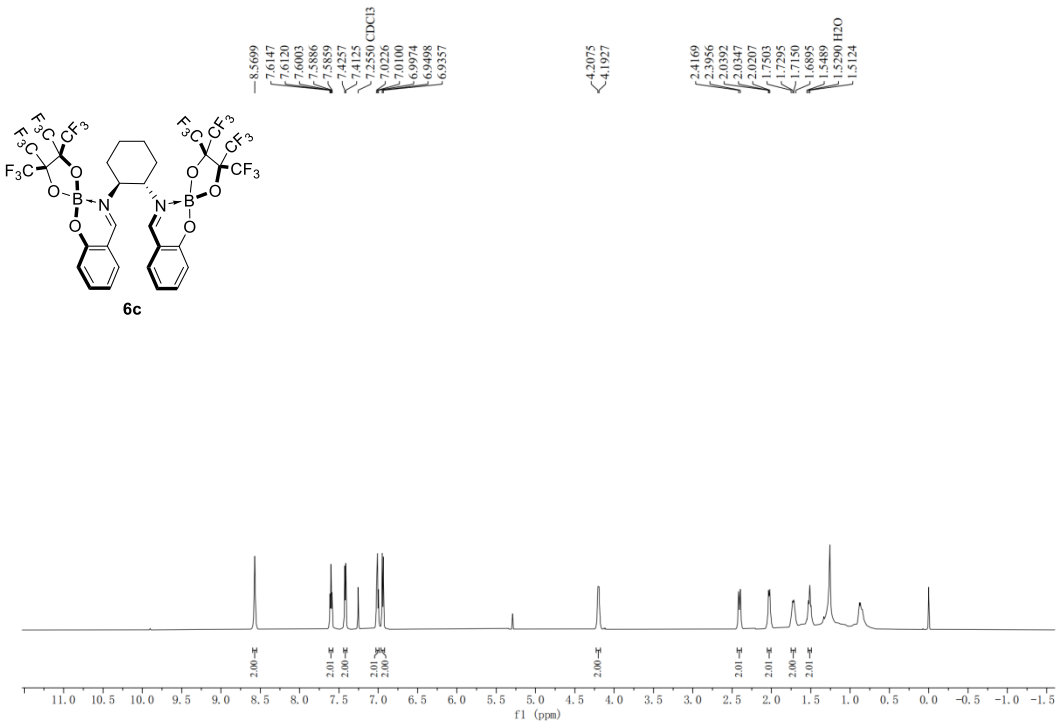
^{13}C NMR spectrum of compound **6b** (600 MHz, $CDCl_3$)



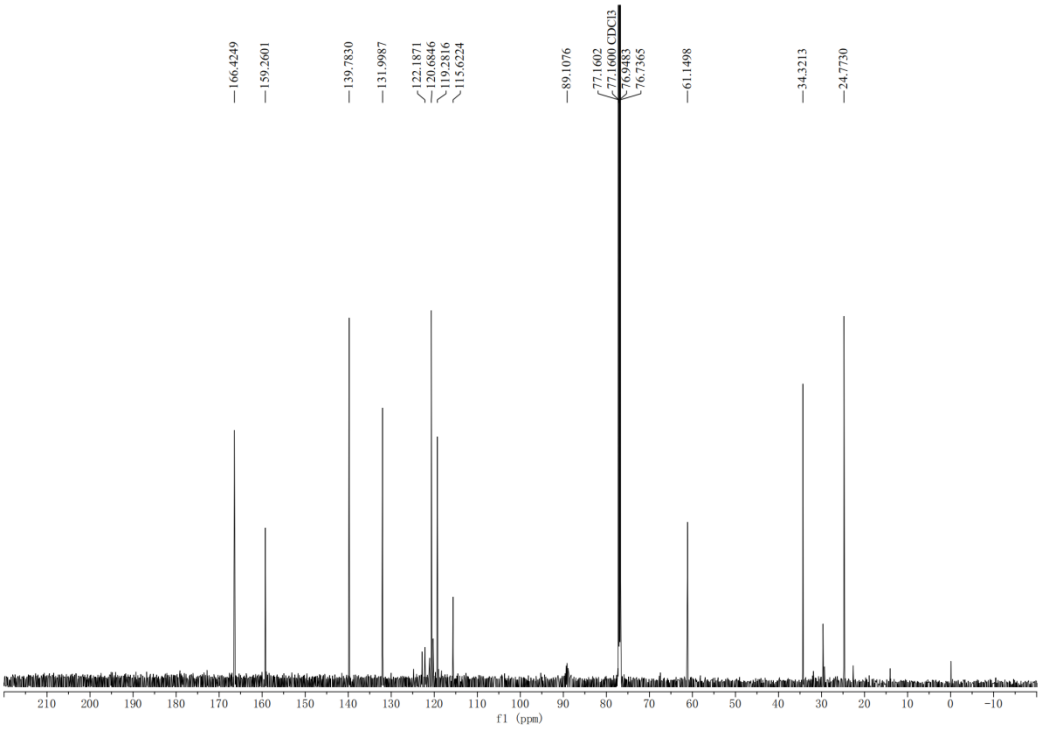
^{19}F NMR spectrum of compound **6b** (600 MHz, $CDCl_3$)



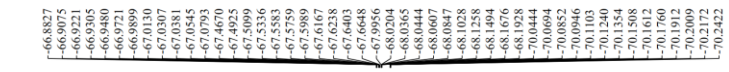
^{11}B NMR spectrum of compound **6b** (600 MHz, $CDCl_3$)

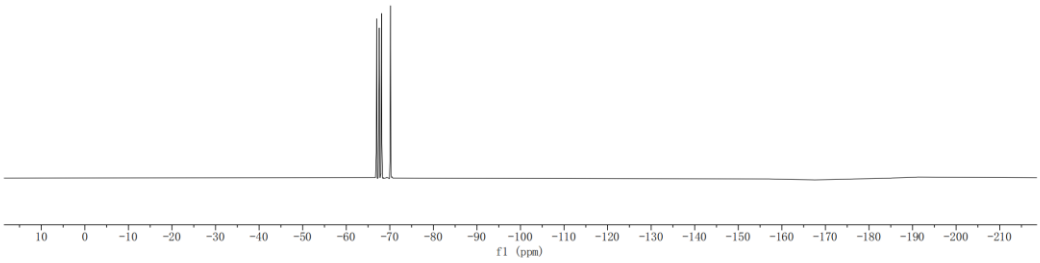


^{1}H NMR spectrum of compound **6c** (600 MHz, $CDCl_3$)

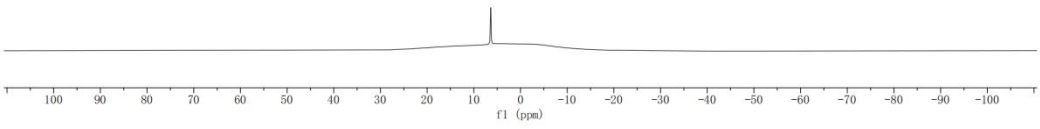


^{13}C NMR spectrum of compound **6c** (600 MHz, $CDCl_3$)

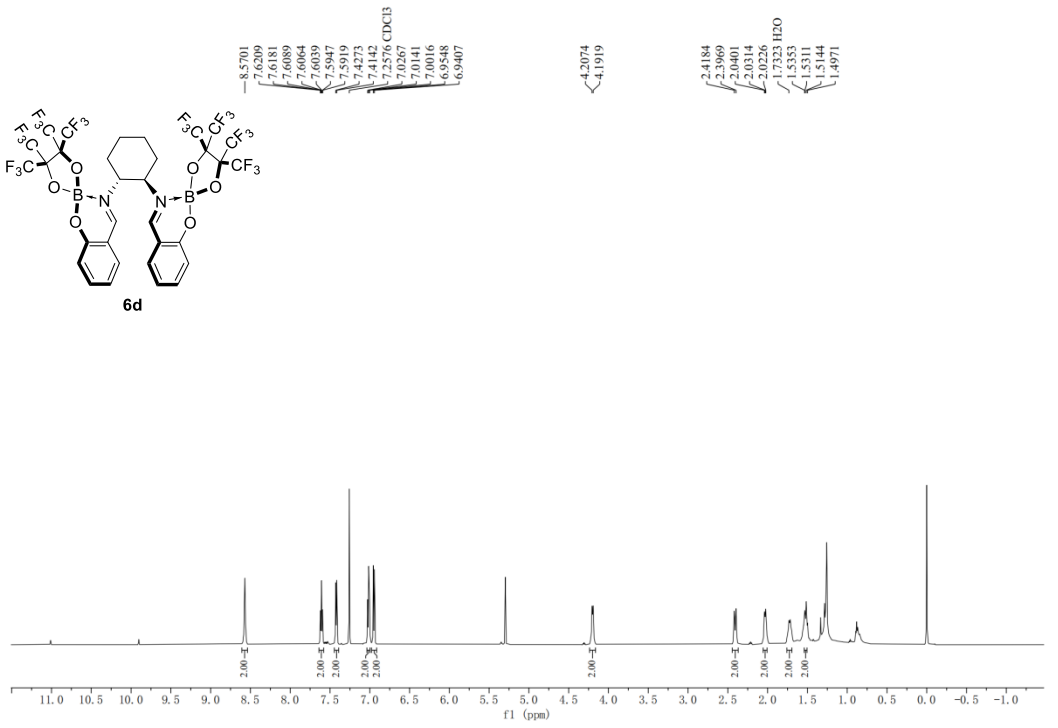




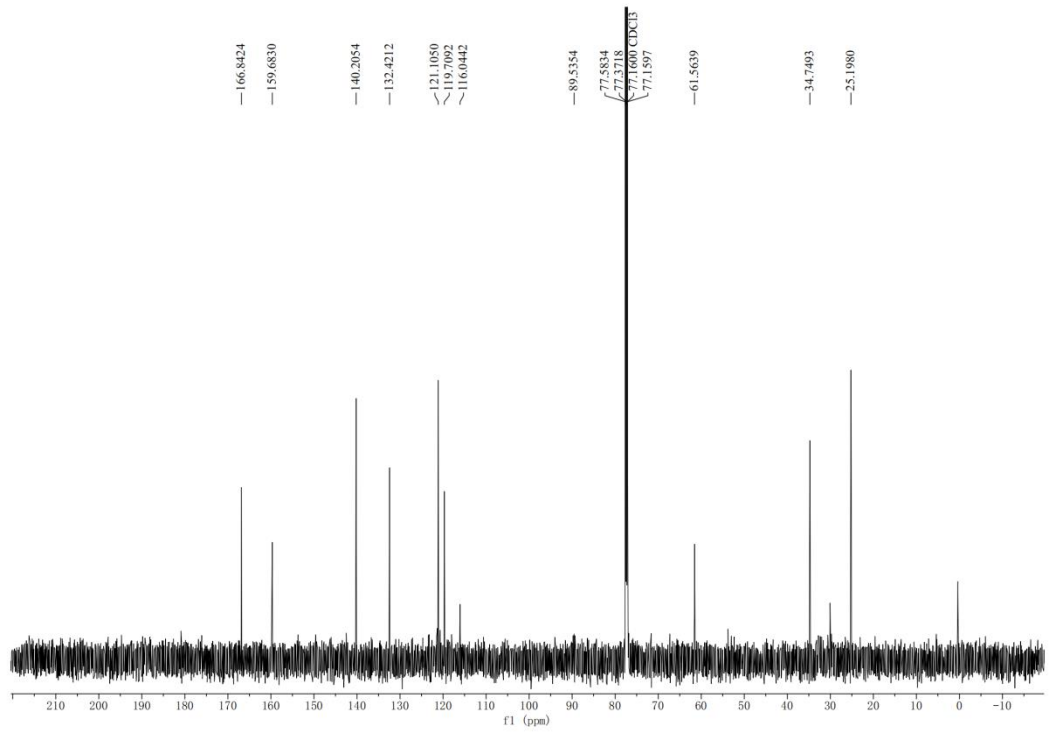
^{19}F NMR spectrum of compound **6c** (600 MHz, $CDCl_3$)



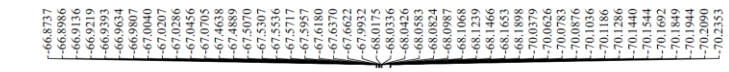
^{11}B NMR spectrum of compound **6c** (600 MHz, $CDCl_3$)

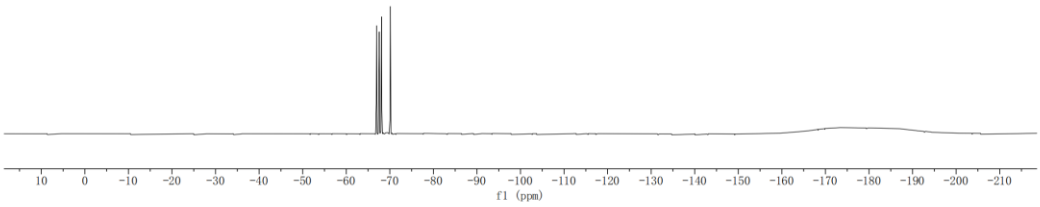


^{1}H NMR spectrum of compound **6d** (600 MHz, $CDCl_3$)

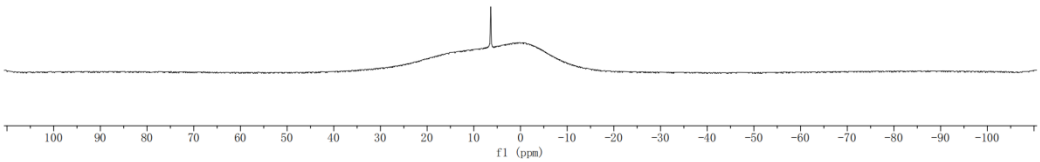


^{13}C NMR spectrum of compound **6d** (600 MHz, $CDCl_3$)

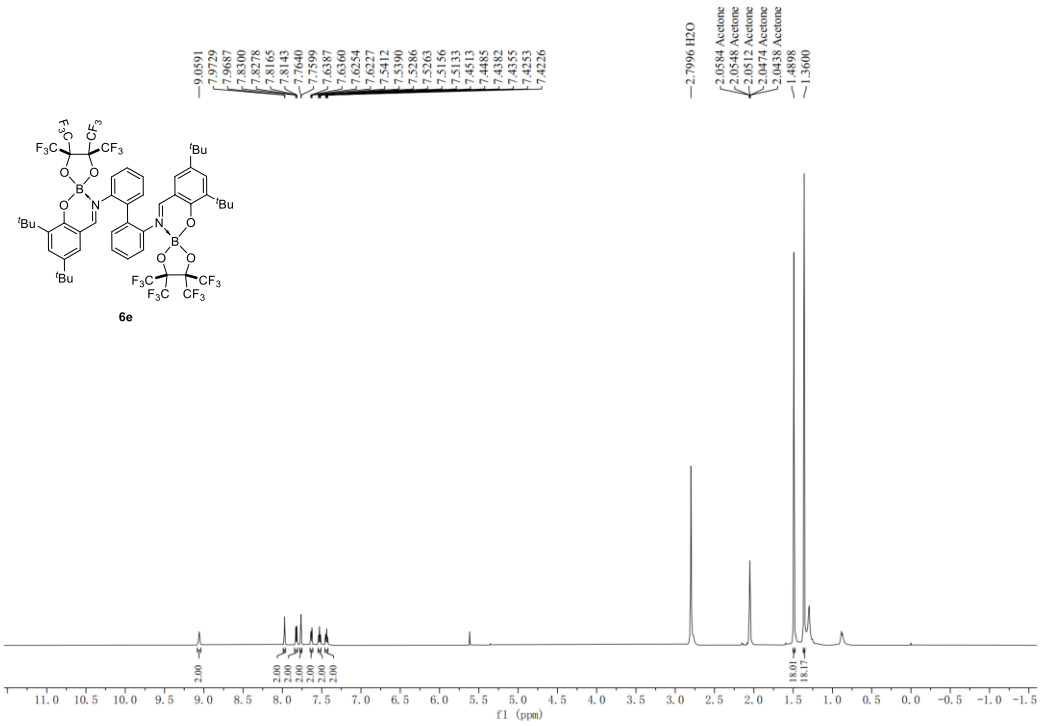




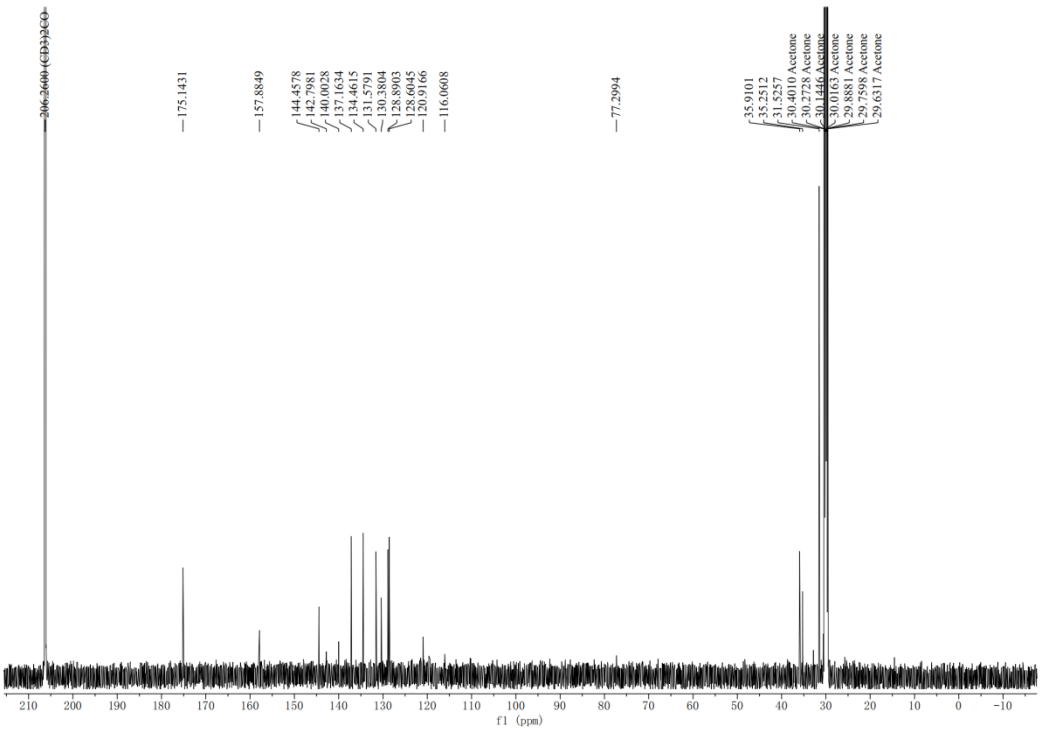
^{19}F NMR spectrum of compound **6d** (600 MHz, $CDCl_3$)



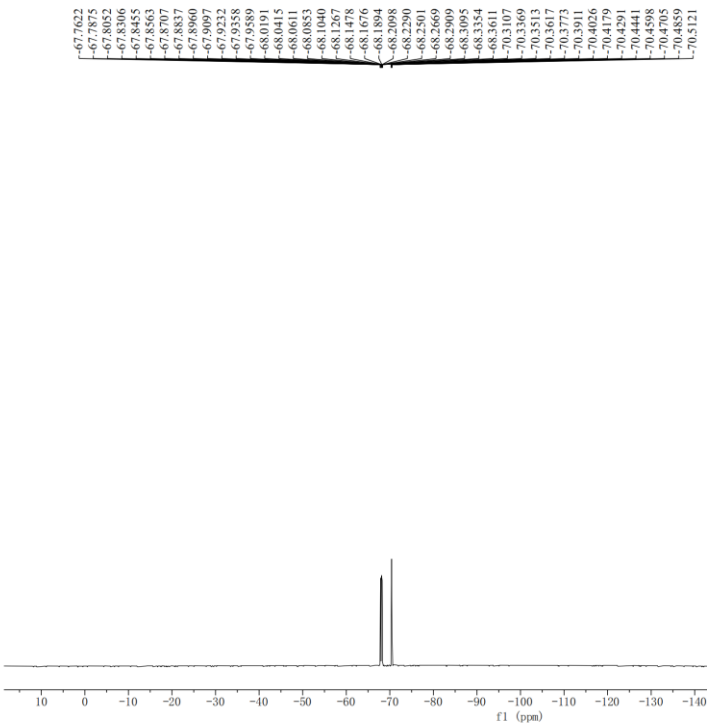
^{11}B NMR spectrum of compound **6d** (600 MHz, $CDCl_3$)



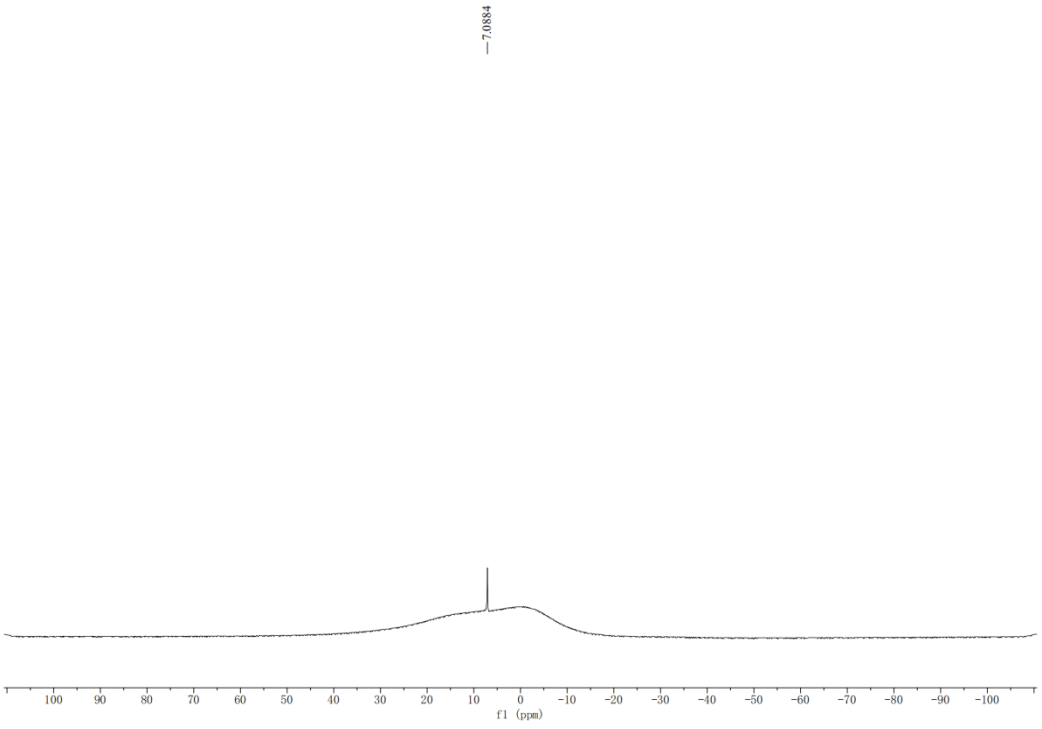
^{1}H NMR spectrum of compound **6e** (600 MHz, Acetone)



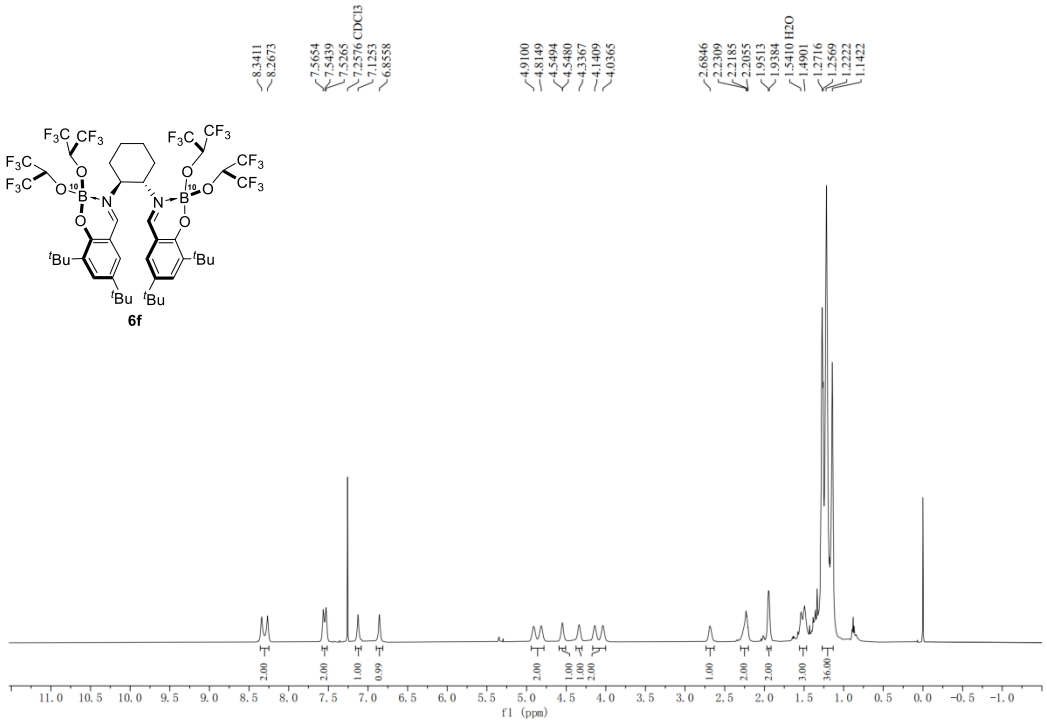
^{13}C NMR spectrum of compound **6e** (600 MHz, Acetone)



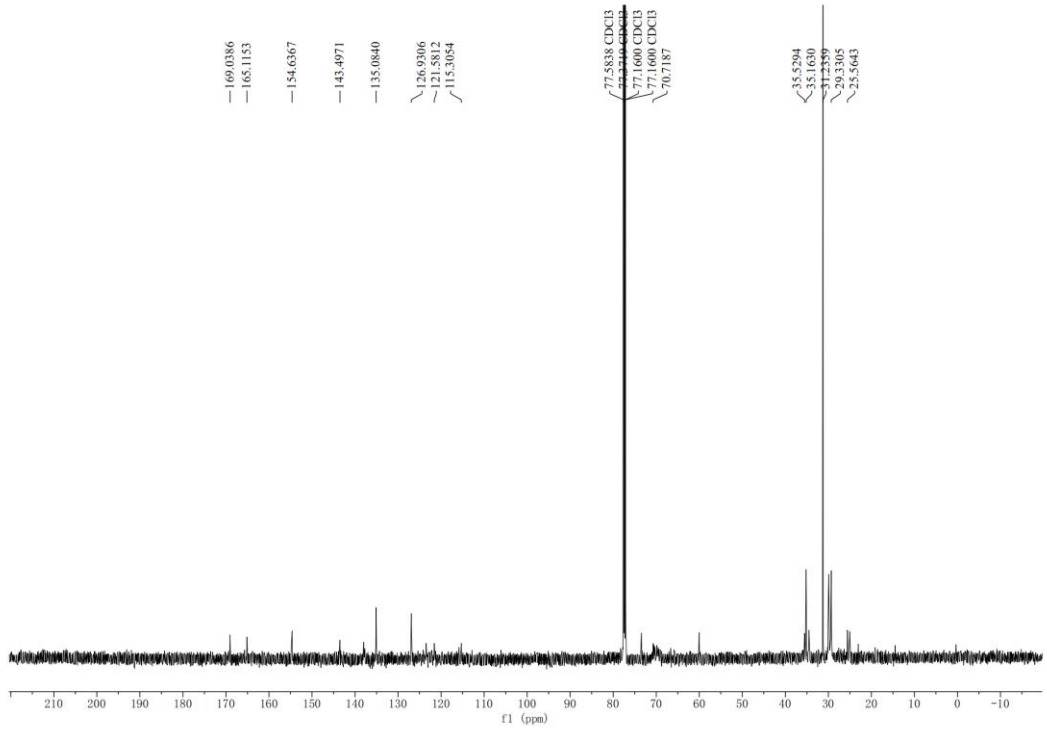
^{19}F NMR spectrum of compound **6e** (600 MHz, Acetone)



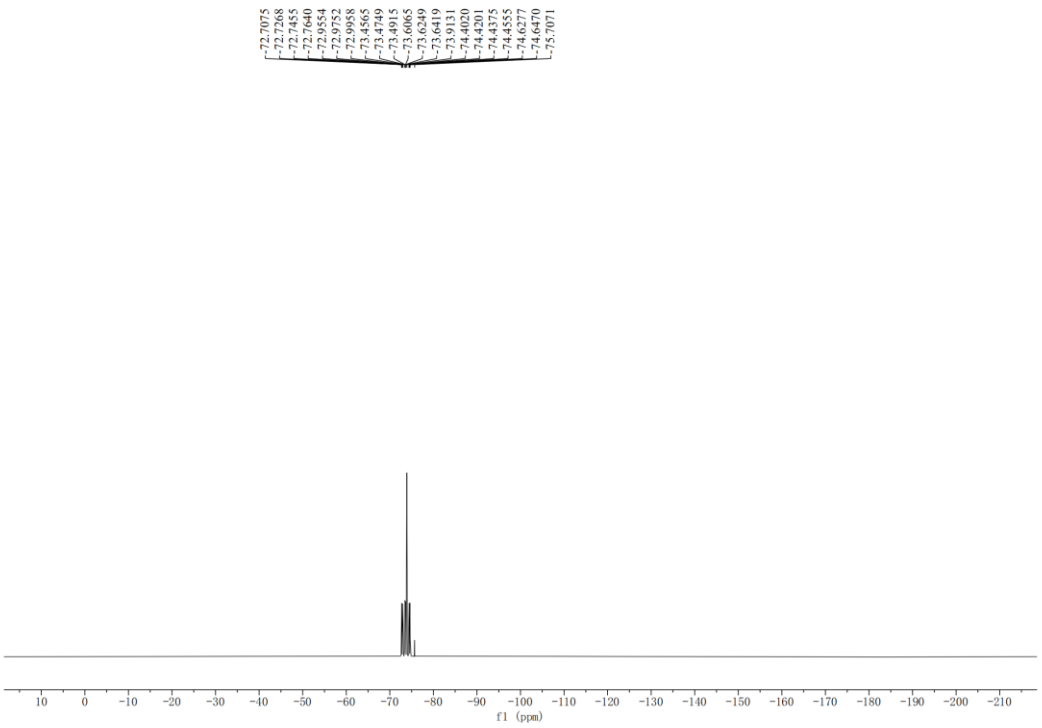
^{11}B NMR spectrum of compound **6e** (600 MHz, Acetone)



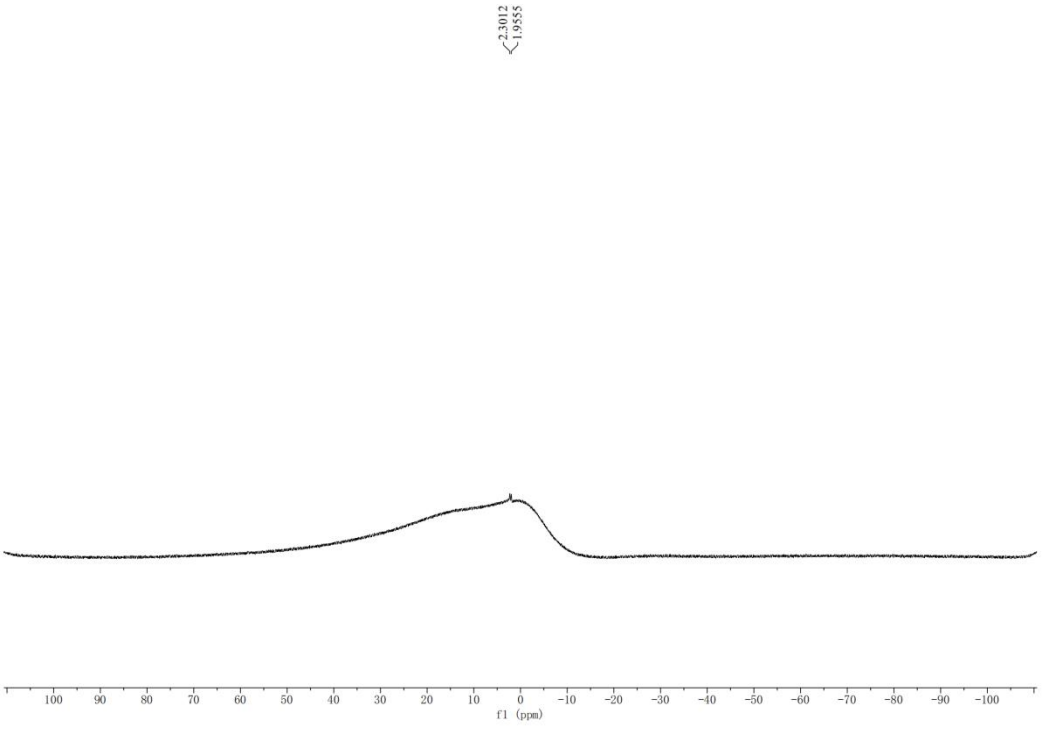
^{1}H NMR spectrum of compound **6f** (600 MHz, $CDCl_3$)



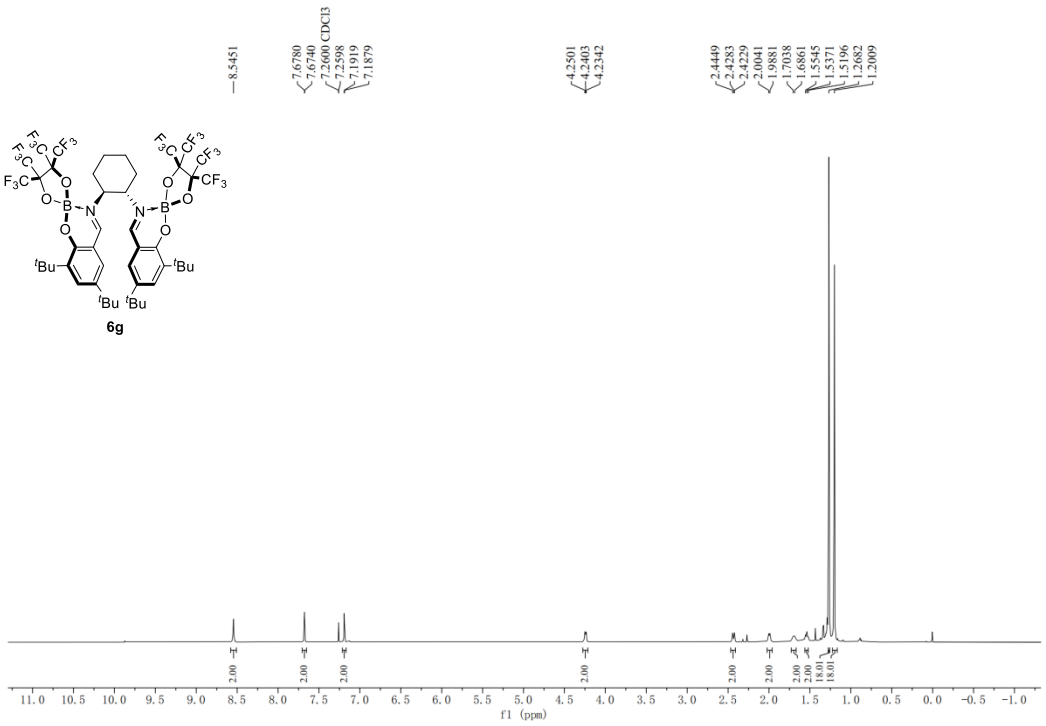
^{13}C NMR spectrum of compound **6f** (600 MHz, $CDCl_3$)



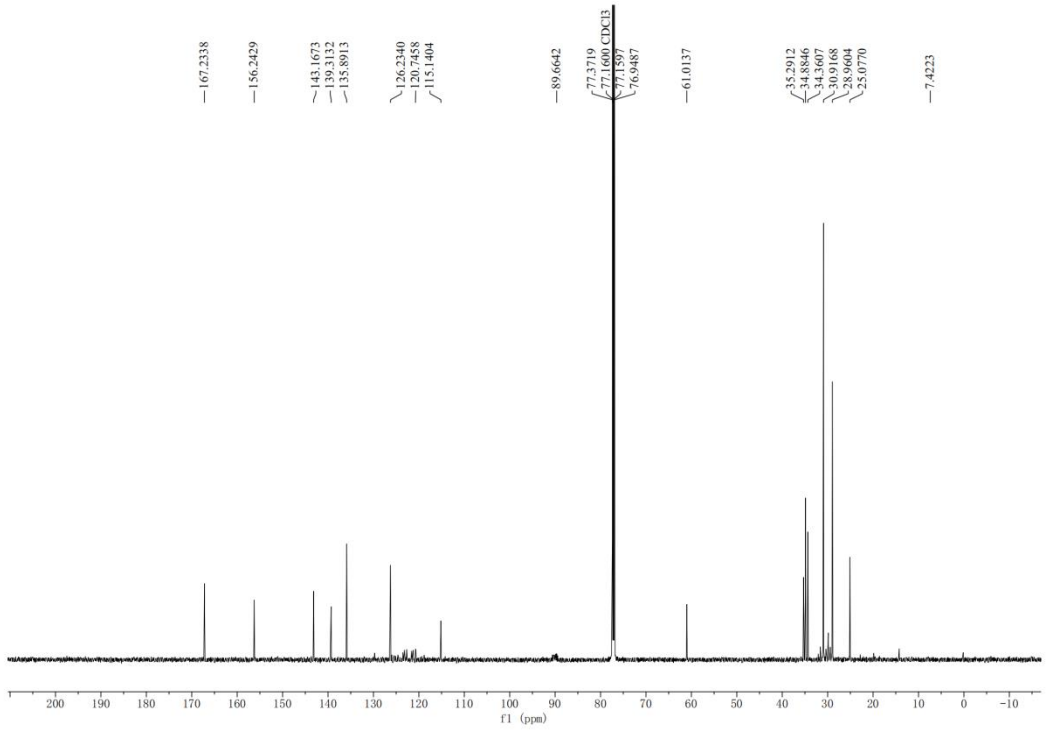
^{19}F NMR spectrum of compound **6f** (600 MHz, $CDCl_3$)



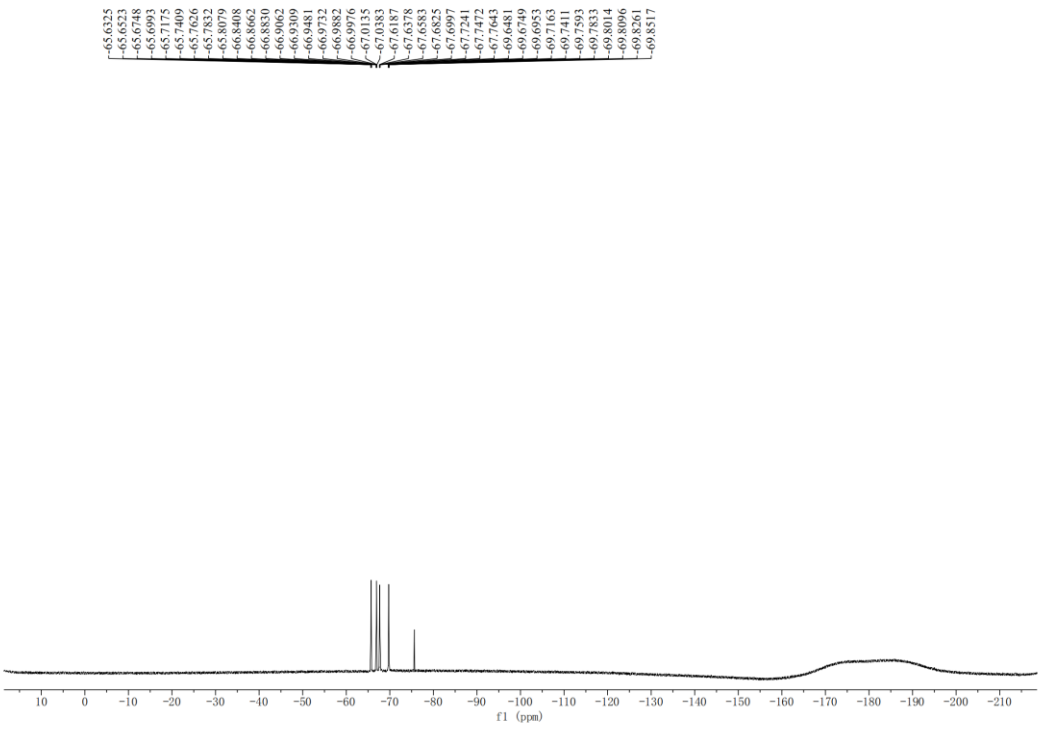
^{11}B NMR spectrum of compound **6f** (600 MHz, $CDCl_3$)



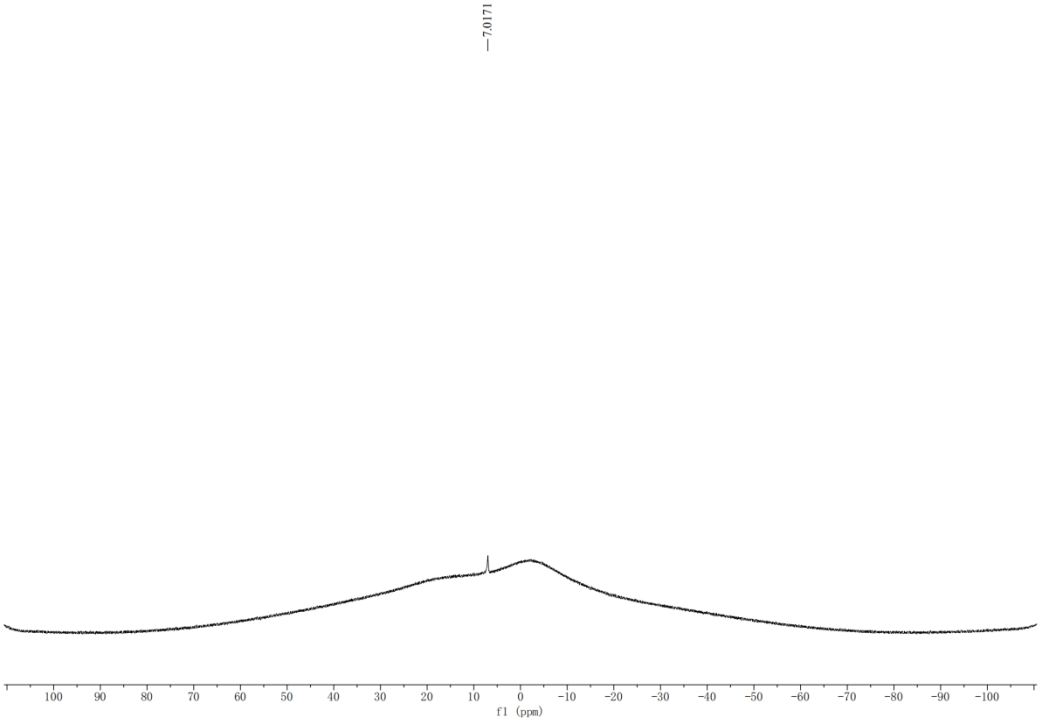
^{1}H NMR spectrum of compound **6g** (600 MHz, $CDCl_3$)



^{13}C NMR spectrum of compound **6g** (600 MHz, $CDCl_3$)



[19]F NMR spectrum of compound **6g** (600 MHz, $CDCl_3$)



[11]B NMR spectrum of compound **6g** (600 MHz, $CDCl_3$)