Metal-Free Visible-Light-Driven Cascade Cyclization Reaction to Synthesize 2-Oxindoles via Benzoyl and Phenylsulfinyl Radicals with Acrylamide Derivatives

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Contents of Supporting Information

Experiment Section.

1. NMR spectra were recorded on Bruker DPX-400, DRX-600 and Bruker Ascend IIITM 600 MHz NMR spectrometer instruments and calibrated using residual solvent peaks as internal reference, such as $CDCl_3$ solutions. High resolution mass spectra were performed on API STAR Pulsar and Thermo Q Exactive. Fluorescence data were obtained with Hitachi F-2700 spectrofluorometer. TLC analyses were performed on commercial glass plates bearing 0.25-mm layer of Merck Silica gel $60F_{254}$. Silica gel (Wakogel 200 - 300 mesh) was used for column chromatography.

2.Reagent: Unless otherwise noted, materials obtained from commercial suppliers were used without further purification. Unsaturated ketenes were purchased from Accela ChemBio Co., Ltd and Shanghai Titan Scientific Co., Ltd.. Cinnamic acids were purchased from Energy-Chemical Co., Ltd.. Other reagents were purchased from Thermo Fisher Scientific Co., Ltd. and Shanghai Aladdin Biochemical Technology Co., Ltd.. Solvents were purchased from Shanghai Titan Scientific Co., Ltd. and Thermo Fisher Scientific Co., Ltd..

The preparation of 2-oxindole reactions were carried out under N_2 atmosphere.

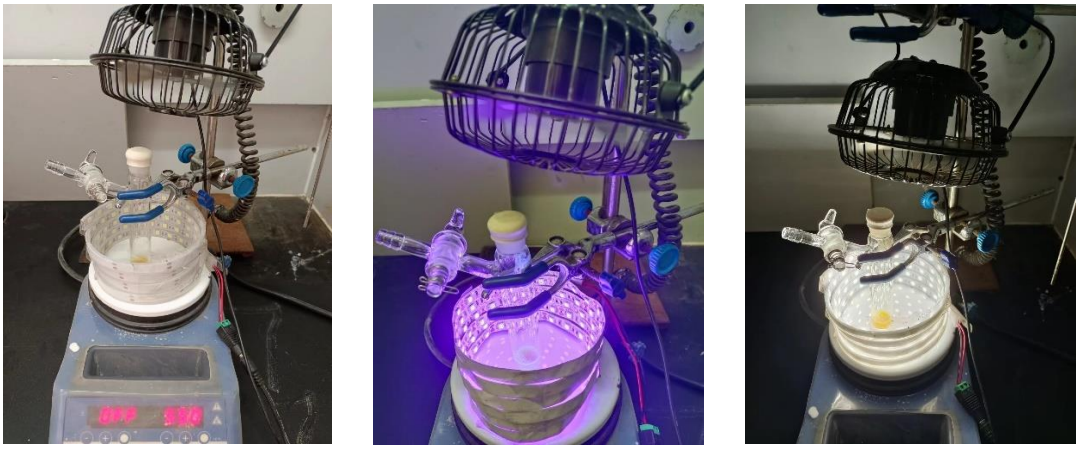
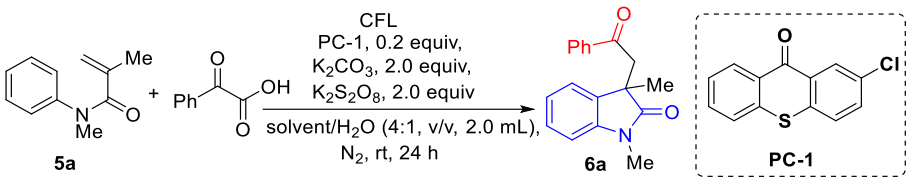


Figure S1. Photos of photochemical reaction devices

Table S1. Screening of Reaction Conditions.[a]



Entry	solvent /H_2O (v/v)		PC	Base	Oxidant	Yield (%)[a]
1	DMF	neat	PC-1	K_2CO_3	$K_2S_2O_8$	29
2	DMF/H_2O	1/1	PC-1	K_2CO_3	$K_2S_2O_8$	57
3	DMF/H_2O	1/1	PC-1	K_2CO_3	$K_2S_2O_8$	37
4	CH_3CN/H_2O	1/1	PC-1	K_2CO_3	$K_2S_2O_8$	90
5	CH_3CN	neat	PC-1	K_2CO_3	$K_2S_2O_8$	16
6	CH_3CN/H_2O	9/1	PC-1	K_2CO_3	$K_2S_2O_8$	54
7	CH_3CN/H_2O	18eq	PC-1	K_2CO_3	$K_2S_2O_8$	41
8	**CH_3CN/H_2O**	**4/1**	PC-1	**K_2CO_3**	**$K_2S_2O_8$**	**96**
9	CH_3CN/H_2O	4/1	PC-1	None	$K_2S_2O_8$	33
10	CH_3CN/H_2O	4/1	PC-1	K_2CO_3	None	14
11	CH_3CN/H_2O	4/1	None	K_2CO_3	$K_2S_2O_8$	0
12[b]	CH_3CN/H_2O	4/1	PC-1	K_2CO_3	$K_2S_2O_8$	0
13	THF/H_2O	4/1	PC-1	K_2CO_3	$K_2S_2O_8$	85
14	dioxane/H_2O	4/1	PC-1	K_2CO_3	$K_2S_2O_8$	66
15	DMSO/H_2O	4/1	PC-1	K_2CO_3	$K_2S_2O_8$	94
16	PhMe/H_2O	4/1	PC-1	K_2CO_3	$K_2S_2O_8$	19
17	CH_3CN/H_2O	4/1	$Ru(bpy)_3Cl_2{\cdot}6H_2O$	K_2CO_3	$K_2S_2O_8$	trace
18	CH_3CN/H_2O	4/1	$Ir(ppy)_3$	K_2CO_3	$K_2S_2O_8$	0
19	CH_3CN/H_2O	4/1	4CzIPN	K_2CO_3	$K_2S_2O_8$	0
20	CH_3CN/H_2O	4/1	xanthen-9-one	K_2CO_3	$K_2S_2O_8$	0
21	CH_3CN/H_2O	4/1	$Ru(bpy)_3Cl_2$	K_2CO_3	$K_2S_2O_8$	trace
22	CH_3CN/H_2O	4/1	PC-1	Na_2CO_3	$K_2S_2O_8$	95
23	CH_3CN/H_2O	4/1	PC-1	Cs_2CO_3	$K_2S_2O_8$	84
24	CH_3CN/H_2O	4/1	PC-1	NaOAc	$K_2S_2O_8$	90
25	CH_3CN/H_2O	4/1	PC-1	$LiOHH_2O$	$K_2S_2O_8$	78
26	CH_3CN/H_2O	4/1	PC-1	K_2CO_3	$Na_2S_2O_8$	93
27	CH_3CN/H_2O	4/1	PC-1	K_2CO_3	$(NH_4)_2S_2O_8$	92
28	CH_3CN/H_2O	4/1	PC-1	K_2CO_3	CAN	0
29	CH_3CN/H_2O	4/1	PC-1	K_2CO_3	$Cu(OAc)_2$	0
30	CH_3CN/H_2O	1/1	PC-1	K_2CO_3	$K_2S_2O_8$	54
31	CH_3CN/H_2O	3/2	PC-1	K_2CO_3	$K_2S_2O_8$	39
32	CH_3CN/H_2O	7/3	PC-1	K_2CO_3	$K_2S_2O_8$	50
33	CH_3CN/H_2O	9/1	PC-1	K_2CO_3	$K_2S_2O_8$	48
34	CH_3CN/H_2O	4/1	PC-1	K_2CO_3	$K_2S_2O_8$	79
35[c]	CH_3CN/H_2O	4/1	PC-1	K_2CO_3	$K_2S_2O_8$	59
36[d]	CH_3CN/H_2O	4/1	PC-1	K_2CO_3	$K_2S_2O_8$	46

37[e]	CH_3CN/H_2O	4/1	PC-1	K_2CO_3	$K_2S_2O_8$	46
38[f]	CH_3CN/H_2O	4/1	PC-1	K_2CO_3	$K_2S_2O_8$	44
39	CH_3CN/H_2O	4/1	PC-1	K_2CO_3	$K_2S_2O_8$	30
40[h]	CH_3CN/H_2O	4/1	PC-1	K_2CO_3	$K_2S_2O_8$	34

[a]Isolated yield. [b]The reaction was run in dark. [c]K_2CO_3 (1.2 equiv) was used. [d]$K_2S_2O_8$ (1.2 equiv) was used. [e]ketonic acid (1.2 equiv) was used. [f]PC-1 (0.1 equiv) was used. [g]PC-1 (0.05 equiv) was used. [h]The reaction was run in air.

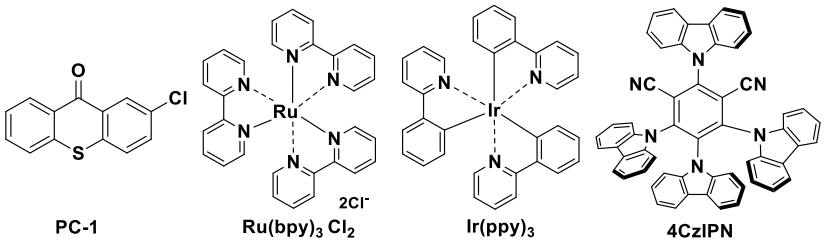
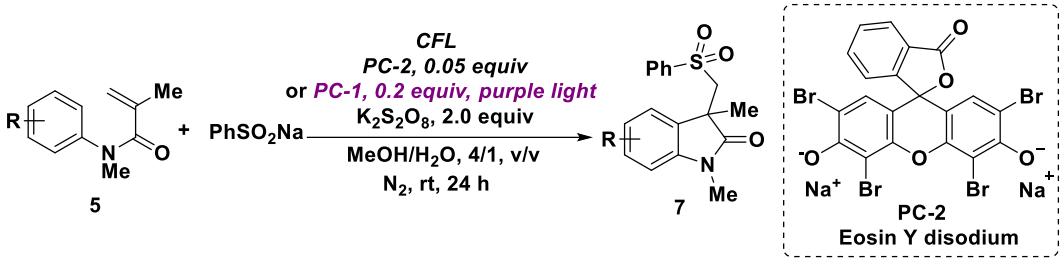
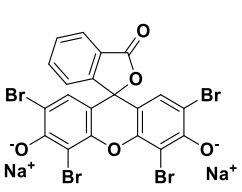


Table S2. Screening of Reaction Conditions.

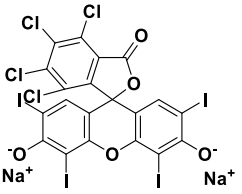


Entry	Solvent/H_2O (v/v)		PC	Oxidant	Yield[a]
1	$MeCN/H_2O$	4/1	PC-1	$K_2S_2O_8$	22
2	MeCN	neat	PC-2	$K_2S_2O_8$	40
3	**MeOH /H_2O**	**4/1**	**PC-1**	**$K_2S_2O_8$**	**90**
4	$MeOH/H_2O$	9/1	PC-2	$K_2S_2O_8$	63
5	**MeOH/H_2O**	**4/1**	**PC-2**	**$K_2S_2O_8$**	**92**
5	$DMSO/H_2O$	4/1	PC-2	$K_2S_2O_8$	86
6	DMF/H_2O	4/1	PC-2	$K_2S_2O_8$	47
7	$MeOH/H_2O$	4/1	PC-3	$K_2S_2O_8$	0
8	$MeOH/H_2O$	4/1	PC-4	$K_2S_2O_8$	63
9	$MeOH/H_2O$	4/1	PC-5	$K_2S_2O_8$	81
10	$MeOH/H_2O$	4/1	PC-6	$K_2S_2O_8$	40
11	$MeOH/H_2O$	4/1	PC-7	$K_2S_2O_8$	49
12	$MeOH/H_2O$	4/1	PC-2	$Na_2S_2O_8$	89
13	$MeOH/H_2O$	4/1	PC-2	$(NH_4)_2S_2O_8$	86
14	$MeOH/H_2O$	4/1	none	$K_2S_2O_8$	12
15	$MeOH/H_2O$	4/1	PC-2	none	34
16[b]	$MeOH/H_2O$	4/1	PC-2	$K_2S_2O_8$	0
17[c]	$MeOH/H_2O$	4/1	PC-2	$K_2S_2O_8$	26
18[d]	$MeOH/H_2O$	4/1	PC-2	$K_2S_2O_8$	68
19[e]	$MeOH/H_2O$	4/1	PC-2	$K_2S_2O_8$	56
20[f]	$MeOH/H_2O$	4/1	PC-2	$K_2S_2O_8$	66

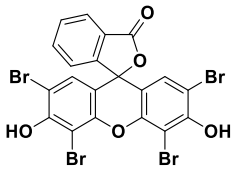
[a]Isolated yield. [b]The reaction was run in dark. [c]The reaction was run in air. [d]Sodium benzenesulfinate (1.2 equiv) was used. [e]PC-2 (0.02 equiv) was used. [f]$K_2S_2O_8$ (1.2 equiv) was used.



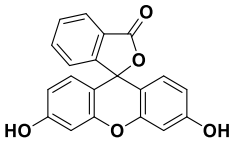
Eosin Y disodiun
PC-2



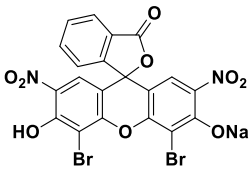
Rose BENGAL
PC-3



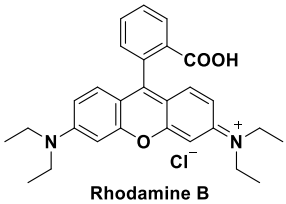
Acid Red 87
PC-4



Fluorescein
PC-5

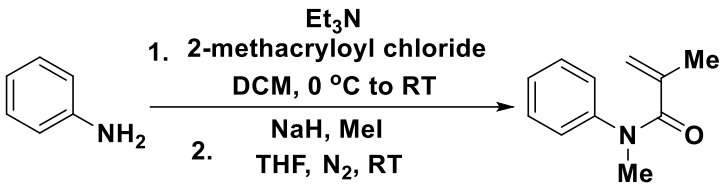


Eosin B
PC-6



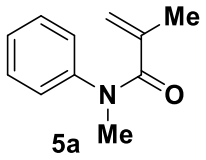
Rhodamine B
PC-7

General procedure for synthesis of starting materials.



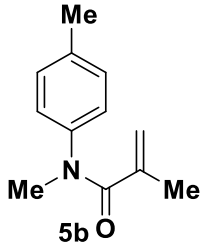
To the mixture of aniline derivatives (10 mmol, 1.0 equiv) and Et_3N (20.0 mmol, 2.0 equiv) in dichloromethane (DCM, 30.0 mL) was added 2-methacryloyl chloride (12.0 mmol, 1.2 equiv) in portions at 0 °C, the resulting mixture was stirred at room temperature until the aniline derivatives totally consumed. The reaction mixture was quenched with water (3.0 mL) and saturated $NaHCO_3$ (3.0 mL), and then extracted with dichloromethane (DCM, 10.0 mL×3), the combined organic phase was dried over anhydrous Na_2SO_4. The solvent was removed by rotary evaporation, the residual was purified by silica gel column chromatography (petroleum ether/ethyl acetate) to afford *N*-phenylmethacrylamide products. The above mentioned *N*-phenylmethacrylamide (5.0 mmol, 1.0 equiv) was dissolved in anhydrous THF (20.0 mL), then NaH (7.5 mmol, 1.5 equiv) was added into the solvent in portions under N_2 atmosphere at 0 °C. After 30 min, CH_3I (6.0 mmol, 1.2 equiv) was added dropwise into the solution, the resulting mixture was stirred at room temperature until *N*-phenylmethacrylamide totally consumed. The reaction mixture was quenched with water (3.0 mL) and saturated NH_4Cl (3.0 mL) and extracted with dichloromethane

(DCM, 10.0 mL×3), the combined organic phase was dried over anhydrous Na_2SO_4. The solvent was removed by rotary evaporation, the residual was purified by silica gel column chromatography (petroleum ether/ethyl acetate) to afford desired *N*-methyl-*N*-phenylmethacrylamide product.



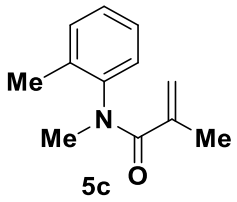
5a

***N*-methyl-*N*-phenylmethacrylamide (5a)**: 543 mg, 62% yield. Light yellow crystal; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.31 (t, *J* = 7.9 Hz, 2H), 7.23 (t, *J* = 7.9 Hz, 1H), 7.13 – 7.11 (m, 2H), 4.99 (d, *J* = 17.6 Hz, 2H), 3.33 (s, 3H), 1.74 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.9, 144.6, 140.6, 129.1, 126.8, 126.4, 119.2, 37.6, 20.2. The NMR spectra data are consistent with previously reported[S1].



5b

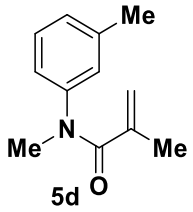
***N*-methyl-*N*-(*p*-tolyl)methacrylamide (5b)**: 587 mg, 62% yield. Light yellow oil;^{1}H NMR (400 MHz, $CDCl_3$) δ 7.11 (d, *J* = 8.0 Hz, 2H), 6.98 (d, *J* = 8.3 Hz, 2H), 4.98(t, *J* = 1.4 Hz, 1H), 4.96 (t, *J* = 10 Hz, 1H), 3.28 (s, 3H), 2.31 (s, 3H), 1.72 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.9, 141.9, 140.7, 136.6, 129.7, 126.2, 118.9, 115.1, 37.5, 20.8, 20.2. The NMR spectra data are consistent with previously reported[S2].



5c

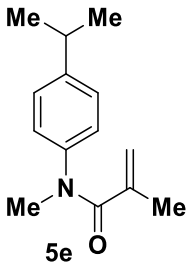
***N*-methyl-*N*-(*o*-tolyl)methacrylamide (5c)**: 748 mg, 79% yield. Light yellow oil;^{1}H NMR (400 MHz, $CDCl_3$) δ 7.20 – 7.12 (m, 3H), 7.01 (d, *J* = 7.2 Hz, 1H), 4.91 (s, 2H), 3.19 (s, 3H), 2.22 (s, 3H), 1.70 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.9, 143.0,

140.4, 134.7, 131.1, 128.0, 127.7, 126.8, 118.3, 36.5, 20.1, 17.5. The NMR spectra data are consistent with previously reported[S3].



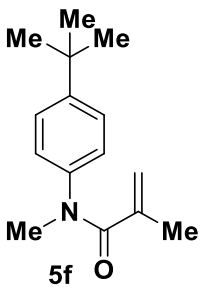
5d

***N*-methyl-*N*-(*m*-tolyl)methacrylamide (5d)**: 776 mg, 82% yield. Light yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.19 (t, *J* = 7.7 Hz, 1H), 7.04 (d, *J* = 8.8 Hz, 1H), 6.98 – 6.78 (m, 2H), 5.01 (s, 1H), 4.97 (s, 1H), 3.31 (s, 3H), 2.32 (s, 3H), 1.75 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.9, 144.5, 140.7, 139.1, 128.9, 127.6, 127.0, 123.5, 119.0, 37.6, 21.2, 20.2. The NMR spectra data are consistent with previously reported[S4].



5e

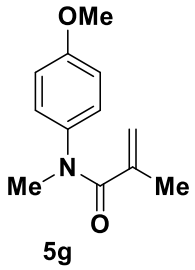
***N*-(4-isopropylphenyl)-*N*-methylmethacrylamide (5e)**: 369 mg, 34% yield. Light yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.18 (d, *J* = 8.2 Hz, 2H), 7.04 (d, *J* = 8.4 Hz, 2H), 5.01 (d, *J* = 10.0 Hz, 2H), 3.32 (s, 3H), 2.93-2.87 (m, 1H), 1.74 (s, 3H), 1.25 (s, 3H), 1.22 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 172.0, 147.7, 142.2, 140.8, 127.1, 126.3, 119.1, 37.7, 33.6, 23.9, 20.3. The NMR spectra data are consistent with previously reported[S5].



5f

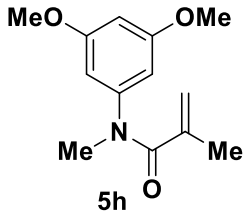
***N*-(4-(*tert*-butyl)phenyl)-*N*-methylmethacrylamide (5f)**: 821mg, 71% yield. Light yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.33 (d, *J* = 8.5 Hz, 2H), 7.04 (d, *J* = 8.5 Hz,

2H), 5.02 (d, *J* = 7.2 Hz, 2H), 3.32 (s, 3H), 1.74 (s, 3H), 1.31 (s, 9H). ^{13}C NMR (100 MHz, cdcl$_3$) δ 172.0, 149.9, 141.8, 140.8, 126.0, 125.9, 119.2, 37.7, 34.5, 31.3, 20.3. The NMR spectra data are consistent with previously reported[S6].



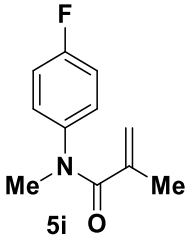
5g

***N*-(4-methoxyphenyl)-*N*-methylmethacrylamide (5g)**: 688 mg, 67% yield. Yellow oil; ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.03 (d, *J* = 8.9 Hz, 2H), 6.84 (d, *J* = 8.9 Hz, 2H), 4.99 (d, *J* = 12.3 Hz, 2H), 3.79 (s, 3H), 3.28 (s, 3H), 1.72 (s, 3H). ^{13}C NMR (100 MHz, CDCl$_3$) δ 172.1, 158.3, 140.9, 137.4, 127.7, 118.8, 114.3, 55.4, 37.8, 20.3. The NMR spectra data are consistent with previously reported[S7].



5h

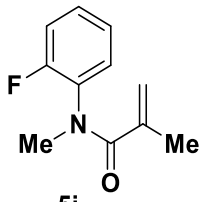
***N*-(3,5-dimethoxyphenyl)-*N*-methylmethacrylamide (5h)**: 529 mg, 45% yield. Yellow solid;^{1}H NMR (400 MHz, CDCl$_3$) δ 6.35 (s, 1H), 6.28 (s, 2H), 5.06 (d, *J* = 4.9 Hz, 2H), 3.77 (s, 3H), 3.31 (s, 3H), 1.80 (s, 3H). ^{13}C NMR (100 MHz, CDCl$_3$) δ 171.9, 161.0, 146.3, 140.8, 119.0, 105.1, 98.7, 55.4, 37.6, 20.3. The NMR spectra data are consistent with previously reported[S8].



5i

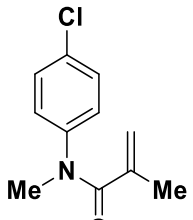
***N*-(4-fluorophenyl)-*N*-methylmethacrylamide (5i)**: 918 mg, 95% yield. Light yellow oil; ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.12-7.08 (m, 2H), 7.02 (t, *J* = 8.6 Hz, 2H),

5.04 (s, 1H), 4.96 (s, 1H), 3.30 (s, 3H), 1.75 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.9, 161.1 (d, J_{C-F} = 245.7 Hz), 140.6 (d, J_{C-F} = 3.3 Hz), 128.2 (d, J_{C-F} = 8.5 Hz), 119.3, 116.1 (d, J_{C-F} = 22.5 Hz), 37.8, 20.3. ^{19}F NMR (376 MHz, $CDCl_3$) δ -114.67. The NMR spectra data are consistent with previously reported[S9].



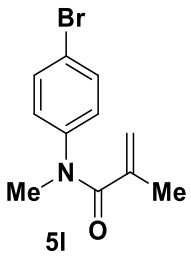
5j

***N*-(2-fluorophenyl)-*N*-methylmethacrylamide (5j)**: 869 mg, 90% yield. Light yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.30 – 7.24 (m, 1H), 7.19 – 7.08 (m, 3H), 5.01 (s, 1H), 4.94 (s, 1H), 3.30 (s, 3H), 1.82 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 172.19, 157.6 (d, J_{C-F} = 247.6 Hz), 140.1, 132.4-132.2 (m), 128.9 (t, J_{C-F} = 4.3 Hz), 124.6 (d, J_{C-F} = 3.9 Hz), 118.3, 116.4 (d, J_{C-F} = 20.1 Hz), 36.8, 19.8. ^{19}F NMR (376 MHz, $CDCl_3$) δ -121.60. The NMR spectra data are consistent with previously reported[S10].

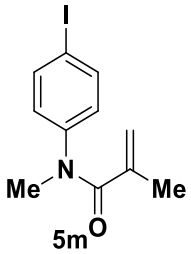


5k

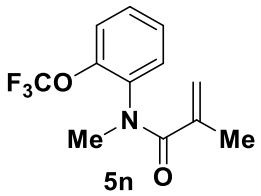
***N*-(4-chlorophenyl)-*N*-methylmethacrylamide (5k)**: 828 mg, 79% yield. Light yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.30 (d, J = 8.8 Hz, 2H), 7.06 (d, J = 8.8 Hz, 2H), 5.13 – 5.01 (t, J = 1.4 Hz, 1H), 5.01 – 4.88 (t, J = 1.0 Hz, 1H), 3.31 (s, 3H), 1.76 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.8, 143.1, 140.4, 132.5, 129.3, 129.0, 127.7, 119.6, 116.3, 37.6, 20.2. The NMR spectra data are consistent with previously reported[S10].



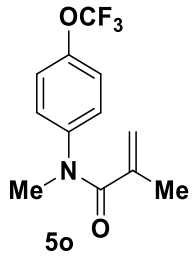
***N*-(4-bromophenyl)-*N*-methylmethacrylamide (5l)**: 813mg, 64% yield. White solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.45 (d, *J* = 8.3 Hz, 2H), 7.01 (d, *J* = 8.7 Hz, 2H), 5.07 (s, 1H), 4.97 (s, 1H), 3.31 (s, 3H), 1.77 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.7, 143.7, 140.3, 132.3, 128.0, 120.3, 119.7, 37.5, 20.2. The NMR spectra data are consistent with previously reported[S11].



***N*-(4-iodophenyl)-*N*-methylmethacrylamide (5m)**: 858 mg, 57% yield. Light yellow crystal solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.66 (d, *J* = 8.6 Hz, 2H), 6.89 (d, *J* = 8.6 Hz, 2H), 5.07 (s, 1H), 4.98 (s, 1H), 3.32 (s, 3H), 1.78 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.7, 144.4, 140.4, 138.4, 128.3, 119.8, 91.5, 37.5, 20.3. The NMR spectra data are consistent with previously reported[S12].

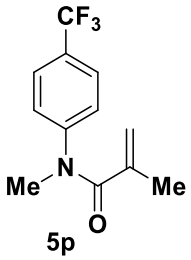


***N*-methyl-*N*-(2-(trifluoromethoxy)phenyl)methacrylamide (5n)**: 804 mg, 62% yield. Light yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.24-7.21 (m, 4H), 4.95 (s, 1H), 4.79 (s, 1H), 3.22 (s, 3H), 1.78 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.9, 144.6, 140.0, 136.9, 129.2, 128.5, 127.3, 120.9, 120.3 (q, *J* = 257.6 Hz), 118.8, 37.0, 19.8. ^{19}F NMR (376 MHz, $CDCl_3$) δ -57.31. The NMR spectra data are consistent with previously reported[S13].



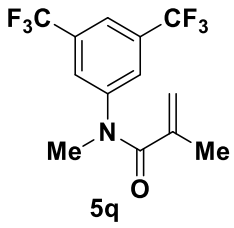
5o

***N*-methyl-*N*-(4-(trifluoromethoxy)phenyl)methacrylamide (5o)**: 959 mg, 74% yield. Light yellow crystal; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.20 (s, 4H), 5.09 (s, 1H), 5.00 (s, 1H), 3.36 (s, 3H), 1.80 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.8, 147.4 (q, J_{C-F} = 7.5 Hz), 143.1, 140.3, 127.7, 124.1, 121.6, 120.3 (q, J_{C-F} = 256.1 Hz), 119.6, 37.6, 20.1. ^{19}F NMR (376 MHz, $CDCl_{33}$) δ -58.15. The NMR spectra data are consistent with previously reported[S5].



5p

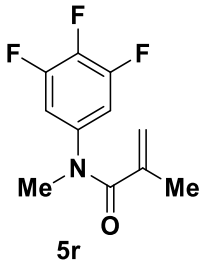
***N*-methyl-*N*-(4-(trifluoromethyl)phenyl)methacrylamide (5p)**: 1.08 g, 89% yield. Light yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.59 (d, J = 8.7 Hz, 2H), 7.25 (d, J = 8.8 Hz, 2H), 5.09 (s, 2H), 4.98 (s, 2H), 3.36 (s, 3H), 1.80 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.7, 147.8 (d, J_{C-F} = 1.2 Hz), 140.2, 128.7 (q, J_{C-F} = 32.7 Hz), 126.4, 126.3 (q, J_{C-F} = 3.8 Hz), 123.7 (q, J_{C-F} = 270.5 Hz), 120.1, 37.5, 20.1. ^{19}F NMR (376 MHz, $CDCl_3$) δ -62.55. The NMR spectra data are consistent with previously reported [S7].



5q

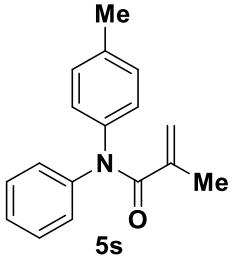
***N*-(3,5-bis(trifluoromethyl)phenyl)-*N*-methylmethacrylamide (5q)**: 763mg, 49%

yield. Yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.74 (s, 1H), 7.62 (s, 2H), 5.18 (s, 1H), 4.99 (s, 1H), 3.42 (s, 3H), 1.86 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.7, 146.0, 139.9, 132.7 (q, J_{C-F} =33.7 Hz), 126.16-126.07 (m), 122.8 (q, J_{C-F} =271.3 Hz), 120.3, 120.18-120.03 (m), 37.6, 20.0. ^{19}F NMR (376 MHz, $CDCl_3$) δ -63.16. HRMS(EI) Calcd for $C_{13}H_{11}F_6NO$ $[M + H]^+$:312.0823, Found 312.0817; IR (KBr) ν(cm^{-1}): 3054, 2925, 1665, 1633, 1615, 1471, 1424, 1356, 1110, 1055, 847.



5r

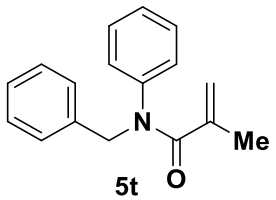
***N*-methyl-*N*-(3,4,5-trifluorophenyl)methacrylamide (5r)**: 367mg, 32% yield. Light yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.82 (dd, J = 8.2 and 6.1 Hz, 2H), 5.16 (s, 1H), 5.03 (s, 1H), 3.31 (s, 3H), 1.84 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.6, 161.3 (dd, J_{C-F} = 25.0 and 14.2 Hz), 152.4 (dd, J_{C-F} =10.5 and 5.2 Hz), 150.2 (dd, J_{C-F} =7.5 and 5.2 Hz), 149.9 (dd, J_{C-F} =10.5 and 5.5Hz), 140.0, 139.9 (dd, J_{C-F} =4.6 and 2.1 Hz), 131.0 (dd, J_{C-F} =15.8 and 6.6 Hz), 119.9, 111.1 (dd, J_{C-F} =16.2 and 6.4 Hz) 110.0, 37.7, 20.2. ^{19}F NMR (376 MHz, $CDCl_3$) δ -132.6 (dd, J = 20.7 and 8.1 Hz), -161.6 (tt, J = 20.8 and 6.0 Hz). HRMS(EI) Calcd for $C_{11}H_{10}F_3NO$ $[M + H]^+$: 230.0793, Found 230.0784; IR (KBr) ν(cm^{-1}): 2924, 2852, 1662, 1623, 1527, 1350, 1239, 1105, 1048.



5s

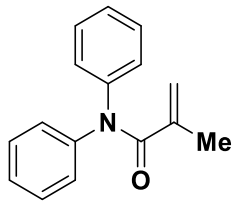
***N*-phenyl-*N*-(p-tolyl)methacrylamide (5s)**: 452 mg, 36% yield. Light yellow solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.32 (t, J = 7.9 Hz, 2H), 7.22 – 7.12 (m, 4H), 7.05 (d, J = 8.3 Hz, 2H), 5.23 (s, 1H), 5.16 (s, 1H), 2.34 (s, 3H), 1.83 (s, 3H). ^{13}C NMR (100

MHz, $CDCl_3$) δ 171.9, 143.6, 141.3, 140.9, 136.4, 129.7, 129.0, 127.04, 126.95, 126.3, 120.7, 21.0, 19.9. The NMR spectra data are consistent with previously reported[S11].



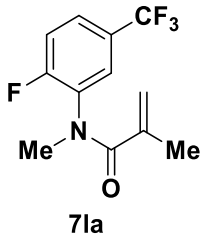
5t

***N*-benzyl-*N*-phenylmethacrylamide (5t)**: 666 mg, 53% yield. Light green oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.35 – 7.29 (m, 7H), 7.03 (d, *J* = 7.8 Hz, 2H), 5.08 (d, *J* = 7.2 Hz, 2H), 5.03 (s, 2H), 1.84 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.8, 143.1, 140.7, 137.4, 129.0, 128.3, 127.4, 127.2, 127.0, 119.3, 53.1, 20.3. The NMR spectra data are consistent with previously reported[S12].



5u

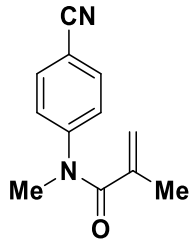
***N*, *N*-diphenylmethacrylamide (5u)**: 759 mg, 64% yield. Light green crystal solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.33 (t, *J* = 7.7 Hz, 3H), 7.22 (t, *J* = 7.4 Hz, 1H), 7.17 (m, 3H), 5.23 (s, 1H), 5.17 (s, 1H), 1.84 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.9, 143.5, 141.2, 129.1, 127.1, 126.5, 120.9, 19.9. The NMR spectra data are consistent with previously reported[S7].



7la

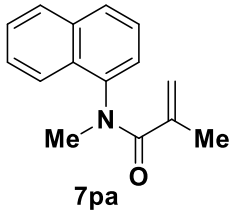
***N*-(2-fluoro-5-(trifluoromethyl)phenyl)-*N*-methylmethacrylamide (7la)**: 1.21 g, 93% yield. Light yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.56 – 7.53 (m, 1H), 7.47 (dd, *J* = 7.0 and 1.9 Hz, 1H), 7.23 (t, *J* = 9.1 Hz, 1H), 5.07 (s, 1H), 4.93 (s, 1H), 3.32 (s, 3H), 1.85 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 172.0, 159.5 (d, $J_{C\text{-}F}$ = 254.9 Hz), 139.8,

133.1(ddd, J_{C-F} = 12.3, 1.9 and 0.9 Hz), 127.6 (dd, J_{C-F} = 33.7 and 4.1 Hz), 126.6-126.4 (m), 126.2-126.0 (m), 123.1 (d, J_{C-F} = 270.6 Hz), 118.9, 117.4 (d, J_{C-F} = 21.7 Hz), 36.9, 19.8. ^{19}F NMR (376 MHz, $CDCl_3$) δ -62.26, -115.57. The NMR spectra data are consistent with previously reported[S14].



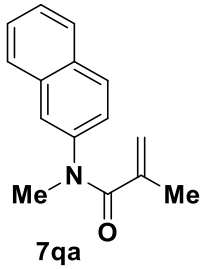
7oa

***N*-(4-cyanophenyl)-*N*-methylmethacrylamide (7oa)**: 451 mg, 45% yield. Light yellow crystal; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.64 (d, *J* = 8.7 Hz, 2H), 7.25 (d, *J* = 8.7 Hz, 2H), 5.14 (s, 1H), 4.99 (s, 1H), 3.38 (s, 3H), 1.83 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.6, 148.6, 140.0, 133.1, 126.5, 120., 118.1, 110.1, 37.4, 20.1. The NMR spectra data are consistent with previously reported[S6].



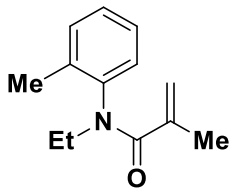
7pa

***N*-methyl-*N*-(naphthalen-1-yl)methacrylamide (7pa)**: 878 mg, 78% yield. Light yellow powder solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.88 (t, *J* = 8.8 Hz, 2H), 7.82 (d, *J* = 8.3 Hz, 1H), 7.60 – 7.52 (m, 2H), 7.43 (t, *J* = 7.7 Hz, 1H), 7.25 (d, *J* = 5.9 Hz, 1H), 4.90 (s, 1H), 4.76 (s, 1H), 3.41 (s, 3H), 1.70 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 172.9, 141.0, 140.5, 134.6, 130.1, 128.6, 128.2, 127.2, 126.5, 125.6, 125.4, 122.8, 117.8, 110.0, 37.6, 20.3. The NMR spectra data are consistent with previously reported[S15].



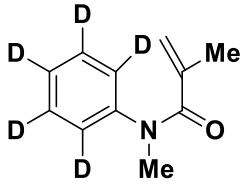
7qa

***N*-methyl-*N*-(naphthalen-2-yl)methacrylamide (7qa)**: 451 mg, 40% yield. Light yellow crystal solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.85-7.78 (m, 3H), 7.57 (d, *J* = 1.8 Hz, 1H), 7.53 – 7.48 (m, 2H), 7.29 – 7.26 (m, 1H), 5.04 (s, 1H), 5.01 (s, 1H), 3.43 (s, 3H), 1.78 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 172.1, 142.0, 140.7, 133.4, 131.9, 129.2, 127.7, 126.7, 126.3, 125.0, 124.4, 119.5, 37.7, 20.3. The NMR spectra data are consistent with previously reported[S16].



7ra

***N*-ethyl-*N*-(*o*-tolyl)methacrylamide (7ra)**: 579 mg, 57% yield. Dark yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.22-7.15 (m, 3H), 7.01 (d, *J* = 7.5 Hz, 1H), 4.91 (s, 2H), 4.14-4.06 (m, 1H), 3.37-3.28 (m, 1H), 2.24 (s, 3H), 1.71 (s, 3H), 1.14 (t, *J* = 7.1 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.4, 141.3, 140.9, 135.4, 131.2, 129.5, 127.7, 126.5, 118.0, 43.6, 20.2, 17.8, 12.4. HRMS(EI) Calcd for $C_{13}H_{17}NO$ $[M + H]^+$: 204.1388, Found 204.1385; IR (KBr) ν(cm^{-1}): 2975, 2933, 1651, 1626, 1492, 1411, 1320, 1228, 1110, 915.

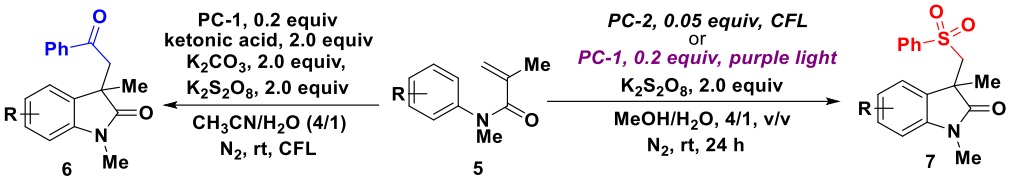


***D*-5a**

***N*-methyl-*N*-(phenyl-d$_5$)methacrylamide (7ra)**: 243 mg, 27% yield. Light yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.03 (s, 1H), 4.98 (s, 1H), 3.35 (s, 3H), 1.76 (s, 3H).

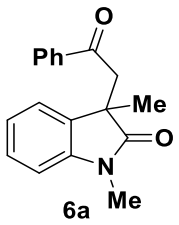
^{13}C NMR (100 MHz, $CDCl_3$) δ 172.0, 140.7, 128.7 (t), 126.1 (t), 119.3, 37.7, 20.3. The NMR spectra data are consistent with previously reported[S17].

General procedure for preparation of 2-oxindoles.



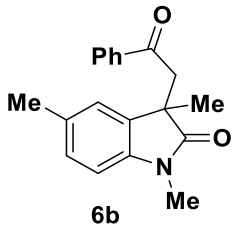
1). General procedure for benzoyl radical cyclization reactions

N-methyl-*N*-phenylmethacrylamide **5a** (0.1 mmol, 1.0 equiv), ketonic acid (0.2 mmol, 2.0 equiv), K_2CO_3 (0.2 mmol, 2.0 equiv), $K_2S_2O_8$ (0.2 mmol, 2.0 equiv) and 2-chlorothioxanthone (0.02 mmol, 0.2 equiv) were added into schlenk tubes, followed by the addition of CH_3CN/H_2O (2.0 mL, 4/1, v/v), the resulting mixture were then exposed to a 23 W white fluorescent lamp (LEDs) under nitrogen atmosphere for corresponding hours until the starting materials *N*-methyl-*N*-phenylmethacrylamide totally consumed or left maintain without change (A fan is used to cool down the reaction temperature). The reaction mixture was filtrated and the filtrate was extracted with dichloromethane (DCM, 5.0 mL×3), the combined organic phase was dried over anhydrous Na_2SO_4. The solvent was removed by rotary evaporation, the residual was purified by silica gel column chromatography (petroleum ether/ethyl acetate) to afford desired 3-methyl-3-acetophenone-2-oxindoles **6**.



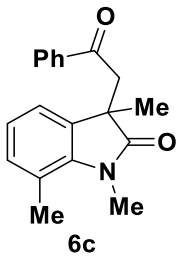
1,3-dimethyl-3-(2-oxo-2-phenylethyl)indolin-2-one (6a): 26.8 mg, 96% yield. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.84 – 7.82 (m, 2H), 7.51 (t, *J* = 7.4 Hz, 1H), 7.39 (t, *J* = 7.7 Hz, 2H), 7.25 (td, *J* = 7.7 and 1.2 Hz,1H), 7.14 (d, *J* = 7.3 Hz, 1H), 6.97 (td, *J* = 7.6 and 0.9 Hz, 1H), 6.90 (d, *J* = 7.7 Hz, 1H), 3.68 (q, *J* = 17.9//11.3 Hz, 2H), 3.31 (s, 3H), 1.44 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 196.1,

180.5, 143.8, 136.4, 133.7, 133.1, 128.4, 127.9, 127.8, 122.1, 121.7, 108.1, 46.00, 45.3, 26.4, 24.9. The NMR spectra data are consistent with previously reported[S17].



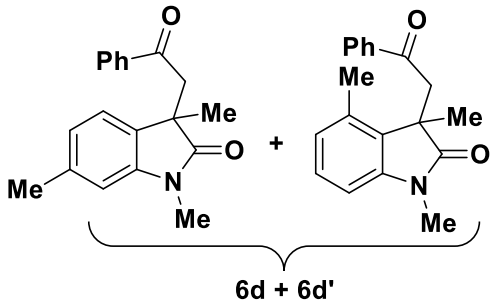
6b

1,3,5-trimethyl-3-(2-oxo-2-phenylethyl)indolin-2-one (6b): 15.4 mg, 53% yield. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.84 (d, *J* = 7.2 Hz, 2H), 7.51 (d, *J* = 7.4 Hz, 1H), 7.40 (t, *J* = 7.9 Hz, 2H), 7.05 (d, *J* = 7.9 Hz, 1H), 6.95 (s, 1H), 6.78 (d, *J* = 7.9 Hz, 1H), 3.92 – 3.55 (m, 1H), 3.29 (s, 3H), 2.27 (s, 3H), 1.43 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 196.1, 180.5, 141.5, 136.4, 133.8, 133.1, 131.6, 128.4, 128.1, 128.0, 122.7, 107.8, 46.0, 45.3, 26.5, 25.0, 21.1. The NMR spectra data are consistent with previously reported[S18-S20].

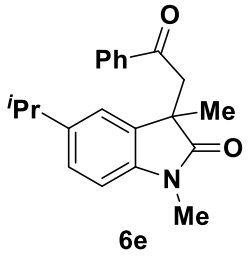


6c

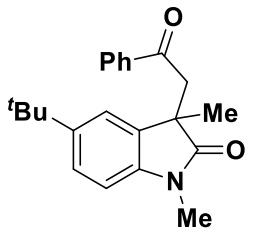
1,3,7-trimethyl-3-(2-oxo-2-phenylethyl)indolin-2-one (6c): 25.6 mg, 87% yield. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.83 (d, *J* = 7.2 Hz, 2H), 7.51 (t, *J* = 7.4 Hz, 1H), 7.39 (t, *J* = 7.7 Hz, 2H), 6.95 (t, *J* = 6.9 Hz, 2H), 6.85 (t, *J* = 7.5 Hz, 1H), 3.67 (d, *J* = 2.8 Hz, 2H), 3.58 (s, 3H), 2.62 (s, 3H), 1.41 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 196.1, 181.3, 141.6, 136.4, 134.3, 133.1, 131.5, 128.4, 127.9, 122.0, 119.7, 119.5, 46.3, 44.6, 29.8, 25.5, 19.1. The NMR spectra data are consistent with previously reported[S18-S20].



Mixture of **1,3,5-trimethyl-3-(2-oxo-2-phenylethyl)indolin-2-one** and **1,3,4-trimethyl-3-(2-oxo-2-phenylethyl)indolin-2-one (6d)**: 15.7 mg, 54% yield. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.84-7.80 (m, 3.07 H), 7.51 (t, *J* = 7.4 Hz, 1.55 H), 7.39 (t, *J* = 7.7 Hz, 3.02 H), 7.15 (t, *J* = 7.8 Hz, 1.11 H), 7.02 (d, *J* = 7.5 Hz, 0.63 H), 6.78 (d, *J* = 7.5 Hz, 0.59 H), 6.73 (d, *J* = 7.9 Hz, 2.44 H), 3.94 (d, *J* = 17.7 Hz, 1.24 H), 3.72 – 3.59 (m, 2.35H), 3.29 (s, 1.51 H), 3.26 (s, 2.95 H), 2.37 (s, 1.54 H), 2.30 (s, 3.00 H), 1.49 (s, 3.15 H), 1.43 (s, 1.70 H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 196.23, 196.15, 180.8, 180.4, 144.0, 143.8, 137.8, 136.4, 136.2, 133.1, 133.0, 132.7, 130.7, 130.3, 128.4, 127.91, 127.87, 127.6, 124.7, 122.6, 121.5, 109.1, 105.9, 46.1, 46.0, 45.04, 44.98, 26.5, 26.4, 24.9, 22.9, 21.8, 18.2. The NMR spectra data are consistent with previously reported[S20-S21].

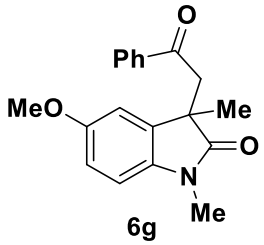


5-isopropyl-1,3-dimethyl-3-(2-oxo-2-phenylethyl)indolin-2-one (6e): 29.6 mg, 92% yield. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.83 (d, *J* = 7.3 Hz, 2H), 7.51 (t, *J* = 7.4 Hz, 1H), 7.39 (t, *J* = 7.8 Hz, 2H), 7.10 (dd, *J* = 8.0 and 1.6 Hz, 1H), 7.00 (d, *J* = 1.2 Hz, 1H), 6.81 (d, *J* = 8.0 Hz, 1H), 3.97 – 3.48 (m, 1H), 3.28 (s, 3H), 1.45 (s, 3H), 1.17 (dd, *J* = 6.8, 4.9 Hz, 6H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 196.3, 180.6, 143.0, 141.6, 136.6, 133.5, 133.0, 128.4, 127.9, 125.4, 120.3, 107.8, 45.9, 45.5, 33.8, 26.4, 24.8, 24.2, 24.1. HRMS(EI) Calcd for $C_{21}H_{23}NO_2$ $[M + H]^+$: 322.1802, Found 322.1802; IR (KBr) ν(cm^{-1}): 2961, 2869, 1712, 1691, 1599, 1498, 1351, 1217, 1119, 815.



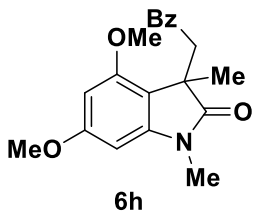
6f

5-(*tert*-butyl)-1,3-dimethyl-3-(2-oxo-2-phenylethyl)indolin-2-one (6f): 20.8 mg, 62% yield. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.83 – 7.81 (m, 2H), 7.51 (t, *J* = 7.6 Hz, 1H), 7.39 (t, *J* = 7.6 Hz, 2H), 7.26 (dd, *J* = 8.1 and 1.9 Hz, 1H), 7.17 (d, *J* = 1.7 Hz, 1H), 6.81 (d, *J* = 8.1 Hz, 1H), 3.65 (q, *J* = 17.5 Hz, 2H), 3.28 (s, 3H), 1.46 (s, 3H), 1.24 (s, 9H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 196.4, 180.6, 145.3, 141.3, 136.7, 133.2, 133.0, 128.4, 128.0, 124.4, 119.2, 107.5, 45.9, 45.7, 34.5, 31.5, 26.4, 24.8. HRMS(EI) Calcd for $C_{22}H_{25}NO_2$ $[M + H]^+$: 336.1964, Found 336.1954; IR (KBr) ν(cm^{-1}): 2963, 2869, 1712, 1693, 1500, 1351, 1256, 1215, 1057, 815.



6g

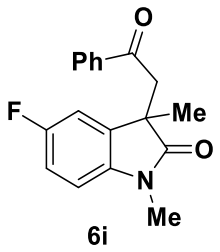
5-methoxy-1,3-dimethyl-3-(2-oxo-2-phenylethyl)indolin-2-one (6g): 22.3 mg, 72% yield. Colorless viscous oil; 1H NMR (400 MHz, CDCl3) δ 7.84 – 7.82 (m, 2H), 7.53 – 7.49 (m, 1H), 7.39 (t, *J* = 7.5 Hz, 2H), 6.81-6.75 (m, 3H), 3.73 (d, *J* = 1.3 Hz, 3H), 3.66 (d, *J* = 1.6 Hz, 2H), 3.28 (d, *J* = 1.3 Hz, 3H), 1.43 (d, *J* = 1.4 Hz, 3H). 13C NMR (100 MHz, CDCl3) δ 196.0, 180.2, 155.7, 137.4, 136.3, 135.2, 133.1, 128.4, 127.9, 111.4, 109.9, 108.3, 55.7, 46.0, 45.7, 26.5, 24.9. The NMR spectra data are consistent with previously reported[S19].



6h

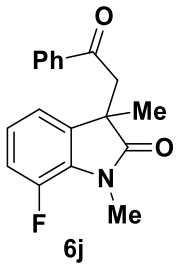
4,6-dimethoxy-1,3-dimethyl-3-(2-oxo-2-phenylethyl)indolin-2-one (6h): 6.6 mg, 19%

yield. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.84 (d, *J* = 8.5 Hz, 2H), 7.50 (t, *J* = 7.4 Hz, 1H), 7.38 (t, *J* = 7.6 Hz, 2H), 6.15 (d, *J* = 2.0 Hz, 1H), 6.06 (d, *J* = 1.9 Hz, 1H), 4.08 (d, *J* = 17.5 Hz, 1H), 3.80 (s, 3H), 3.71 (s, 3H), 3.46 (d, *J* = 17.5 Hz, 1H), 3.27 (s, 3H), 1.45 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 197.1, 181.4, 161.2, 155.9, 145.7, 136.7, 132.8, 128.3, 128.0, 110.9, 92.1, 55.5, 55.2, 45.1, 44.6, 26.6, 23.0. HRMS(EI) Calcd for $C_{20}H_{21}NO_4$ $[M + H]^+$: 340.1549, Found 340.1533; IR (KBr) ν(cm^{-1}): 2965, 2933, 1714, 1690, 1450, 1380, 1256, 1211, 1146, 1071, 813.



6i

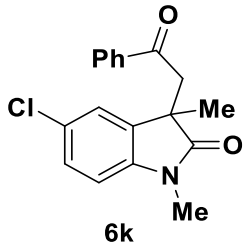
5-fluoro-1,3-dimethyl-3-(2-oxo-2-phenylethyl)indolin-2-one (6i): 22.8 mg, 77% yield. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.84 (d, *J* = 7.2 Hz, 2H), 7.53 (t, *J* = 7.4 Hz, 1H), 7.40 (t, *J* = 7.7 Hz, 2H), 6.97 – 6.89 (m, 2H), 6.81 (dd, *J* = 8.4 and 4.2 Hz, 1H), 3.67 (s, 2H), 3.29 (s, 3H), 1.43 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 195.9, 180.2, 159.1 (d, $J_{C\text{-}F}$ = 238.6 Hz), 139.8 (d, $J_{C\text{-}F}$ = 1.9 Hz), 136.2, 135.4 (d, $J_{C\text{-}F}$ = 7.8 Hz), 133.3, 128.5, 127.9, 113.8 (d, $J_{C\text{-}F}$ = 23.2 Hz), 110.1 (d, $J_{C\text{-}F}$ = 24.7 Hz), 108.5 (d, $J_{C\text{-}F}$ = 8.1 Hz), 45.9, 45.7, 26.6, 24.8. ^{19}F NMR (376 MHz, $CDCl_3$) δ -121.24. The NMR spectra data are consistent with previously reported[S19-S20].



6j

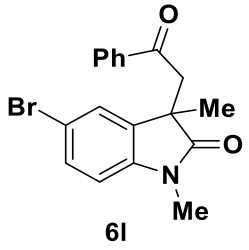
7-fluoro-1,3-dimethyl-3-(2-oxo-2-phenylethyl)indolin-2-one (6j): 22.0 mg, 74% yield. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.83 (dd, *J* = 8.2 and 1.1 Hz, 2H), 7.52 (tt, *J* = 6.9 and 1.2 Hz, 1H), 7.40 (t, *J* = 7.7 Hz, 2H), 7.00 – 6.94 (m,

1H), 6.90 – 6.87 (m, 2H), 3.69 (d, J = 0.9 Hz, 2H), 3.52 (d, J = 2.7 Hz, 3H), 1.43 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 195.9, 180.2, 148.2 (d, J_{C-F} = 241.9 Hz), 136.8 (d, J_{C-F} = 3.5 Hz), 136.2, 133.3, 130.5 (d, J_{C-F} = 8.1 Hz), 128.5, 127.9, 122.6 (d, J_{C-F} = 6.4 Hz), 117.4 (d, J_{C-F} = 3.1 Hz), 115.9 (d, J_{C-F} = 19.3 Hz), 46.3, 45.5, 28.9 (d, J_{C-F} = 5.7 Hz), 25.1. ^{19}F NMR (376 MHz, $CDCl_3$) δ -136.62. The NMR spectra data are consistent with previously reported[S19, S23].



6k

5-chloro-1,3-dimethyl-3-(2-oxo-2-phenylethyl)indolin-2-one (6k)[5a]: 25.9 mg, 83% yield. Colorless viscous oil; 1H NMR (400 MHz, CDCl3) δ 7.84 (d, J = 7.9 Hz, 2H), 7.53 (t, J = 6.8 Hz, 1H), 7.41 (t, J = 7.0 Hz, 2H), 7.22 (dd, J = 8.3 and 2.0 Hz, 1H), 7.10 (s, 1H), 6.82 (dd, J = 8.3 and 1.7 Hz, 1H), 3.69 (s, 2H), 3.30 (d, J = 1.8 Hz, 3H), 1.43 (d, J = 1.7 Hz, 3H). 13C NMR (100 MHz, CDCl3) δ 195.8, 180.1, 142.5, 136.0, 135.5, 133.3, 128.5, 127.9, 127.7, 127.4, 122.3, 109.0, 46.0, 45.4, 26.6, 24.8. The NMR spectra data are consistent with previously reported[S19].



6l

5-bromo-1,3-dimethyl-3-(2-oxo-2-phenylethyl)indolin-2-one (6l): 18.6 mg, 52% yield. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.84 (d, J = 7.2 Hz, 2H), 7.53 (t, J = 7.4 Hz, 1H), 7.42 – 7.46 (m, 3H), 7.24 (d, J = 1.9 Hz, 1H), 6.78 (d, J = 8.3 Hz, 1H), 3.68 (s, 2H), 3.29 (s, 3H), 1.42 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 195.7, 180.0, 143.0, 136.0, 135.9, 133.3, 130.6, 128.5, 127.9, 125.0, 114.8, 109.6, 46.1, 45.4, 26.5, 24.8. The NMR spectra data are consistent with previously reported[S18, S22, S24].

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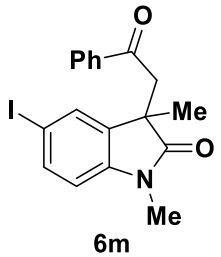
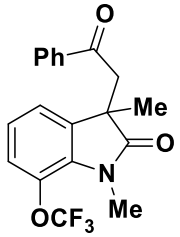


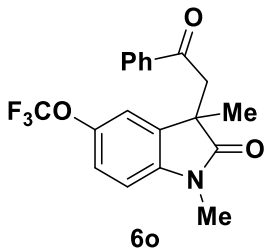
6m

5-iodo-1,3-dimethyl-3-(2-oxo-2-phenylethyl)indolin-2-one (6m): 25.8 mg, 64% yield. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.84 (d, *J* = 7.2 Hz, 2H), 7.57 (dd, *J* = 8.2 and 1.7 Hz, 1H), 7.52 (d, *J* = 7.4 Hz, 1H), 7.43 – 7.39 (m, 3H), 6.69 (d, *J* = 8.2 Hz, 1H), 3.67 (s, 2H), 3.29 (s, 3H), 1.42 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 195.8, 179.8, 143.7, 136.6, 136.3, 136.1, 133.3, 130.5, 128.5, 128.0, 110.2, 84.6, 46.1, 45.2, 26.5, 24.9. The NMR spectra data are consistent with previously reported[S19-S20, S22].



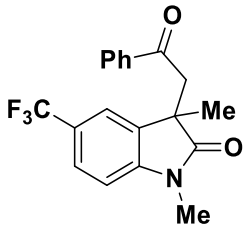
6n

1,3-dimethyl-3-(2-oxo-2-phenylethyl)-7-(trifluoromethoxy)indolin-2-one (6n): 16.3 mg, 45% yield. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.83 (d, *J* = 7.4 Hz, 2H), 7.52 (t, *J* = 7.3 Hz, 1H), 7.40 (t, *J* = 7.7 Hz, 2H), 7.13 (d, *J* = 8.4 Hz, 1H), 7.05 (d, *J* = 7.3 Hz, 1H), 6.94 (t, *J* = 7.3 Hz, 1H), 3.70 (s, 2H), 3.52 (s, 3H), 1.43 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 195.8, 180.5, 136.9, 136.1, 135.5, 133.3, 133.2 (q, $J_{C\text{-}F}$ = 2.0 Hz), 128.5, 127.9, 122.5, 121.3, 120.7 (q, $J_{C\text{-}F}$ = 256.6 Hz), 120.2, 46.4, 45.1, 28.9, 25.1. ^{19}F NMR (376 MHz, $CDCl_3$) δ -57.41. HRMS(EI) Calcd for $C_{19}H_{16}F_3NO_3$ $[M + H]^+$: 364.1161, Found 364.1156; IR (KBr) ν (cm^{-1}): 2934, 2898, 1714, 1625, 1483, 1361, 1126, 1058, 798.



6o

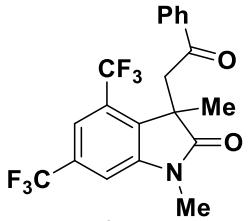
1,3-dimethyl-3-(2-oxo-2-phenylethyl)-5-(trifluoromethoxy)indolin-2-one (6o): 33.5 mg, 92% yield. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.83 (d, *J* = 7.3 Hz, 2H), 7.53 (t, *J* = 7.4 Hz, 1H), 7.40 (t, *J* = 7.7 Hz, 2H), 7.19 – 7.07 (m, 1H), 7.03 (s, 1H), 6.87 (d, *J* = 8.5 Hz, 1H), 3.69 (d, *J* = 1.6 Hz, 2H), 3.31 (s, 3H), 1.44 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 195.9, 180.2, 144. 5 (q, J_{C-F} =2.0 Hz), 142.5, 136.1, 135.3, 133.3, 128.5, 127.9, 120.8, 120.5 (q, J_{C-F} = 254.9 Hz), 115.9, 108.4, 46.0, 45.6, 26.6, 24.7. ^{19}F NMR (376 MHz, $CDCl_3$) δ -58.34. HRMS(EI) Calcd for $C_{19}H_{16}F_3NO_3$ $[M + H]^+$: 364.1161, Found 364.1156; IR (KBr) ν (cm^{-1}): 2970, 2931, 1719, 1690, 1622, 1499, 1450, 1353, 1258, 690.



6p

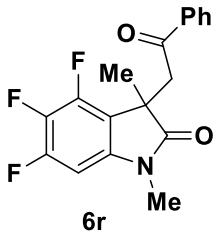
1,3-dimethyl-3-(2-oxo-2-phenylethyl)-5-(trifluoromethyl)indolin-2-one (6p): 26.1 mg, 75% yield. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.84 (d, *J* = 7.2 Hz, 2H), 7.53 (t, *J* = 8.0 Hz, 2H), 7.41 (t, *J* = 7.7 Hz, 2H), 7.35 (s, 1H), 6.97 (d, *J* = 8.2 Hz, 1H), 3.74 (d, *J* = 2.2 Hz, 2H), 3.35 (s, 3H), 1.45 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 195.8, 180.5, 146.9, 136.0, 134.4, 133.4, 128.6, 127.9, 125.7 (q, J_{C-F}= 4.1 Hz), 124.5 (q, J_{C-F}= 270 Hz), 124.3 (q, J_{C-F}= 32.2 Hz), 118.6 (q, J_{C-F}= 3.6 Hz), 118.6 (q, *J*=14.7 Hz), 107.8, 46.1, 45.1, 26.6, 24.8. ^{19}F NMR (376 MHz, $CDCl_3$) δ -61.30.

The NMR spectra data are consistent with previously reported[S19, S21].



6q

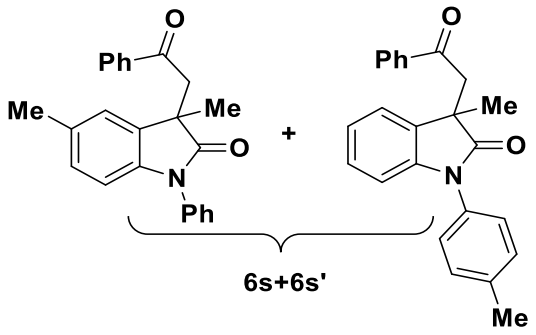
1,3-dimethyl-3-(2-oxo-2-phenylethyl)-4,6-bis(trifluoromethyl)indolin-2-one (6q): 18.6 mg, 45% yield. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.84 – 7.81 (m, 2H), 7.56 – 7.51 (m, 2H), 7.41 (t, J = 7.7 Hz, 2H), 7.32 (s, 1H), 4.13 (d, J = 18.8 Hz, 1H), 3.79 (d, J = 20.0 Hz, 1H), 3.40 (s, 3H), 1.51 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 196.5, 179.8, 146.5, 135.7, 135.61-135.56 (m), 130.8 (d, J_{C-F} = 33.4 Hz), 128.6, 127.9, 125.93, 125.6 (q, J_{C-F} = 33.4 Hz), 124.7 (d, J_{C-F} = 7.0 Hz), 122.0 (d, J_{C-F} = 6.3 Hz), 116.6-116.4 (m), 108.2 (q, J_{C-F} = 3.6 Hz), 46.9, 45.7 (q, J_{C-F} = 3.0 Hz), 27.1, 24.5 (q, J_{C-F} = 2.3 Hz). ^{19}F NMR (376 MHz, $CDCl_3$) δ -58.56, -62.88. HRMS(EI) Calcd for $C_{20}H_{15}F_6NO_2$ $[M + H]^+$: 416.1085, Found 416.1068; IR (KBr) ν (cm^{-1}): 2978, 1737, 1687, 1470, 1319, 1211, 1135, 874.



6r

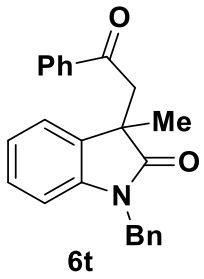
4,5,6-trifluoro-1,3-dimethyl-3-(2-oxo-2-phenylethyl)indolin-2-one (6r): 19.5 mg, 59% yield. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.85 (d, J = 8.5 Hz, 2H), 7.55 (t, J = 7.4 Hz, 1H), 7.42 (t, J = 7.7 Hz, 2H), 6.55 (ddd, J = 9.5, 5.3 and 1.6 Hz, 1H), 3.95 (d, J = 18.2 Hz, 1H), 3.70 (d, J = 18.2 Hz, 1H), 3.27 (s, 3H), 1.51 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 196.2, 179.6, 152.4 (dd, J_{C-F} = 11.2 and 4.2 Hz), 139.8(td, J_{C-F} = 11.7 and 3.0 Hz), 137.2 (dd, J_{C-F} = 13.7 and 4.4 Hz), 135.8, 134.7 (t, J_{C-F} = 14.7 Hz), 133.5, 128.6, 128.0, 115.3 (dd, J_{C-F} = 16.8 and 4.2 Hz), 93.9 (dq, J_{C-F} = 23.2 and 1.5 Hz), 70.3, 45.3, 26.9, 23.4. ^{19}F NMR (376 MHz, $CDCl_3$) δ -134.60, -143.68, -169.82. HRMS(EI) Calcd for $C_{18}H_{14}F_3NO_2$ $[M + H]^+$: 334.1055, Found 334.1046; IR (KBr) ν (cm^{-1}): 2986, 1748, 1689, 1468, 1326, 1208, 1146, 868.

The NMR spectra data are consistent with previously reported[S19-S20, S22].



3-(2-oxo-2-phenylethyl)-1-(*p*-tolyl)indolin-2-one and

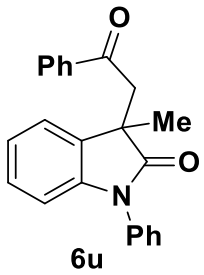
3-methyl-3-(2-oxo-2-(*p*-tolyl)ethyl)-1-phenylindolin-2-one (6s+6s'): 26.4 mg, 74% yield. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.84 (d, *J* = 7.2 Hz, 2H), 7.51 (t, *J* = 7.4 Hz, 1H), 7.39 (t, *J* = 7.7 Hz, 2H), 6.96 (t, *J* = 8.4 Hz, 2H), 6.85 (t, *J* = 7.5 Hz, 1H), 4.07-3.97 (m, 2H), 3.67 (s, 2H), 2.58 (s, 3H), 1.39 (s, 3H), 1.36 (t, *J* = 7.1 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 195.9, 181.1, 140.8, 136.5, 134.8, 133.0, 131.7, 128.4, 127.9, 121.8, 119.5, 119.2, 46.2, 44.5, 36.5, 25.7, 19.0, 14.5. HRMS(EI) Calcd for $C_{24}H_{21}NO_2$ $[M + H]^+$: 356.1651, Found 356.1642; IR (KBr) ν (cm^{-1}): 2961, 2928, 1712, 1691, 1498, 1351, 1217, 1119, 815, 760, 691. The NMR spectra data are consistent with previously reported[S8].



6t

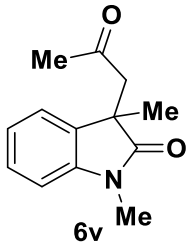
1-benzyl-3-methyl-3-(2-oxo-2-phenylethyl)indolin-2-one (6t): 10.3 mg, 29% yield. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.89 (d, *J* = 7.2 Hz, 2H), 7.53 (t, *J* = 7.4 Hz, 1H), 7.44-7.40 (m, 4H), 7.35 (t, *J* = 7.5 Hz, 2H), 7.28 (d, *J* = 7.3 Hz, 1H), 7.16 – 7.10 (m, 2H), 6.94 (td, *J* = 7.7 and 0.9 Hz, 1H), 6.74 (d, *J* = 7.7 Hz, 1H), 5.10 (d, *J* = 15.8 Hz, 1H), 4.97 (d, *J* = 15.8 Hz, 1H), 3.76 (d, *J* = 5.5 Hz, 2H), 1.51 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 195.9, 180.6, 142.9, 136.4, 136.2, 133.7, 133.1, 128.7, 128.5, 128.0, 127.7, 127.3, 127.2, 122.2, 121.7, 109.3, 45.8, 45.4, 44.0, 25.5. The

NMR spectra data are consistent with previously reported[S18-S19, S24].



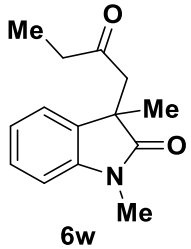
6u

3-methyl-3-(2-oxo-2-phenylethyl)-1-phenylindolin-2-one (6u): 15.4 mg, 45% yield. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.88 (d, *J* = 7.3 Hz, 2H), 7.58 – 7.51 (m, 5H), 7.41 (t, *J* = 7.6 Hz, 3H), 7.17 (t, *J* = 7.4 Hz, 2H), 7.00 (t, *J* = 7.5 Hz, 1H), 6.85 (d, *J* = 7.9 Hz, 1H), 3.98 – 3.65 (m, 2H), 1.57 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 196.0, 180.1, 144.1, 136.4, 135.2, 133.5, 133.2, 129.5, 128.5, 128.0, 127.9, 127.7, 127.0, 122.5, 121.8, 109.4, 46.7, 45.4, 25.3. The NMR spectra data are consistent with previously reported[S18].



6v

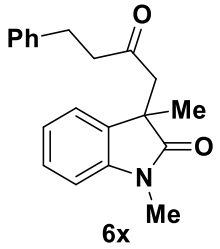
1,3-dimethyl-3-(2-oxopropyl)indolin-2-one (6v): 18.8 mg, 87% yield. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.29 – 7.21 (td, *J* = 7.7 and 1.2 Hz, 1H), 7.14 (dd, *J* = 7.3 and 1.1 Hz, 1H), 7.00 (td, *J* = 7.7 and 0.9 Hz, 1H), 6.86 (d, *J* = 7.8 Hz, 1H), 3.26 (s, 3H), 3.09 (d, *J* = 2.5 Hz, 2H), 1.97 (s, 3H), 1.33 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 204.5, 180.3, 143.7, 133.4, 127.9, 122.2, 121.8, 108.1, 50.5, 45.2, 30.0, 26.4, 24.3. The NMR spectra data are consistent with previously reported[S22].



6w

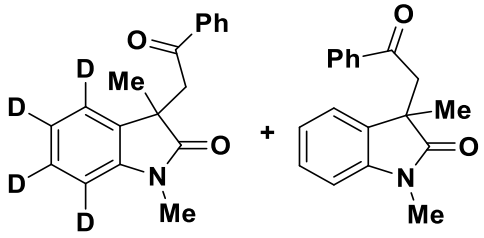
1,3-dimethyl-3-(2-oxobutyl)indolin-2-one (6w): 19.6 mg, 85% yield. Colorless

viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.55-7.50 (m, 3H), 7.38 (t, *J* = 7.7 Hz, 2H), 7.28 (d, *J* = 7.7 Hz, 1H), 7.06 (d, *J* = 7.4 Hz, 1H), 6.90 (t, *J* = 7.5 Hz, 1H), 6.85 (d, *J* = 7.8 Hz, 1H), 3.87 (d, *J* = 14.5 Hz, 1H), 3.68 (d, *J* = 14.5 Hz, 1H), 3.16 (s, 3H), 1.39 (s, 3H). ^{13}C NMR (100MHz, $CDCl_3$) δ 177.6, 143.3, 140.0, 133.3, 129.5, 128.9, 128.6, 127.8, 124.1, 122.5, 108.4, 61.9, 45.6, 26.5, 25.4. The NMR spectra data are consistent with previously reported[S2].



6x

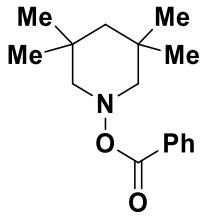
1,3-dimethyl-3-(2-oxo-4-phenylbutyl)indolin-2-one (6x): 12.9 mg, 42% yield. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.29 – 7.21 (m, 3 H), 7.18 – 7.15 (m, 1 H), 7.09 (d, *J* = 6.1 Hz, 1H), 7.04-6.99 (m, 3 H), 6.87 (d, *J* = 7.8 Hz, 1H), 3.27 (s, 3H), 3.17 – 2.94 (m, 2H), 2.72 (t, *J* = 7.6 Hz, 2H), 2.65 – 2.50 (m, 2H), 1.33 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 205.9, 180.2, 143.7, 140.7, 133.4, 128.4, 128.1, 127.9, 126.0, 122.2, 121.8, 108.2, 49.9, 45.2, 44.3, 29.4, 26.4, 24.4. The NMR spectra data are consistent with previously reported[S25].



***D*-6a** **6a**

1,3-dimethyl-3-(2-oxo-2-phenylethyl)indolin-2-one-4,5,6,7-d4 (*D5*-6a) and 1,3-dimethyl-3-(2-oxo-2-phenylethyl)indolin-2-one (6a): 14.3 mg, 51% yield. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.84 – 7.82 (m, 2H), 7.51 (t, *J* = 7.4 Hz, 1H), 7.39 (t, *J* = 7.7 Hz, 2H), 7.25 (td, *J* = 7.7 and 1.2 Hz, 0.68 H), 7.14 (dd, *J* = 7.3 and 0.6 Hz, 0.51 H), 6.97 (td, *J* = 8.2 and 0.8 Hz, 0.54 H), 6.89 (d, *J* = 7.8 Hz,

0.52 H), 3.68 (q, *J* = 17.9 Hz, 2.2 H), 3.31 (s, 3H), 1.44 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 196.1, 180.5, 143.8, 143.77, 136.4, 133.7, 133.6, 133.1, 128.4, 127.9, 127.8, 122.1, 121.8, 108.1, 46.01, 45.28, 45.27, 26.44, 26.43, 24.9. The NMR spectra data are consistent with previously reported[S17].



Tempo-benzoyl 8

3,3,5,5-tetramethylpiperidin-1-yl benzoate (8): 32.9 mg, 63% yield. Light yellow solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.07 (d, *J* = 8.3 Hz, 2H), 7.57 (t, *J* = 7.4 Hz, 1H), 7.46 (t, *J* = 7.6 Hz, 2H), 1.82 – 1.68 (m, 4H), 1.60-1.57 (m, 2H), 1.49-1.45 (m, 1H), 1.28 (s, 6H), 1.12 (s, 6H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 166.3, 132.8, 129.8, 129.5, 128.4, 60.4, 39.1, 32.0, 20.8, 17.0. The NMR spectra data are consistent with previously reported[S25].

2). General procedure for phenylsulfinyl radical cyclization reactions

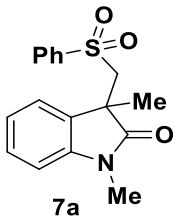
Condition A:

N-methyl-*N*-phenylmethacrylamide **5a** (0.1 mmol, 1.0 equiv), Sodium benzenesulfinate (0.2 mmol, 2.0 equiv), $K_2S_2O_8$ (0.2 mmol, 2.0 equiv) and Eosin Y disodium salt (0.005 mmol, 0.05 equiv) were added into schlenk tubes, followed by the addition of MeOH/H_2O (2.0 mL, 4/1, v/v), the resulting mixture were then exposed to a 23 W white fluorescent lamp (LEDs) under nitrogen atmosphere for corresponding hours until the starting materials *N*-methyl-*N*-phenylmethacrylamide totally consumed or left maintain without change (A fan is used to cool down the reaction temperature). The reaction mixture was filtrated and the filtrate was extracted with dichloromethane (5.0 mL×3), the combined organic phase was dried over anhydrous Na_2SO_4. The solvent was removed by rotary evaporation, the residual was purified by silica gel column chromatography (petroleum ether/ethyl acetate) to afford

desired 3-methyl-3-(methylsulfonyl)benzene-2-oxindoles **7**.

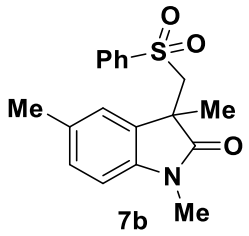
Condition B:

N-methyl-*N*-phenylmethacrylamide **5a** (0.1 mmol, 1.0 equiv), Sodium benzenesulfinate (0.2 mmol, 2.0 equiv), $K_2S_2O_8$ (0.2 mmol, 2.0 equiv) and 2-chlorothioxanthone (0.02 mmol, 0.2 equiv) were added into schlenk tubes, followed by the addition of MeOH/H_2O (2.0 mL, 4/1, v/v), the resulting mixture were then exposed to a 23 W purple fluorescent lamp (LEDs) under nitrogen atmosphere for corresponding hours until the starting materials *N*-methyl-*N*-phenylmethacrylamide totally consumed or left maintain without change (A fan is used to cool down the reaction temperature). The reaction mixture was filtrated and the filtrate was extracted with dichloromethane (5.0 mL×3), the combined organic phase was dried over anhydrous Na_2SO_4. The solvent was removed by rotary evaporation, the residual was purified by silica gel column chromatography (petroleum ether/ethyl acetate) to afford desired 3-methyl-3-(methylsulfonyl)benzene-2-oxindoles **7**.



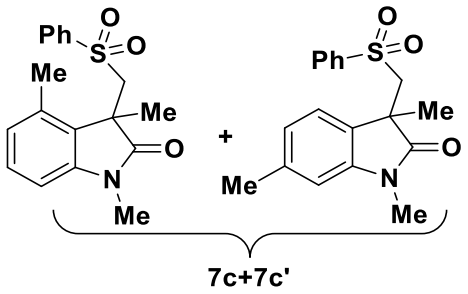
7a

1,3-dimethyl-3-((phenylsulfonyl)methyl)indolin-2-one (7a): 28.4 mg, 90% yield, condition A; 29.0 mg, 92% yield, condition B. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.56 – 7.50 (m, 3H), 7.38 (t, *J* = 7.8 Hz, 2H), 7.31 – 7.27 (m, 1H), 7.07 (d, *J* = 8.4 Hz, 1H), 6.91 (td, *J* = 7.6 and 0.8 Hz, 1H), 6.85 (d, *J* = 7.8 Hz, 1H), 3.88 (d, *J* = 14.5 Hz, 1H), 3.68 (d, *J* = 14.5 Hz, 1H), 3.17 (s, 3H), 1.40 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 177.6, 143.3, 140.0, 133.3, 129.5, 128.9, 128.6, 127.8, 124.1, 122.5, 108.4, 61.9, 45.6, 26.6, 25.5. The NMR spectra data are consistent with previously reported [S9].



7b

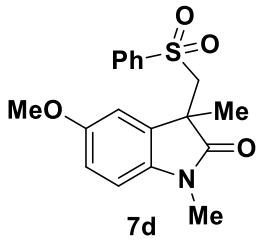
1,3,5-trimethyl-3-((phenylsulfonyl)methyl)indolin-2-one (7b): 31.6 mg, 96% yield, condition A; 30.3 mg, 92% yield, condition B. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.51 (t, *J* = 7.4 Hz, 1H), 7.42 (d, *J* = 7.3 Hz, 2H), 7.33 (t, *J* = 7.7 Hz, 2H), 7.03 (d, *J* = 7.9 Hz, 1H), 6.72 (d, *J* = 7.9 Hz, 1H), 6.64 (s, 1H), 3.88 (dd, *J* = 14.7 Hz, 1H), 3.67 (d, *J* = 14.7 Hz, 1H), 3.17 (s, 3H), 2.13 (s, 3H), 1.34 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 177.5, 141.0, 140.0, 133.0, 131.8, 129.3, 128.9, 128.6, 127.7, 124.7, 108.1, 61.9, 45.5, 26.5, 25.4, 20.8. The NMR spectra data are consistent with previously reported [S9].



7c+7c'

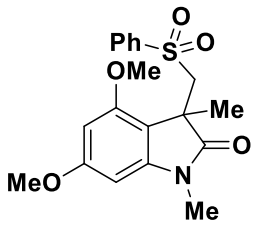
1,3,4-trimethyl-3-((phenylsulfonyl)methyl)indolin-2-one and

1,3,5-trimethyl-3-((phenylsulfonyl)methyl)indolin-2-one (7c+7c'): 32.6 mg, 99% yield, condition A; 30. 6 mg, 93% yield, condition B. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.56 – 7.52 (m, 4.04 H), 7.44 (d, *J* = 8.5 Hz, 2.72 H), 7.40-7.34 (q, *J* = 8.4 Hz, 4.66 H), 7.20 (t, *J* = 7.8 Hz, 1.55 H), 6.95 (d, *J* = 7.6 Hz, 1H), 6.72 – 6.66 (m, 4.65 H), 3.98 (d, *J* = 14.7 Hz, 1.91 H), 3.86 – 3.81 (m, 2.87 H), 3.66 (d, *J* = 14.5 Hz, 1.41 H), 3.15 (s, 2.8 H), 3.13 (s, 4.32 H), 2.38 (s, 2.96 H), 2.08 (s, 4.55 H), 1.40 (s, 4.39 H), 1.37 (s, 3.07 H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 177.9, 177.6, 143.7, 143.3, 140.1, 139.5, 138.8, 135.4, 133.4, 133.3, 128.8, 128.7, 128.6, 128.1, 127.8, 126.60, 126.59, 125.0, 123.8, 123.1, 109.3, 106.1, 62.0, 60.9, 45.9, 45.4, 26.6, 26.5, 25.4, 23.2, 21.8, 18.2. The NMR spectra data are consistent with previously reported [S9].



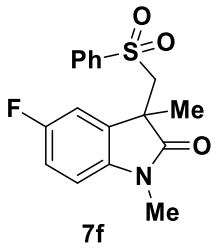
7d

5-methoxy-1,3-dimethyl-3-((phenylsulfonyl)methyl)indolin-2-one (7d): 28.7 mg, 83% yield, condition A; 21.8 mg, 63% yield, condition B. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.52 (t, *J* = 2.3 Hz, 1H), 7.48 – 7.46 (m, 2H), 7.36 (t, *J* = 7.7 Hz, 2H), 6.80 – 6.73 (m, 2H), 6.56 (d, *J* = 2.3 Hz, 1H), 3.86 (d, *J* = 14.6 Hz, 1H), 3.66 (d, *J* = 14.6 Hz, 1H), 3.65 (s, 3H), 3.15 (s, 3H), 1.37 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 177.2, 155.8, 140.0, 136.8, 133.2, 130.6, 128.7, 127.8, 113.3, 111.1, 108.7, 61.8, 55.5, 46.0, 26.6, 25.3. The NMR spectra data are consistent with previously reported [S9].



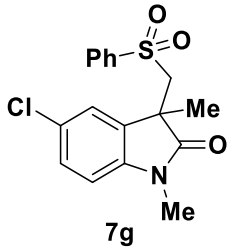
7e

4,6-dimethoxy-1,3-dimethyl-3-((phenylsulfonyl)methyl)indolin-2-one (7e): 24.8 mg, 66%yield, condition A; 15.8 mg, 42 % yield, condition B. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.51 – 7.46 (m, 1H), 7.40 – 7.38 (m, 2H), 7.34 – 7.39 (m, 2H), 6.10 (d, *J* = 2.0 Hz, 1H), 5.75 (d, *J* = 1.8 Hz, 1H), 4.01 (d, *J* = 14.5 Hz, 1H), 3.82 (s, 3H), 3.81(d, *J* = 14.5 Hz, 1H), 3.41 (s, 3H), 3.17 (s, 3H), 1.34 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 178.5, 162.2, 156.6, 145.3, 139.9, 132.7, 128.3, 127.9, 107.3, 92.0, 88.4, 60.6, 55.6, 54.8, 44.8, 26.8, 23.0. HRMS(EI) Calcd for $C_{19}H_{21}NO_5S$ $[M + H]^+$: 376.1219, Found 376.1211; IR (KBr) ν (cm^{-1}): 2930, 2850, 1719, 1690, 1622, 1499, 1450, 1353, 1258, 690.



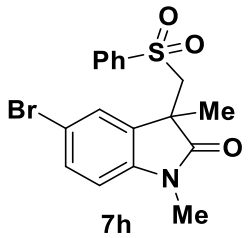
7f

5-fluoro-1,3-dimethyl-3-((phenylsulfonyl)methyl)indolin-2-one (7f): 32.1 mg, 96% yield, condition A; 20.7 mg, 62% yield, condition B. Colorless viscous oil; 1H NMR (400 MHz, $CDCl_3$) δ 7.58 – 7.52 (m, 3H), 7.41 (t, J = 8.1 Hz, 2 H), 6.97 (td, J = 14.7 Hz, 1H), 6.79 – 6.74 (m, 2H), 3.86 (d, J = 14.6 Hz, 1H), 3.65 (d, J = 14.7 Hz, 1H), 3.18 (s, 3H), 1.38 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 177.3, 159.0 (d, J_{C-F} = 239.8 Hz), 139.9, 139. (d, J_{C-F} = 2.0 Hz), 133.5, 131.1 (d, J_{C-F} = 8.2 Hz), 128.9, 127.7, 115.0 (d, J_{C-F} = 23.4 Hz), 112.3 (d, J_{C-F} = 24.9 Hz), 108.8 (d, J_{C-F} = 8.1 Hz), 61.6, 46.0, 26.7, 25.2. ^{19}F NMR (376 MHz, $CDCl_3$) δ -120.63. The NMR spectra data are consistent with previously reported [S9].



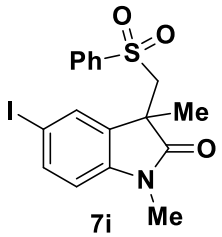
7g

5-chloro-1,3-dimethyl-3-((phenylsulfonyl)methyl)indolin-2-one (7g): 27.7 mg, 79% yield, condition A; 16.5 mg, 47% yield, condition B. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.57 (t, J = 7.4 Hz, 1H), 7.48 – 7.46(m, 2H), 7.39 (t, J = 7.8 Hz, 2H), 7.22 (dd, J = 8.3 and 2.1 Hz, 1H), 6.82 (d, J = 1.9 Hz, 1H), 6.78 (d, J = 8.3 Hz, 1H), 3.88 (d, J = 14.7 Hz, 1H), 3.66 (d, J = 14.7 Hz, 1H), 3.20 (s, 3H), 1.36 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 177.1, 142.0, 139.7, 133.6, 131.0, 128.9, 128.6, 127.8, 127.6, 124.5, 109.3, 61.7, 45.7, 26.7, 25.2. The NMR spectra data are consistent with previously reported [S9].



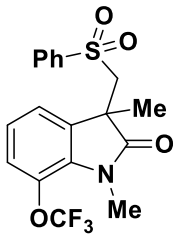
7h

5-bromo-1,3-dimethyl-3-((phenylsulfonyl)methyl)indolin-2-one (7h): 21.0 mg, 53% yield, condition A; 34.4 mg, 87% yield, condition B. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.58 (t, *J* = 7.3 Hz, 1H), 7.45 (dd, *J* = 8.5 and 1.3 Hz, 2H), 7.43 – 7.32 (m, 3H), 6.92 (d, *J* = 1.9 Hz, 1H), 6.73 (d, *J* = 8.3 Hz, 1H), 3.88 (d, *J* = 14.7 Hz, 1H), 3.66 (d, *J* = 14.7 Hz, 1H), 3.20 (s, 3H), 1.35 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 177.0, 142.5, 139.7, 133.7, 131.5, 131.4, 128.9, 127.5, 127.1, 115.1, 109.8, 61.7, 45.7, 26.7, 25.2. The NMR spectra data are consistent with previously reported [S9].



7i

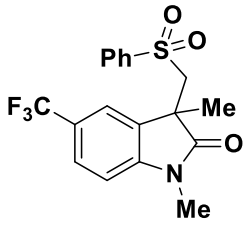
5-iodo-1,3-dimethyl-3-((phenylsulfonyl)methyl)indolin-2-one (7i): 14.1 mg, 32% yield, condition A; 26.5 mg, 60% yield, condition B. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.60 (t, *J* = 7.2 Hz, 1H), 7.54 (dd, *J* = 8.1 and 1.5 Hz, 1H), 7.44-7.37 (m, 4H), 7.04 (s, 1H), 6.64 (d, *J* = 8.2 Hz, 1H), 3.87 (d, *J* = 14.8 Hz, 1H), 3.65 (d, *J* = 14.8 Hz, 1H), 3.20 (s, 3H), 1.34 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 176.9, 143.3, 139.7, 137.4, 133.8, 132.6, 128.9, 127.5, 110.4, 85.1, 61.7, 45.5, 26.6, 25.2. The NMR spectra data are consistent with previously reported [S24].



7j

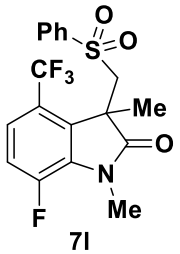
1,3-dimethyl-3-((phenylsulfonyl)methyl)-7-(trifluoromethoxy)indolin-2-one (7j): 20.0 mg, 50% yield, condition A; 32 mg, 80% yield, condition B. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.57 – 7.53 (m, 3H), 7.40 (td, *J* = 7.2 and 2.1 Hz,

2H), 7.15 (dt, J = 8.4 and 1.4 Hz, 1H), 6.97 (dd, J = 7.4 and 0.9 Hz, 1H), 6.86 (dd, J = 8.3 and 7.5 Hz, 1H), 3.89 (d, J = 14.6 Hz, 1H), 3.68 (d, J = 14.6 Hz, 1H), 3.38 (s, 3H), 1.39 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 177.5, 139.8, 135.0, 133.5, 133.2 (q, J_{C-F} = 2.1 Hz), 132.5, 129.0, 127.7, 122.8, 122.6, 122.1 (d, J_{C-F} = 0.9 Hz), 120.6 (q, J_{C-F} = 257.1 Hz), 61.8, 45.5, 29.1, 25.7. ^{19}F NMR (376 MHz, $CDCl_3$) δ -57.41. HRMS(EI) Calcd for $C_{18}H_{16}F_3NO_4S$ $[M + H]^+$: 400.0830, Found 400.0820; IR (KBr) ν(cm^{-1}): 2985, 2970, 1729, 1624, 1484, 1371, 1182, 874.



7k

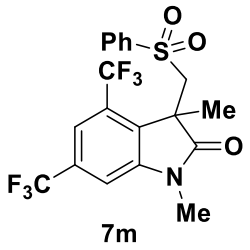
1,3-dimethyl-3-((phenylsulfonyl)methyl)-5-(trifluoromethyl)indolin-2-one (7k): 34.9 mg, 91% yield, condition A; 25.3 mg, 66% yield, condition B. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.53 (t, J = 7.9 Hz, 2H), 7.45 (d, J = 8.5 Hz, 2H), 7.36 (t, J = 7.8 Hz, 2H), 7.12 (s, 1H), 6.94 (d, J = 8.2 Hz, 1H), 3.93 (d, J = 14.7 Hz, 1H), 3.74 (d, J = 14.8 Hz, 1H), 3.26 (s, 3H), 1.40 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 177.6, 146.4 (d, J_{C-F} = 1.2 Hz), 139.8, 133.7, 129.9, 129.34, 129.00, 127.86, 127.41, 125.15, 124.83, 124.50, 124.18, 122.67, 120.94, 120.91, 120.87, 120.83, 119.51, 108.3, 61.8, 45.5, 26.8, 25.2. ^{19}F NMR (376 MHz, $CDCl_3$) δ -61.28. The NMR spectra data are consistent with previously reported [S9].



7l

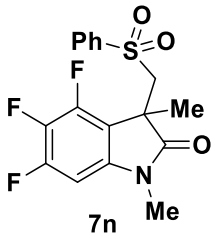
7-fluoro-1,3-dimethyl-3-((phenylsulfonyl)methyl)-4-(trifluoromethyl)indolin-2-one (7l): 11.7 mg, 29% yield, condition A; 22.1 mg, 55% yield, condition B. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.61 – 7.56 (m, 3H), 7.44 (t, J = 7.8 Hz, 2H), 7.19 (d, J = 7.3 Hz, 2H), 3.88 (d, J = 2.0 Hz, 2H), 3.49 (d, J = 3.6 Hz, 3H), 1.47

(s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 177.1, 151.08-151.05 (m), 148.60-148.56 (m), 139.6, 133.7, 132.4-132.2 (m), 130.05-130.00 (m), 129.1, 127.8, 124.5 (d, J_{C-F} = 20.3 Hz), 121.6-121.3 (m), 117.3 (d, J_{C-F} = 20.3 Hz), 62.1, 46.8, 29.5, 23.8. ^{19}F NMR (376 MHz, $CDCl_3$) δ -57.45, -129.69. HRMS(EI) Calcd for $C_{18}H_{15}F_4NO_3S$ $[M + H]^+$: 402.0787, Found 402.0781; IR (KBr) (cm^{-1}): 3054, 2944, 1731, 1624, 1467, 1353, 1101, 1086, 907, 831.



7m

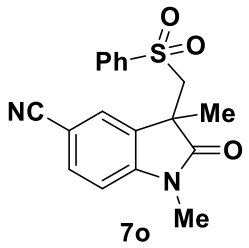
1,3-dimethyl-3-((phenylsulfonyl)methyl)-4,6-bis(trifluoromethyl)indolin-2-one(7m): 40.7 mg, 90% yield, condition A; 35.7 mg, 79% yield, condition B. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.60 – 7.53 (m, 3H), 7.44 – 7.40 (m, 3H), 7.30 (s, 1H), 3.91 (s, 2H), 3.34 (s, 3H), 1.49 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 177.0, 146.2, 139.4, 133.8, 132.2 (q, J_{C-F} = 33.5 Hz), 130.57-130.45 (m), 129.1, 128.3 (q, J_{C-F} = 33.9 Hz), 127.7, 123.1 (q, J_{C-F} = 271.9 Hz), 117.4- 117.2 (m), 108.4 (q, J_{C-F} = 3.1 Hz), 61.9, 46.5, 27.3, 23.5. ^{19}F NMR (376 MHz, $CDCl_3$) δ -58.37, -63.04. The NMR spectra data are consistent with previously reported [S26].



7n

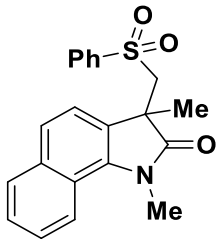
4,5,6-trifluoro-1,3-dimethyl-3-((phenylsulfonyl)methyl)indolin-2-one (7n): trace, condition A; 14.4 mg, 39% yield, condition B. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.63 – 7.57 (m, 3H), 7.45 (t, J = 7.8 Hz, 2H), 6.53 (ddd, J = 9.4, 5.2 and 1.6 Hz, 1H), 3.85 (q, J = 3.6 Hz, 1H), 3.20 (s, 3H), 1.43 (s, 3H). ^{13}C NMR (100 MHz, CDCl3) δ 176.7, 139.3, 133.8, 129.0, 127.6, 111.8 (dd, J_{C-F} = 15 and 5.1 Hz), 94.2 (ddd, J_{C-F} = 234.5, 3.4 and 1.4 Hz), 44.9, 29.7, 27.1, 23.6. ^{19}F NMR (376 MHz, $CDCl_3$) δ -132.40, -139.23, -169.22. HRMS(EI) Calcd for $C_{17}H_{14}F_3NO_3S$ $[M + H]^+$:

370.0725, Found 370.0701; IR (KBr) ν(cm^{-1}): 2974, 1727, 1627, 1499, 1320, 1155, 1062, 876, 745.



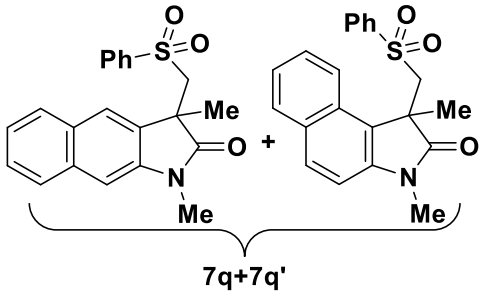
7o

1,3-dimethyl-2-oxo-3-((phenylsulfonyl)methyl)indoline-5-carbonitrile (7o): 19.7 mg, 58% yield, condition A; 13.6 mg, 40% yield, condition B. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.65-7.58 (m, 2H), 7.51 (d, *J* = 8.3 Hz, 2H), 7.43 (t, *J* = 7.2 Hz, 2H), 7.13 (s, 1H), 6.94 (d, *J* = 8.1 Hz, 1H), 3.90 (d, *J* = 15.7 Hz, 1H), 3.71 (d, *J* = 14.7 Hz, 1H), 3.27 (s, 3H), 1.39 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 177.5, 147.3, 139.7, 133.9, 133.8, 130.5, 129.2, 127.4, 127.3, 118.7, 108.9, 105.7, 61.5, 45.3, 26.9, 25.1. The NMR spectra data are consistent with previously reported [S9].

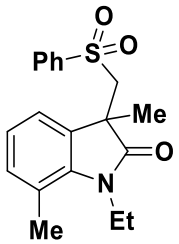


7p

1,3-dimethyl-3-((phenylsulfonyl)methyl)-1,3-dihydro-2H-benzo[g]indol-2-one(7p): 24.5 mg, 67% yield, condition A; 21.2 mg, 58% yield, condition B. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.67 (dd, *J* = 8.1 and 0.9 Hz, 1H), 7.52 (dd, *J* = 8.3 and 0.8 Hz, 1H), 7.48-7.43 (m, 2H), 7.39-7.37 (dd, *J* = 8.4 and 1.2 Hz, 2H), 7.31 – 7.27 (m, 2H), 7.24 – 7.20 (m, 1H), 6.98 (dd, *J* = 7.5 and 0.8 Hz, 1H), 4.64 (d, *J* = 14.5 Hz, 1H), 3.91 (d, *J* = 14.5 Hz, 1H), 3.52 (s, 3H), 1.65 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.8, 140.6, 136.4, 133.5, 133.4, 133.0, 128.6, 127.7, 126.8, 126.6, 126.5, 123.7, 122.7, 119.2, 65.9, 45.7, 33.7, 30.0. The NMR spectra data are consistent with previously reported [S9].



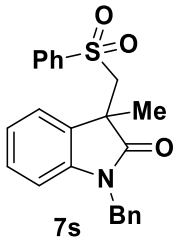
1,3-dimethyl-3-((phenylsulfonyl)methyl)-1,3-dihydro-2H-benzo[f]indol-2-one and **1,3-dimethyl-1-((phenylsulfonyl)methyl)-1,3-dihydro-2H-benzo[e]indol-2-one(7q +7q')**: 7.7 mg, 21% yield, condition A; 22.3 mg, 61% yield, condition B. Colorless viscous oil; 1H NMR (400 MHz, $CDCl_3$) δ 7.83 (d, *J* = 8.6 Hz, 1.02H), 7.78 (d, *J* = 8.2 Hz, 0.49 H), 7.72 – 7.65 (m, 1.07 H), 7.53 (d, *J* = 8.1 Hz, 0.47 H), 7.47 (td, *J* = 7.1 and 1.1Hz, 0.49 H), 7.40 (dd, *J* = 8.2 and 0.7 Hz, 1H), 7.34-7.31 (m, 1.94 H), 7.23 – 7.19 (m, 2.69H), 7.17-7.16 (m, 0.32 H), 7.14 – 7.10 (m, 3.43H), 6.92 (t, *J* = 7.9 Hz, 2.01H), 4.14 (d, *J* = 1.0 Hz, 2.13 H), 3.97 (d, *J* = 14.7 Hz, 0.51H), 3.78 (d, *J* = 14.7 Hz, 0.49 H), 3.36 (s, 3.00 H), 3.31 (s, 0.96 H), 1.57 (s, 3.23H), 1.47 (s, 1.13H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 178.8, **177.2 // 176.1,** 141.6, 140.1, 138.7, 133.9, 133.2, 132.6, 130.3, 130.2, 129.7, 129.4, 128.6, 128.2, 128.1, 127.6, 127.4, 127.2, 127.0, 126.8, 124.2, 123.8, 123.3, 121.1, 120.9, 109.7, 104.1, 62.3, 62.1, 46.6, 45.2, 26.9, 26.8, 25.8, 24.5. The NMR spectra data are consistent with previously reported [S9].



7r

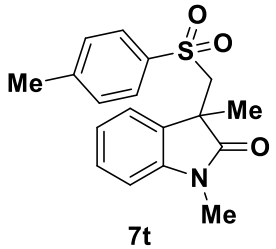
1-ethyl-3,7-dimethyl-3-((phenylsulfonyl)methyl)indolin-2-one (7r): trace, condition A; 24.7 mg, 72% yield, condition B. Colorless viscous oil; ^1H NMR (400 MHz, $CDCl_3$) δ 7.54 – 7.52 (m, 3H), 7.38 (t, *J* = 7.6 Hz, 2H), 6.99 (d, *J* = 7.6 Hz, 1H), 6.84 (d, *J* = 7.3 Hz, 1H), 6.75 (t, *J* = 7.5 Hz, 1H), 4.05 – 3.95 (m, 1H), 3.94 – 3.88 (m, 1H), 3.88 (d, *J* = 14.4 Hz, 1H), 3.65 (d, *J* = 14.5 Hz, 1H), 2.55 (s, 3H), 1.34 – 1.31 (m, 6H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 178.3, 140.4, 140.2, 133.2, 132.4, 130.5, 128.9,

127.7, 122.2, 121.8, 119.5, 62.0, 44.9, 36.8, 26.1, 18.9, 14.5. HRMS(EI) Calcd for $C_{19}H_{21}NO_3S$ $[M + H]^+$: 344.1320, Found 344.1311; IR (KBr) ν(cm^{-1}): 2925, 1706, 1603, 1447, 1352, 1216, 1141, 1084, 745.



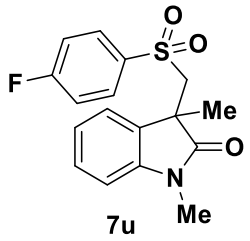
7s

1-benzyl-3-methyl-3-((phenylsulfonyl)methyl)indolin-2-one **(7s)**: 30.2 mg, 77% yield, condition A; 18.8 mg, 48% yield, condition B. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.56-7.52 (m, 3H), 7.40-7.36 (dd, *J* = 8.5 and 7.1 Hz, 3H), 7.33 (t, *J* = 7.3 Hz, 2H), 7.28-7.24 (m, 1H), 7.13 (td, *J* = 7.8 and 1.2 Hz, 1H), 7.03 (dd, *J* = 7.4 and 0.6 Hz, 1H), 6.83 (td, *J* = 7.6 and 0.9 Hz, 1H), 6.71 (d, *J* = 7.8 Hz, 1H), 5.00 (d, *J* = 15.8 Hz, 1H), 4.79 (d, *J* = 15.8 Hz, 1H), 3.93 (d, *J* = 14.5 Hz, 1H), 3.74 (d, *J* = 14.5 Hz, 1H), 1.46 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 177.8, 142.4, 140.2, 135.8, 133.3, 129.6, 128.9, 128.8, 128.5, 127.8, 127.6, 127.3, 124.0, 122.5, 109.6, 61.7, 45.8, 44.3, 26.0. The NMR spectra data are consistent with previously reported [S27].



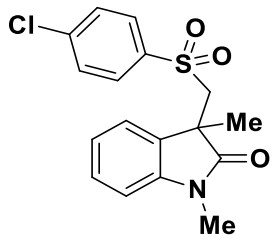
7t

1,3-dimethyl-3-(tosylmethyl)indolin-2-one (7t): 13.8 mg, 42% yield, condition A; 30.6 mg, 93% yield, condition B. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.38 (d, *J* = 8.3 Hz, 1H), 7.30 – 7.26 (m, 2H), 7.16 (d, *J* = 8.5 Hz, 2H), 7.09 (d, *J* = 6.8 Hz, 1H), 6.92 (td, *J* = 7.6 and 0.9 Hz, 1H), 6.84 (d, *J* = 7.8 Hz, 1H), 3.84 (d, *J* = 14.5 Hz, 1H), 3.65 (d, *J* = 14.5 Hz, 1H), 3.15 (s, 3H), 2.39 (s, 3H), 1.38 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 177.6, 144.3, 143.2, 137.1, 129.5, 128.5, 127.8, 124.1, 122.4, 108.3, 61.9, 45.6, 26.5, 25.5, 21.5. The NMR spectra data are consistent with previously reported [S28].



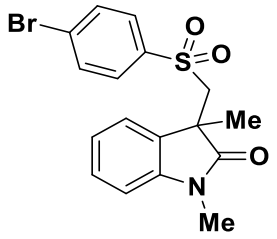
7u

3-(((4-fluorophenyl)sulfonyl)methyl)-1,3-dimethylindolin-2-one (7u): 25.0 mg, 75% yield, condition A; 29.3 mg, 88% yield, condition B. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.49 – 7.46 (m, 2 H), 7.29 (td, *J* = 7.7 and 1.3 Hz, 1H), 7.03 (t, *J* = 8.6 Hz, 3H), 6.92 (td, *J* = 7.6 and 0.9 Hz, 1H), 6.85 (d, *J* = 7.8 Hz, 1H), 3.89 (d, *J* = 14.6 Hz, 1H), 3.67 (d, *J* = 14.6 Hz, 1H), 3.17 (s, 3H), 1.38 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 177.5, 165.5 (d, J_{C-F} = 254.8 Hz), 143.3, 136.0 (d, J_{C-F} = 3.1 Hz), 130.7 (d, J_{C-F} = 9.6 Hz), 129.4, 128.7, 124.0, 122.5, 116.1 (d, J_{C-F} = 22.6 Hz), 108.4, 62.0, 45.6, 26.5, 25.5. ^{19}F NMR (376 MHz, $CDCl_3$) δ -103.88. The NMR spectra data are consistent with previously reported [S26].



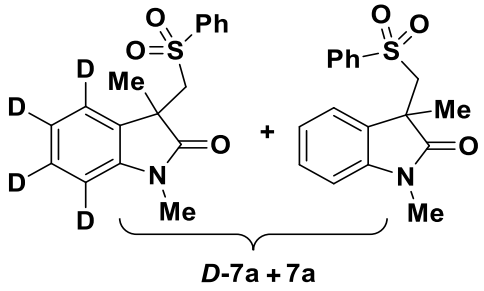
7v

3-(((4-chlorophenyl)sulfonyl)methyl)-1,3-dimethylindolin-2-one (7v): 7.4 mg, 21% yield, condition A; 34.3 mg, 98% yield, condition B. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.38 (d, *J* = 8.8 Hz, 2H), 7.37-7.27 (m, 3H), 7.00 (d, *J* = 7.9 Hz, 1H), 6.91 (t, *J* = 7.5 Hz, 1H), 6.84 (d, *J* = 7.8 Hz, 1H), 3.89 (d, *J* = 14.6 Hz, 1H), 3.67 (d, *J* = 14.6 Hz, 1H), 3.16 (s, 3H), 1.38 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 177.4, 143.3, 140.1, 138.3, 129.29, 129.26, 129.1, 128.7, 123.9, 122.5, 108.4, 62.0, 45.5, 26.5, 25.5. The NMR spectra data are consistent with previously reported [S9].



7w

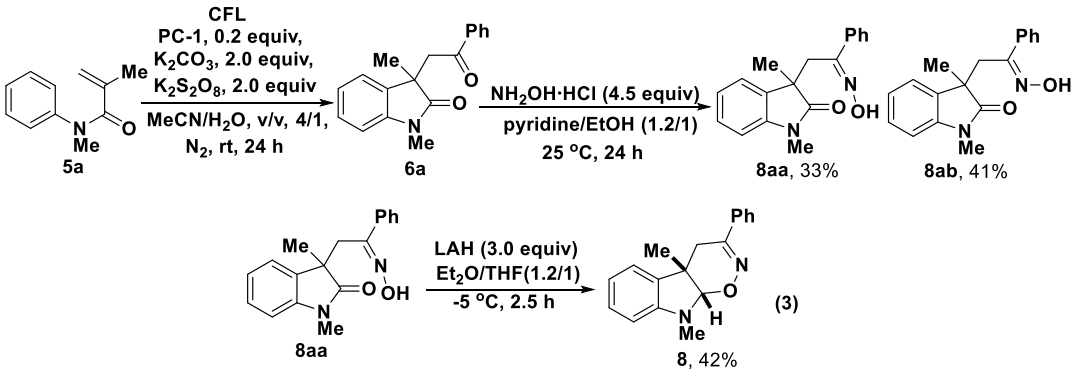
3-(((4-bromophenyl)sulfonyl)methyl)-1,3-dimethylindolin-2-one (7w): 30.8 mg, 78% yield, condition A; 37.5 mg, 95% yield, condition B. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.49 (d, *J* = 8.7 Hz, 2 H), 7.31 – 7.27 (m, 3H), 7.00 (d, *J* = 7.4 Hz, 1H), 6.91 (t, *J* = 7.5 Hz, 1H), 6.84 (d, *J* = 7.8 Hz, 1H), 3.89 (d, *J* = 14.6 Hz, 1H), 3.67 (d, *J* = 14.6 Hz, 1H), 3.16 (s, 3H), 1.37 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 177.4, 143.3, 138.7, 132.1, 129.3, 129.2, 128.7, 128.7, 123.9, 122.5, 108.4, 61.9, 45.5, 26.5, 25.5. The NMR spectra data are consistent with previously reported [S26].



D-7a + 7a

1,3-dimethyl-3-((phenylsulfonyl)methyl)indolin-2-one-4,5,6,7-d4 (D-7a) and 1,3-dimethyl-3-((phenylsulfonyl)methyl)indolin-2-one (7a): 16.5 mg, 52% yield. Colorless viscous oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.55 – 7.49 (m, 3H), 7.37 (td, *J* = 7.6 and 1.8 Hz, 2H), 7.27 (td, *J* = 7.8 and 1.2 Hz, 1 H), 7.05 (dd, 7.4 and 0.55 H), 6.90 (td, *J* = 7.6 and 0.9 Hz, 0.58 H), 6.84 (d, *J* = 7.8 Hz, 0.57 H), 3.87 (d, *J* = 14.6 Hz, 1.33 H), 3.68 (d, *J* = 14.6 Hz, 1.25 H), 3.16 (s, 3H), 1.39 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 177.6, 143.3, 140.0, 133.3, 129.5, 129.1, 128.9, 128.6, 127.7, 108.4, 61.8, 45.60, 45.59, 26.53, 26.52, 25.4. The NMR spectra data are consistent with previously reported [S17].

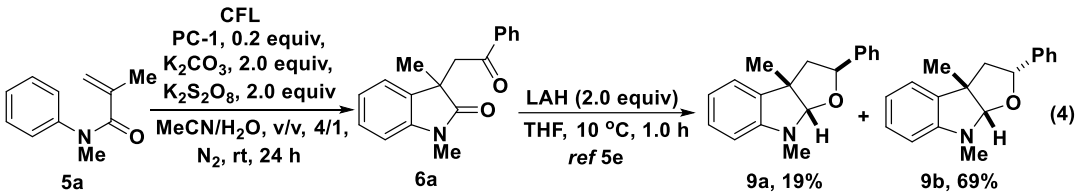
3) Synthesis of indole alkaloid derivatives



(a) To a solution of **6a** (72 mg, 0.256 mmol) in pyridine (3 mL) and EtOH (2.5 mL) was added $NH_2OH·HCl$ (104 mg, 1.50 mmol) and the reaction mixture was stirred at 10 °C for 24 hours. After the completion of **6a**, the reaction was quenched with water (10 mL) in room temperature and extracted with ethyl acetate for three times. The combined extracts were washed with 1 N HCl and dried over Na_2SO_4. After concentration under reduced pressure, the residue the residue was purified by column chromatography on silica gel with ethyl acetate/petroleum ether (1:5) to afford **8aa** (24.9 mg, 33%) and **8ab** (30.8 mg, 41%). A solution of **8aa** (17 mg, 0.058 mmol) in THF (0.72 mL) was added to the stirred solution of $LiAlH_4$ (6.6 mg, 0.174 mmol) at 10 °C in air. The reaction mixture was stirred at 10 °C for 2.0 h. Then quenched with water (10 mL) in the same temperature and extracted with ethyl acetate for three times. The combined organic layer was washed with brine, dried over Na_2SO_4 and concentrated under vacuum. The residue was purified by flash column chromatography on silica gel with ethyl acetate/petroleum ether (1:100) to afford the product **8** (6.8 mg, 42 %).

(4aS,9aS)-4a,9-dimethyl-3-phenyl-4,4a,9,9a-tetrahydro-[1,2]oxazino[6,5-b]indole (8): 6.8 mg, 42% yield. Colorless viscous oil. ^1H NMR (400 MHz, $CDCl_3$) δ 7.46 (d, *J* = 7.4 Hz, 2H), 7.37-7.28 (m, 3H), 7.04 – 6.99 (m, 2H), 6.59 (t, *J* = 7.4 Hz, 1H), 6.32 (d, *J* = 7.8 Hz, 1H), 5.24 (s, 1H), 3.06 (m, 4H), 2.65 (d, *J* = 14.2 Hz, 1H), 1.54 (s, 3H).^{13}C NMR (100 MHz, $CDCl_3$) δ 170.5, 150.2, 134.6, 132.9, 130.1, 128.5, 128.4, 126.1, 121.7, 117.3, 104.7, 100.9, 47.3, 33.6, 30.3, 26.8.

(**b**)



To a stirred solution of **6a** (56 mg, 0.2 mmol) in 2.0 mL of anhydrous THF was added $LiAlH_4$ (15.2 mg, 2.0 equiv) at 10 °C in one portion in air. The resulting mixture was stirred at 10 °C for 15 min. Then the reaction was quenched by the addition of 1.0 mL of ethyl acetate, and the resulting mixture was stirred at room temperature until the generation of gas ceased. The reaction mixture was filtered through a plug of Celite with ethyl acetate. Then the filtrate was extracted with ethyl acetate (5.0 mL×3), the combined organic layer was dried over anhydrous Na_2SO_4, and concentrated under vacuum. The residue was purified by flash column chromatography on silica gel with ethyl acetate/petroleum ether (1:100) to afford the product **9a** (10.1 mg, 19%) and **9b** (36.6 mg, 69%).

(2S,3aS,8aS)-3a,8-dimethyl-2-phenyl-3,3a,8,8a-tetrahydro-2H-furo[2,3-b]indole (9a): colorless oil; 10.1 mg, 19% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.27 – 7.26 (m, 4H), 7.22-7.20 (m, 1H), 7.10 (t, *J* = 7.6 Hz, 1H), 7.03 (d, *J* = 7.2 Hz, 1H), 6.67 (t, *J* = 7.4 Hz, 1H), 6.37 (d, *J* = 7.8 Hz, 1H), 5.24 (s, 1H), 4.69 – 4.56 (ddd, 11.2, 4.5 and 1.2Hz, 1H), 2.92 (d, *J* = 1.5 Hz, 3H), 2.44 (dd, *J* = 12.1 and 3.5 Hz, 1H), 1.99 – 1.92 (m, 1H), 1.46 (d, *J* = 1.4 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 150.7, 141.0, 134.5, 128.3, 128.2, 127.6, 126.1, 122.5, 117.3, 104.9, 104.8, 80.4, 53.1, 50.5, 30.9, 25.0.

(2R,3aS,8aS)-3a,8-dimethyl-2-phenyl-3,3a,8,8a-tetrahydro-2H-furo[2,3-b]indole (9b): colorless oil; 36.6 mg, 69% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.29 – 7.21 (m, 5H), 7.14 (t, *J* = 7.7 Hz, 1H), 7.04 (d, *J* = 7.2 Hz, 1H), 6.70 (t, *J* = 7.4 Hz, 1H), 6.47 (d, *J* = 7.7 Hz, 1H), 5.17 – 5.13 (m, 2H), 3.04 (d, *J* = 1.9 Hz, 3H), 2.50 (ddd, *J* = 12.5, 6.4 and 1.9 Hz, 1H), 2.18 (ddd, *J* = 12.2, 9.1 and 1.7 Hz, 10H), 1.51 (d, *J* = 1.9 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 148.8, 141.9, 135.6, 128.1, 128.0, 127.3, 126.0, 122.2, 117.6, 107.2, 106.0, 79.7, 52.5, 49.1, 31.8, 23.3.

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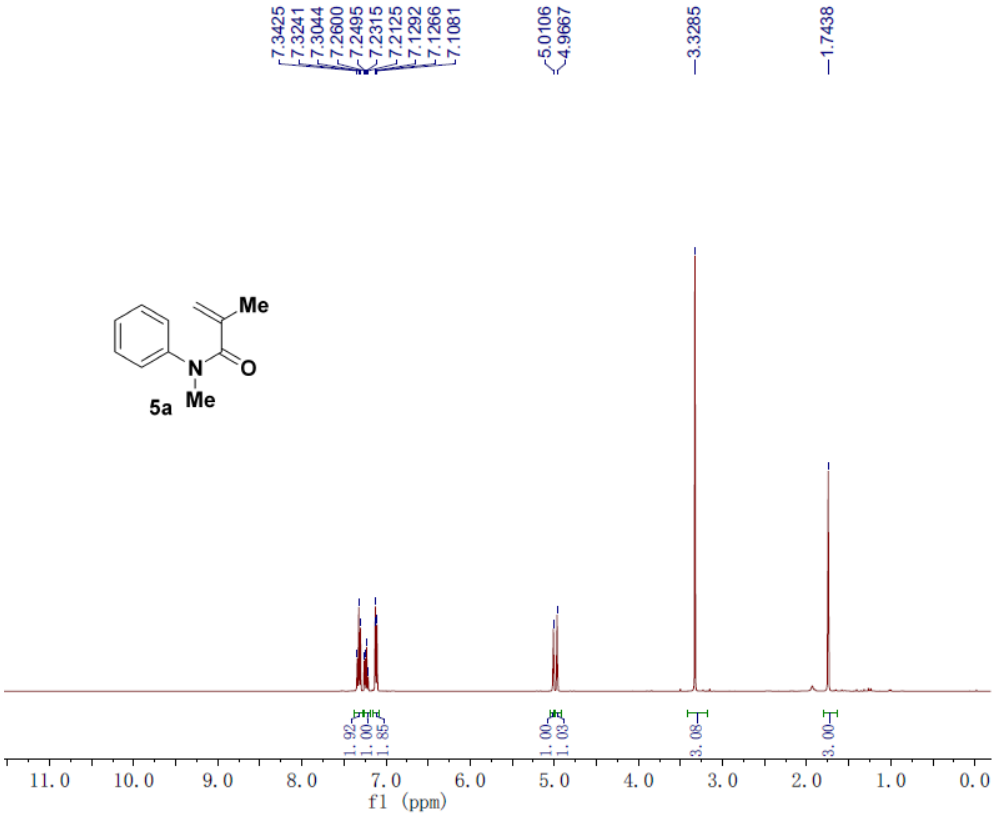
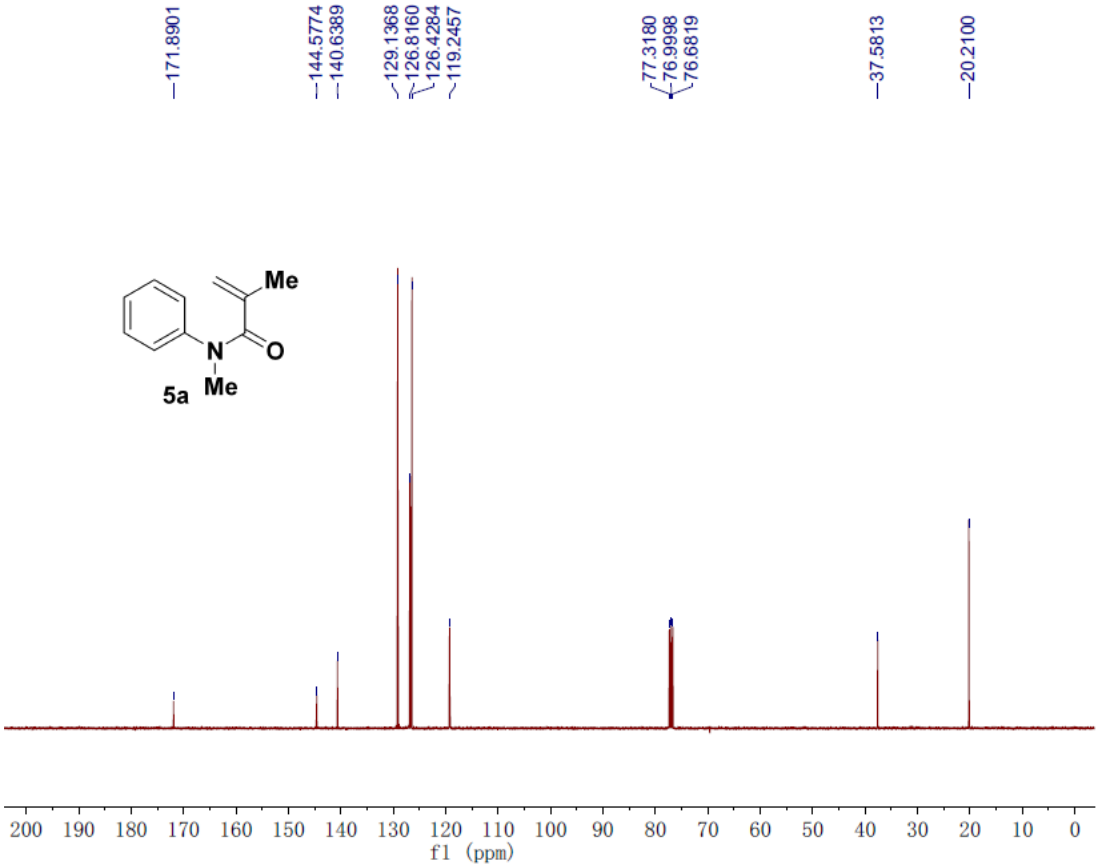
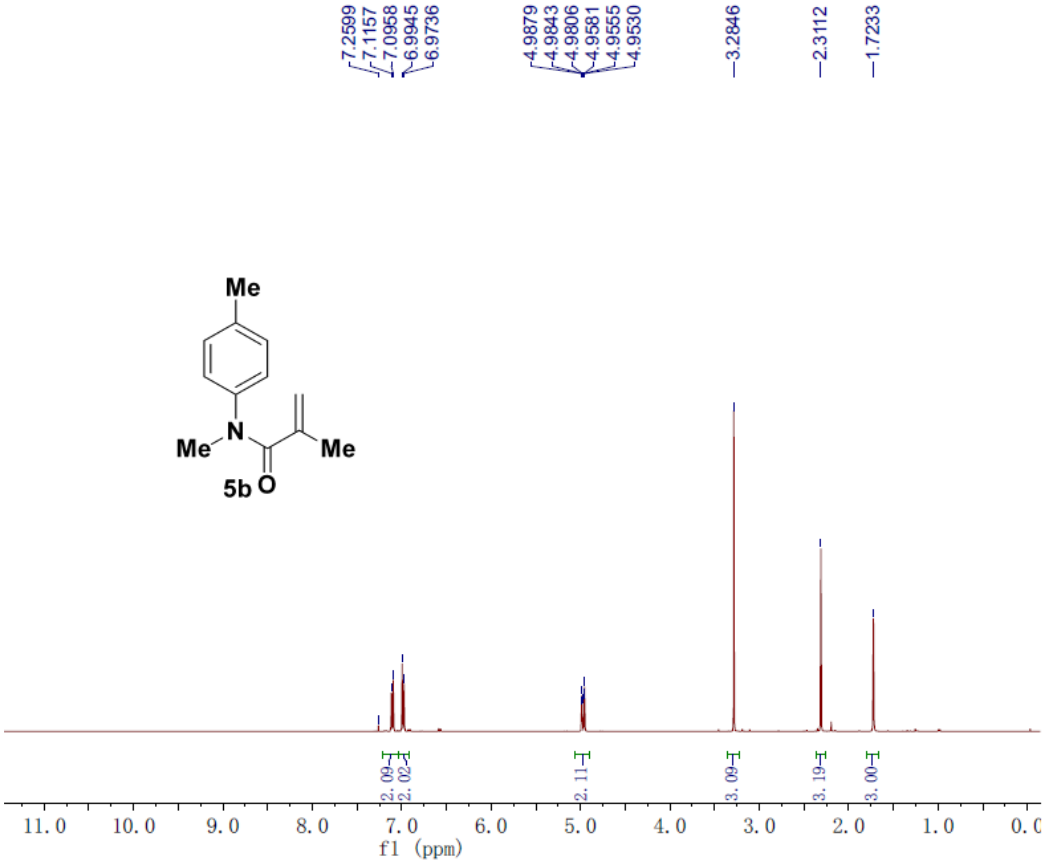
^{1}H NMR of **5a** (400 M, $CDCl_3$)



^{13}C NMR of **5a** (100 M, $CDCl_3$)



^{1}H NMR of **5b** (400 M, $CDCl_3$)



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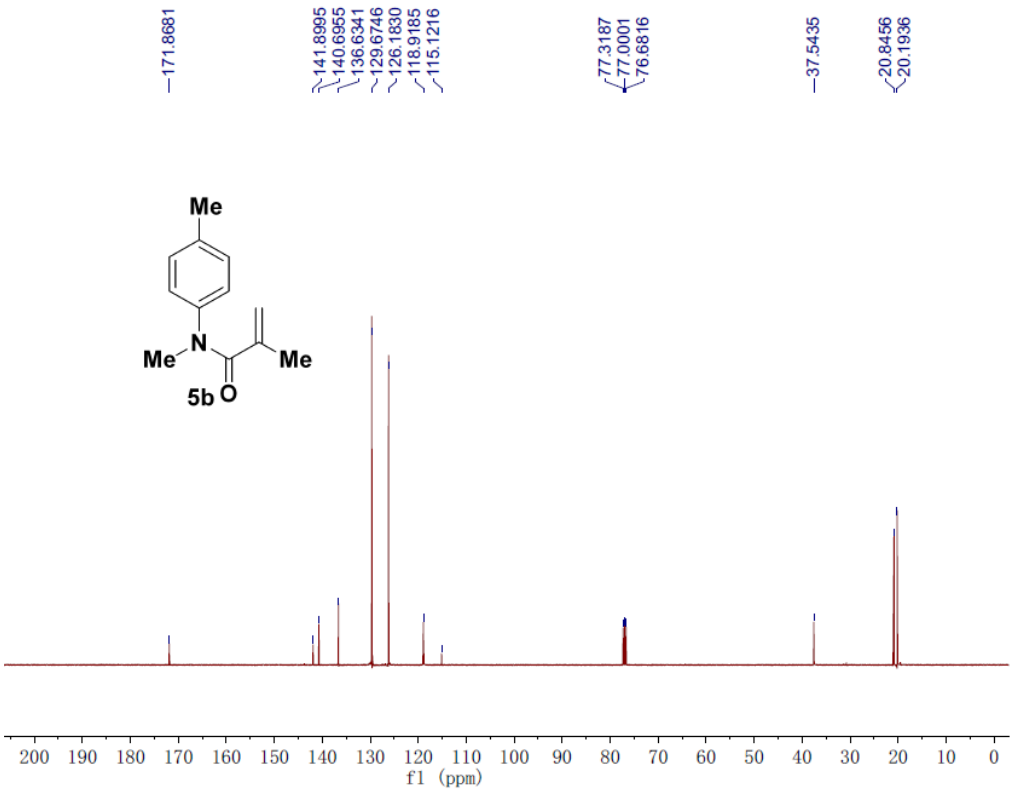

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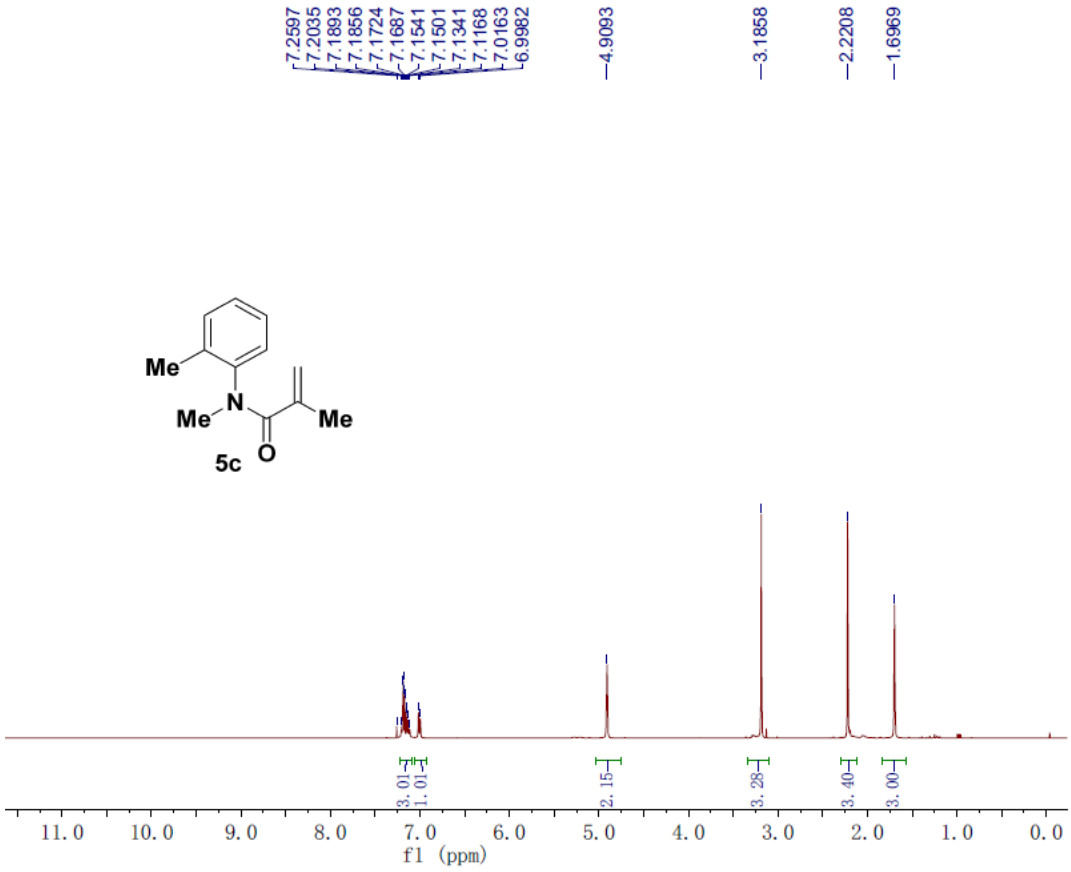
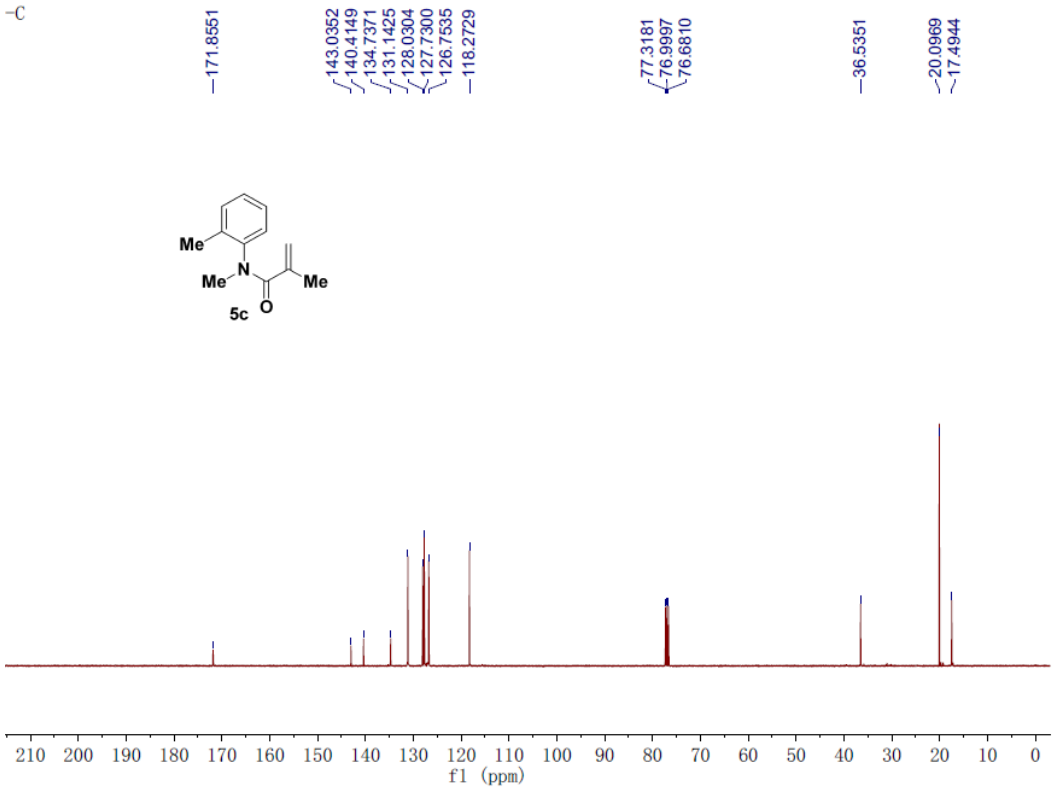
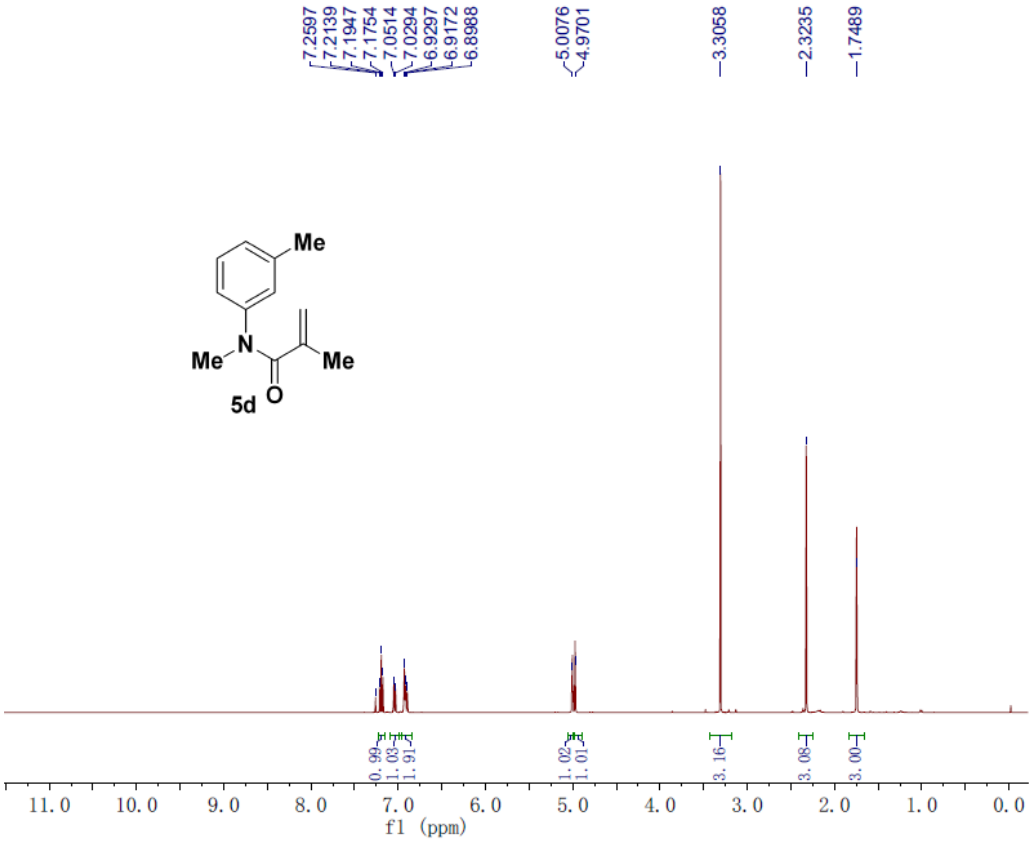


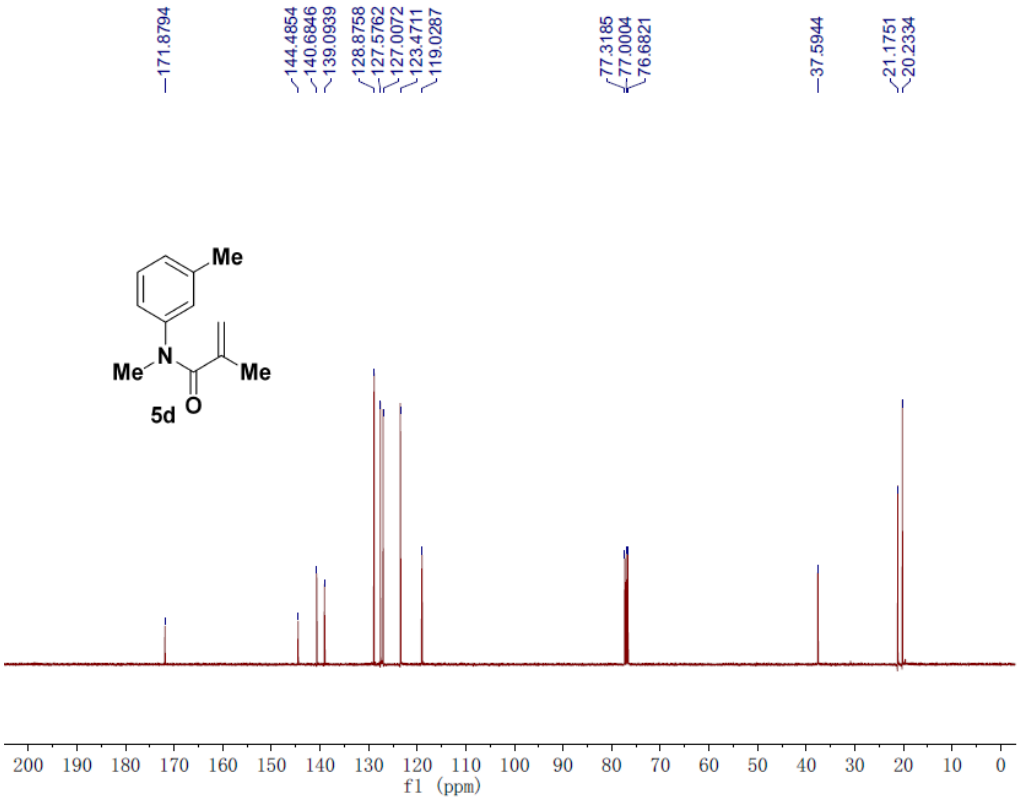
^{13}C NMR of **5c** (100 M, $CDCl_3$)



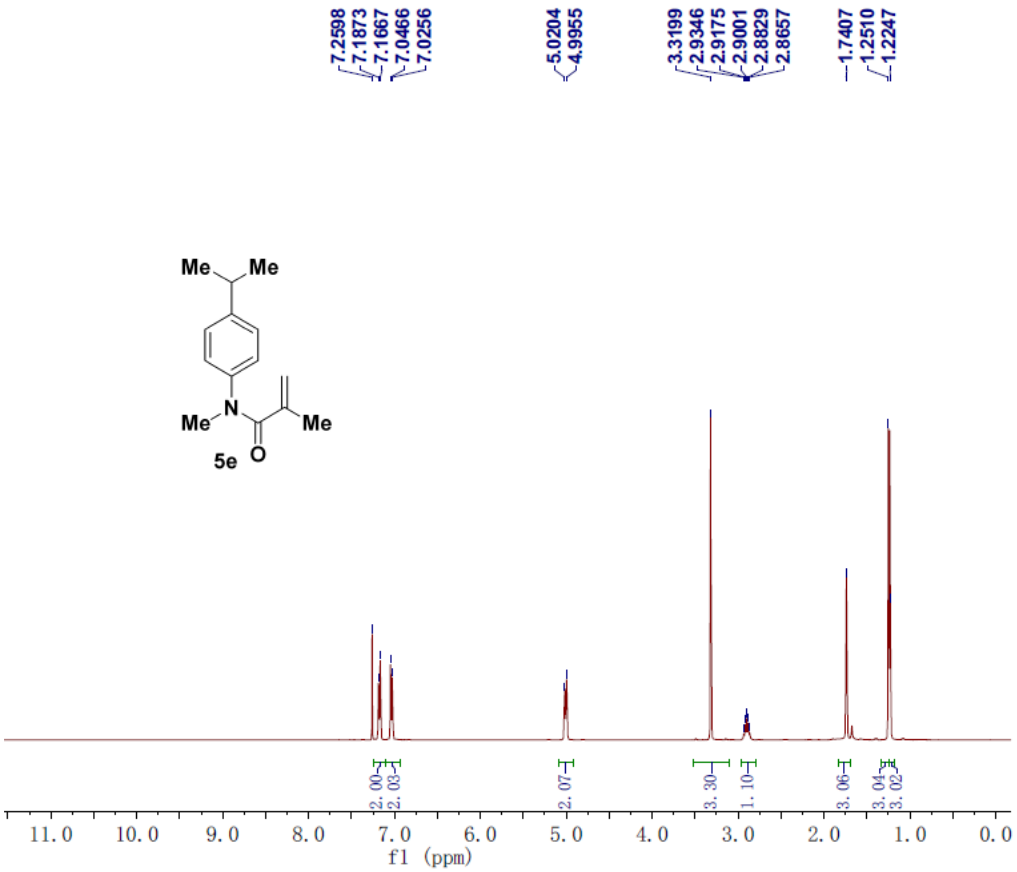
^{1}H NMR of **5d** (400 M, $CDCl_3$)



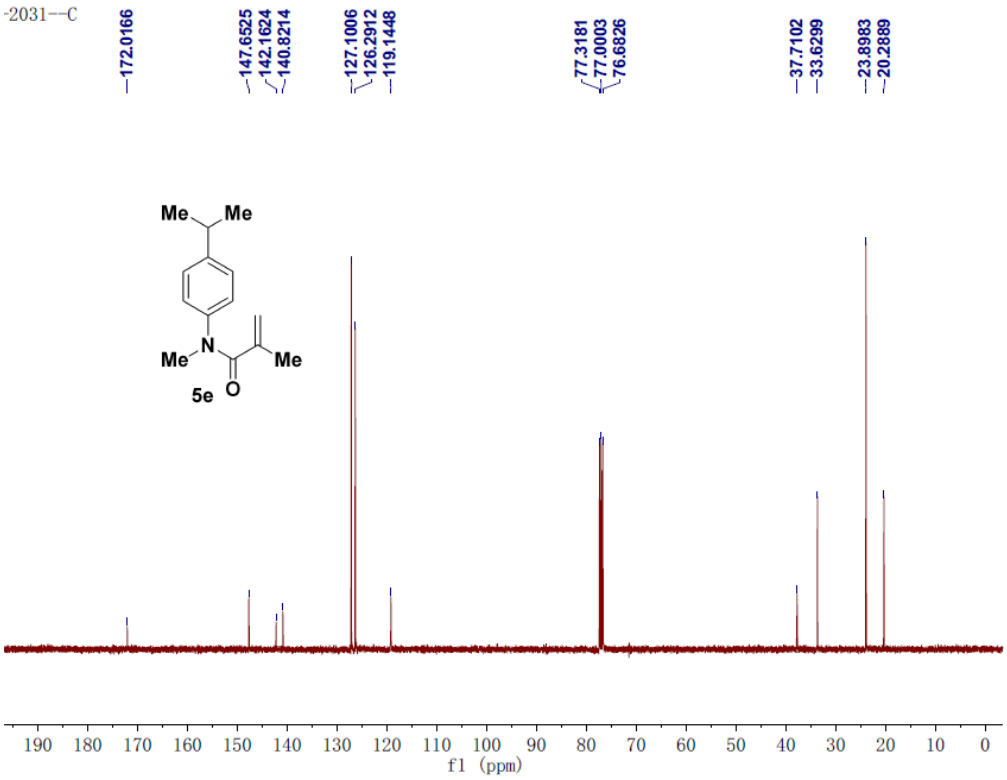
^{13}C NMR of **5d** (100 M, $CDCl_3$)



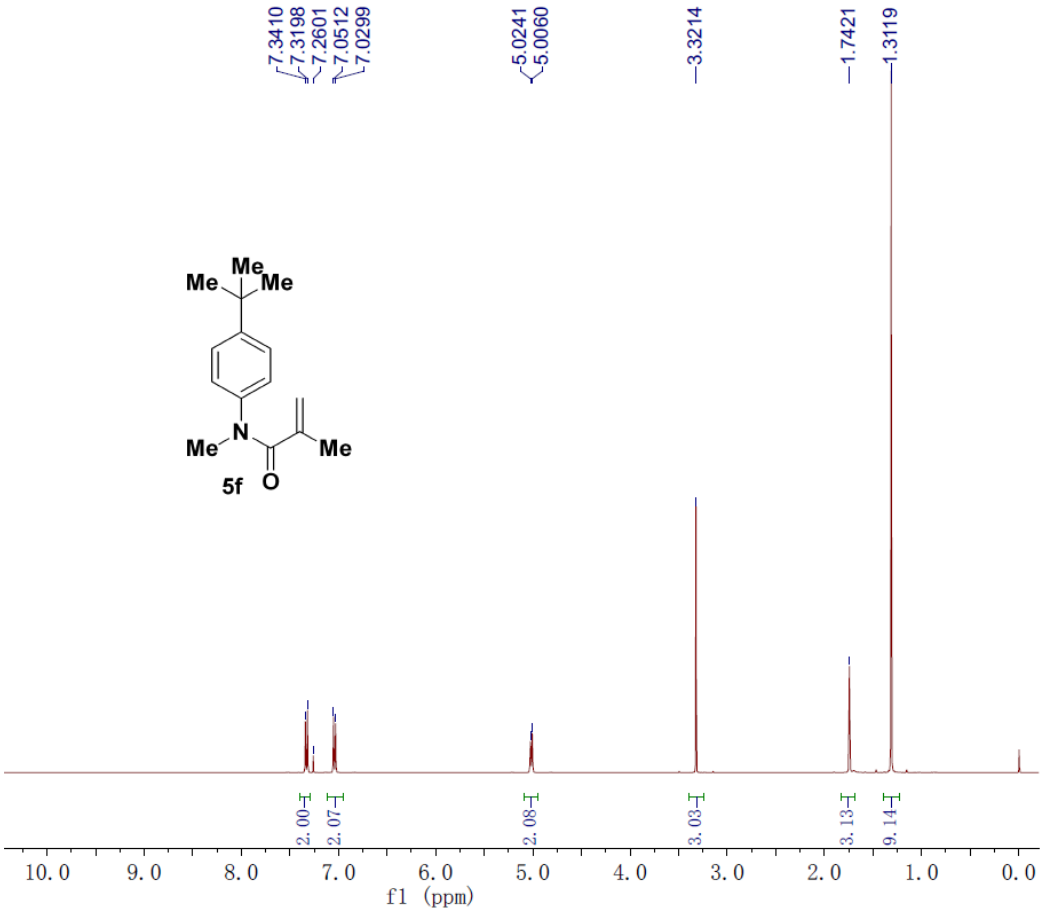
^{1}H NMR of **5e** (400 M, $CDCl_3$)



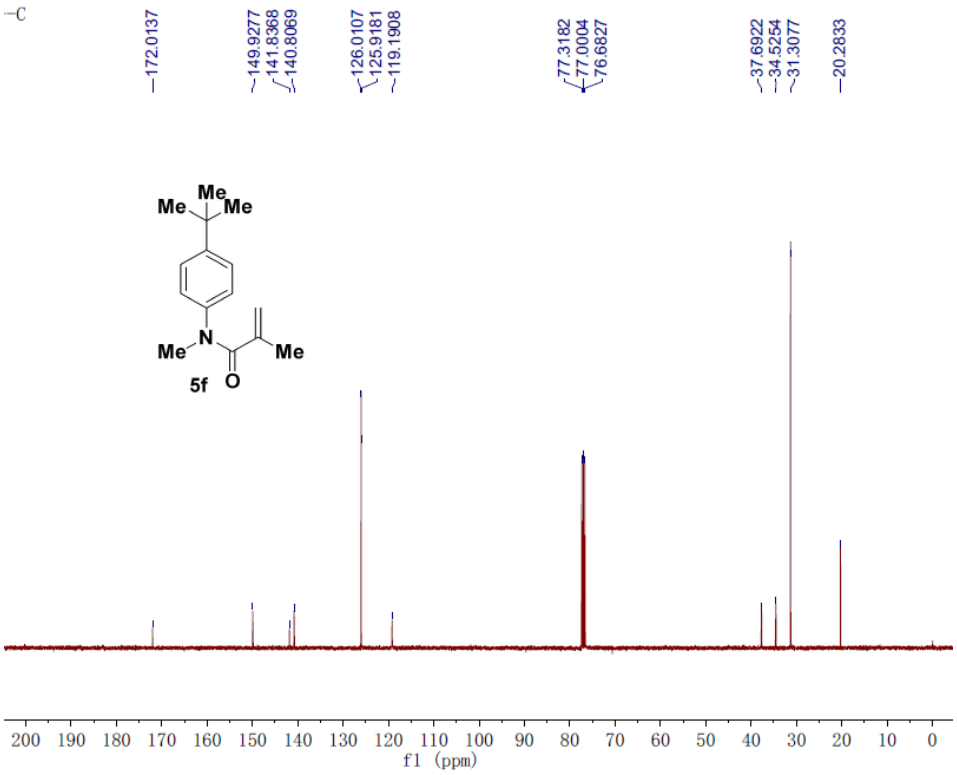
^{13}C NMR of **5e** (100 M, $CDCl_3$)



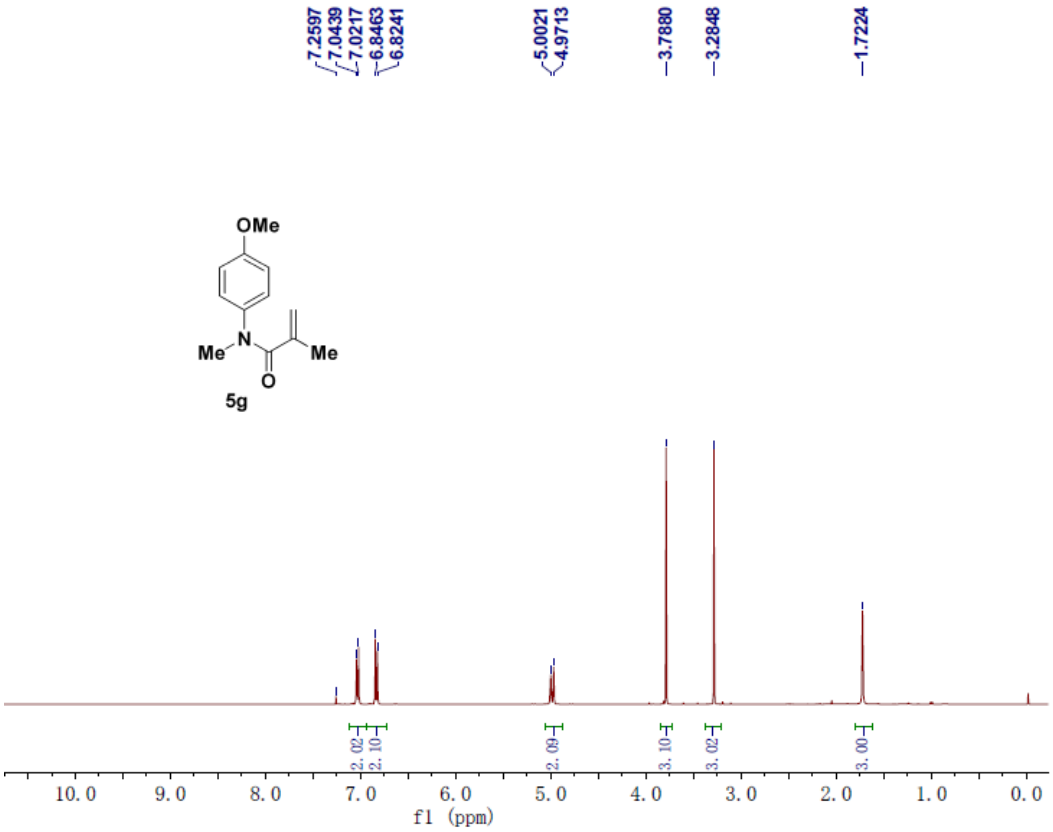
^{1}H NMR of **5f** (400 M, $CDCl_3$)



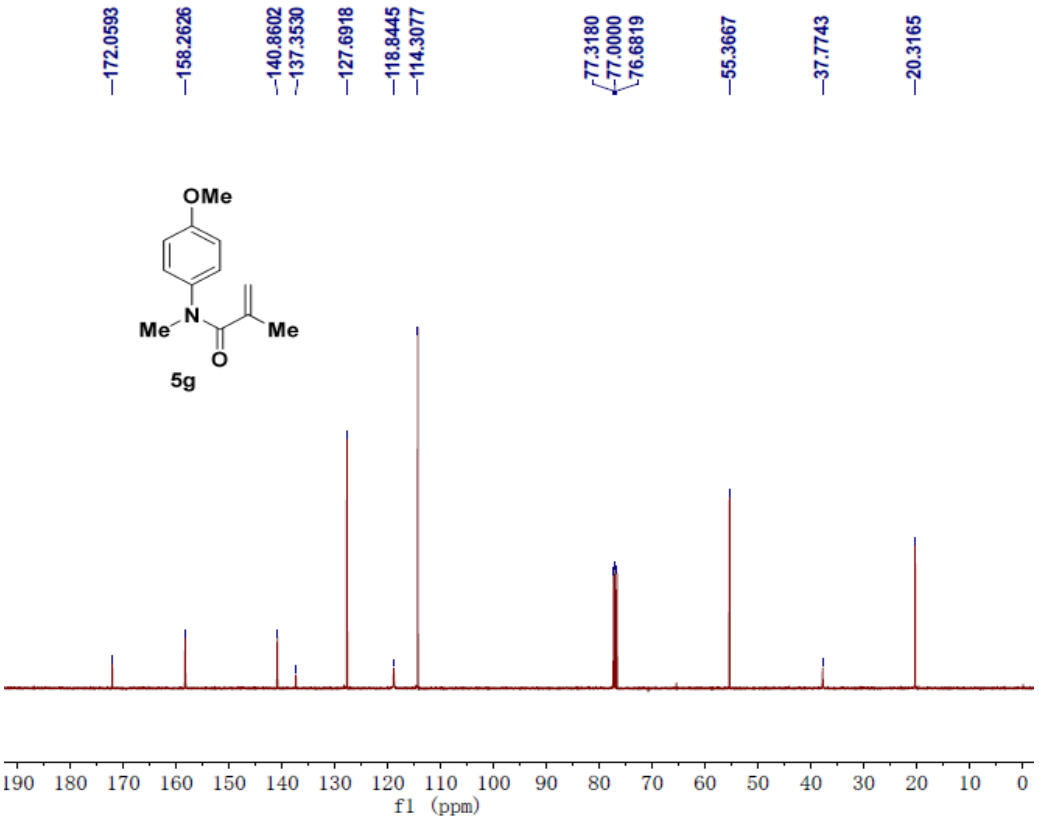
^{13}C NMR of **5f** (100 M, $CDCl_3$)



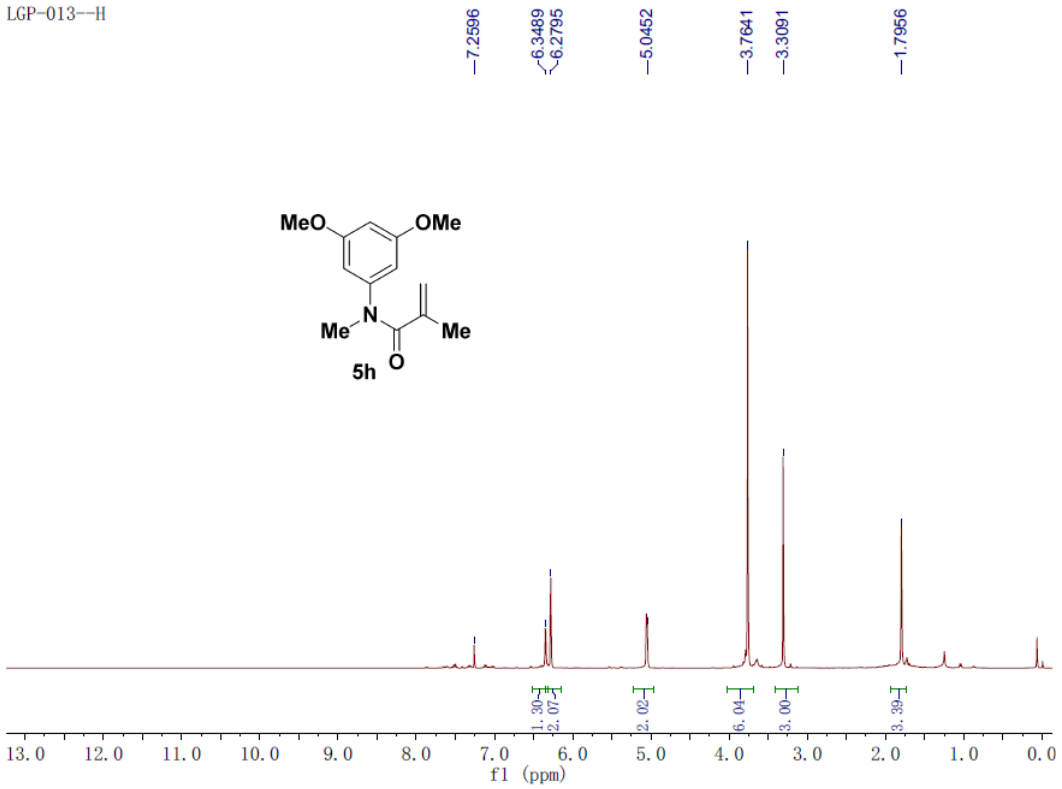
^{1}H NMR of **5g** (400 M, $CDCl_3$)



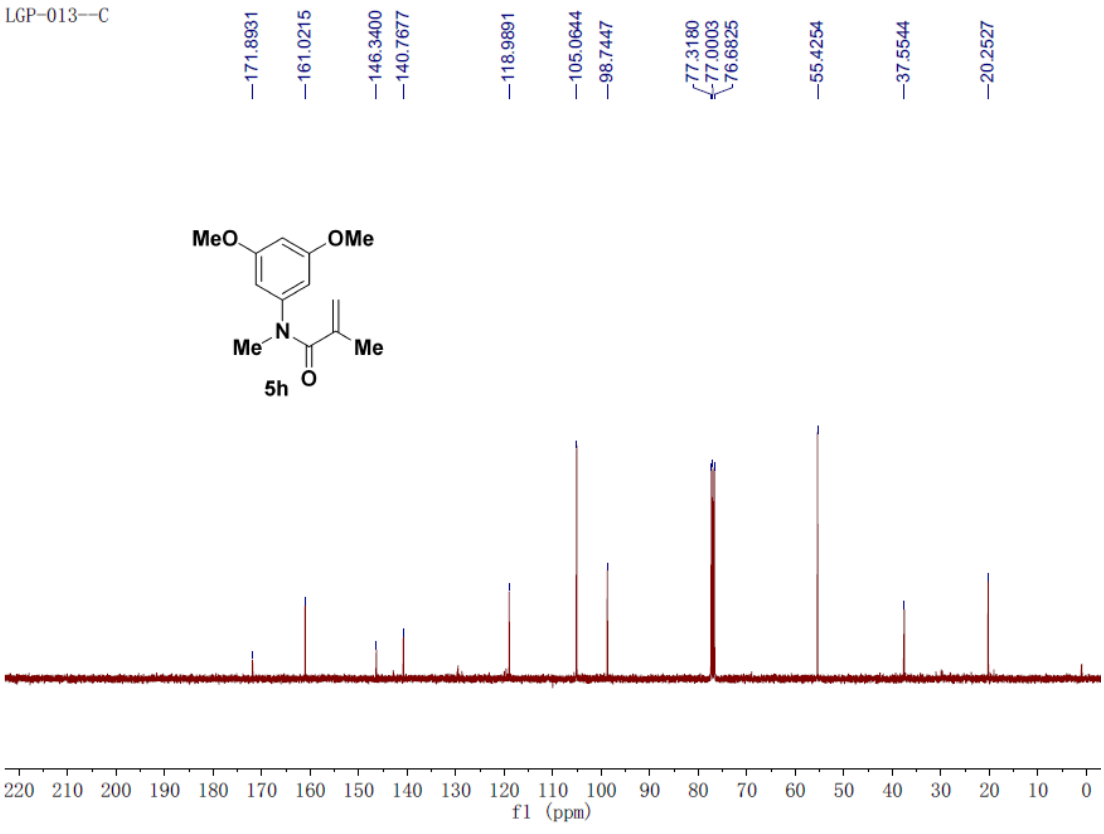
^{13}C NMR of **5g** (100 M, $CDCl_3$)



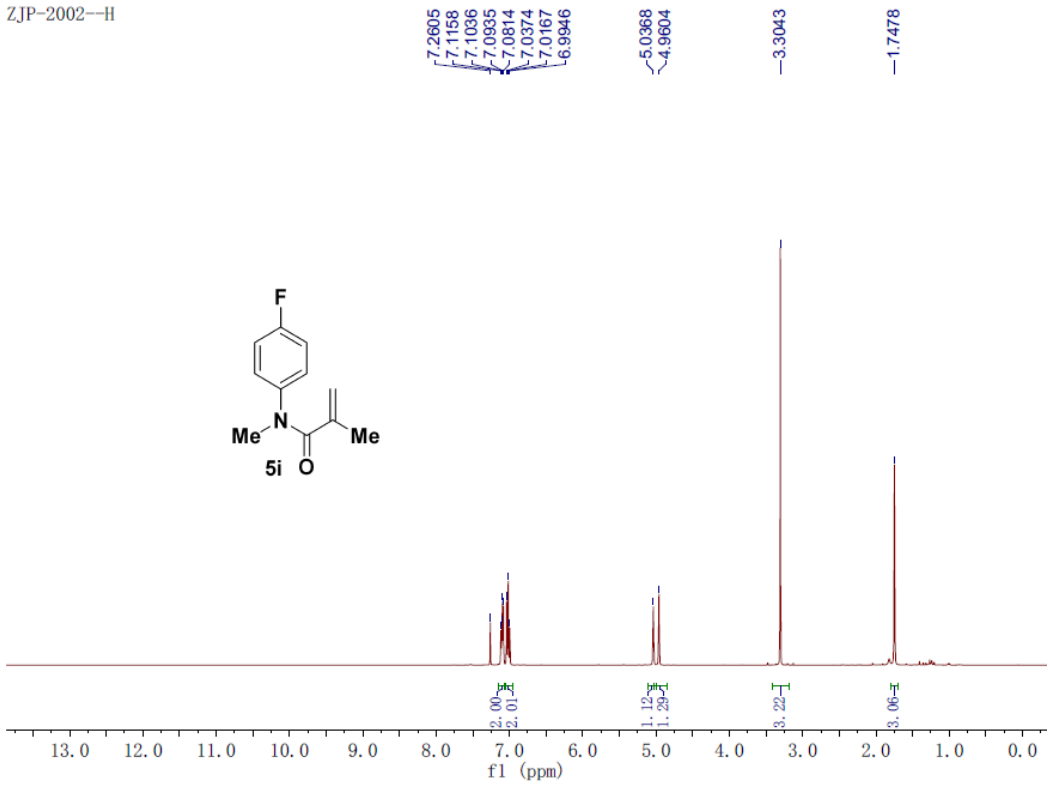
^{1}H NMR of **5h** (400 M, $CDCl_3$)



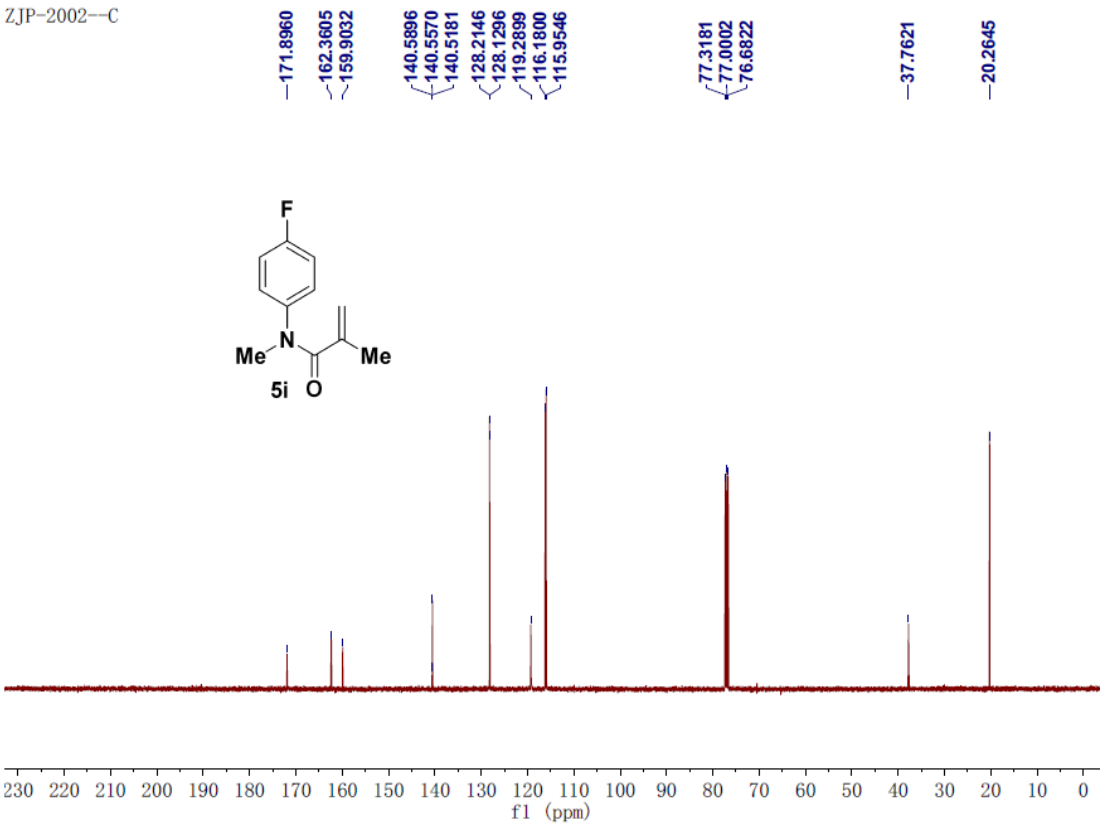
^{13}C NMR of **5h** (100 M, $CDCl_3$)



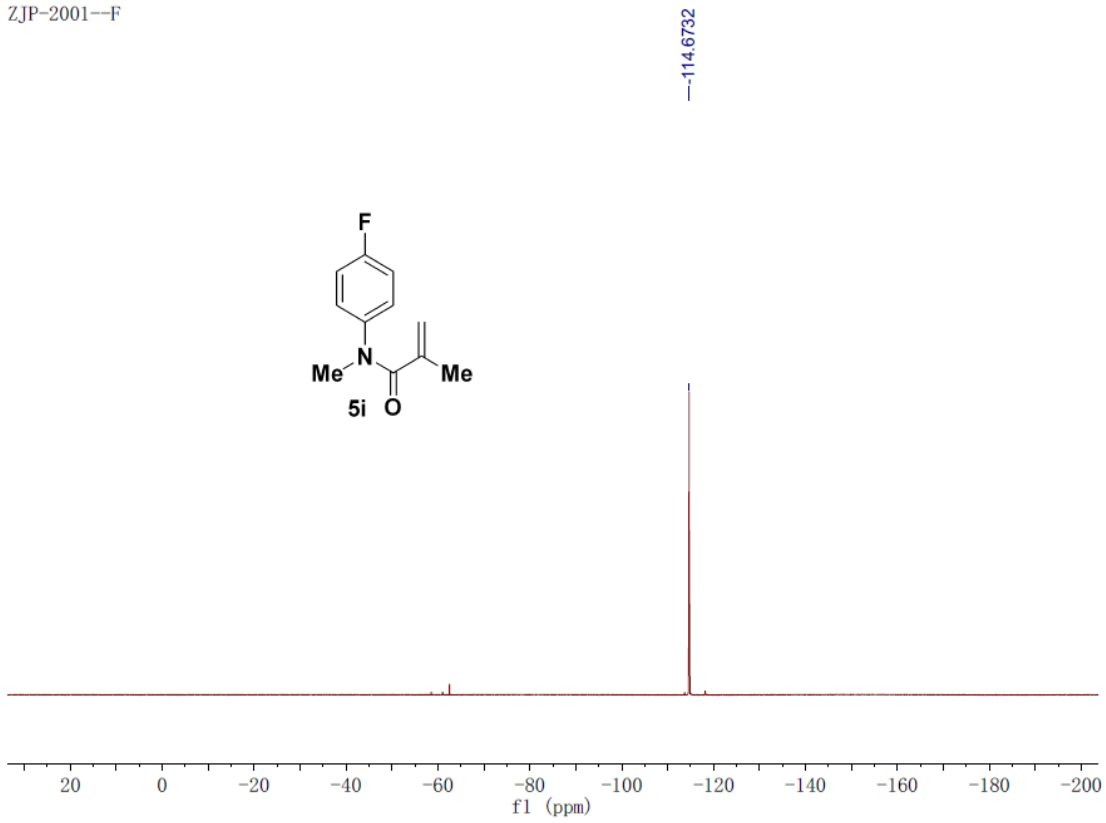
^{1}H NMR of **5i** (400 M, $CDCl_3$)



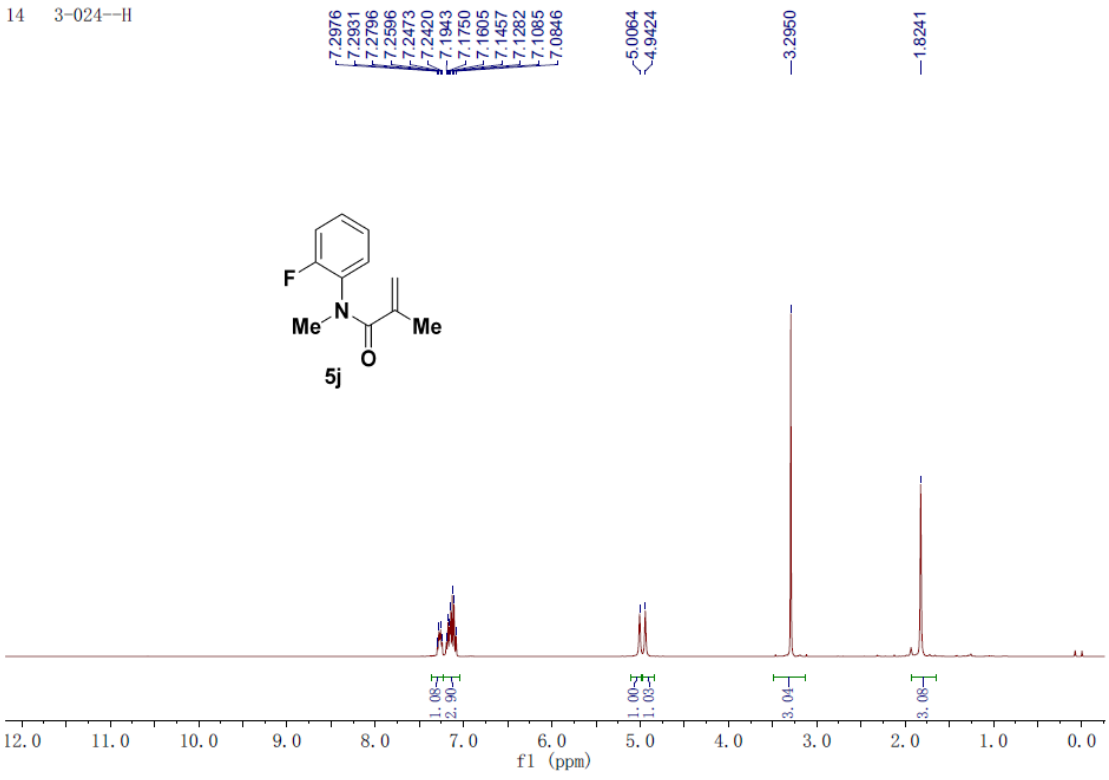
^{13}C NMR of **5i** (100 M, $CDCl_3$)



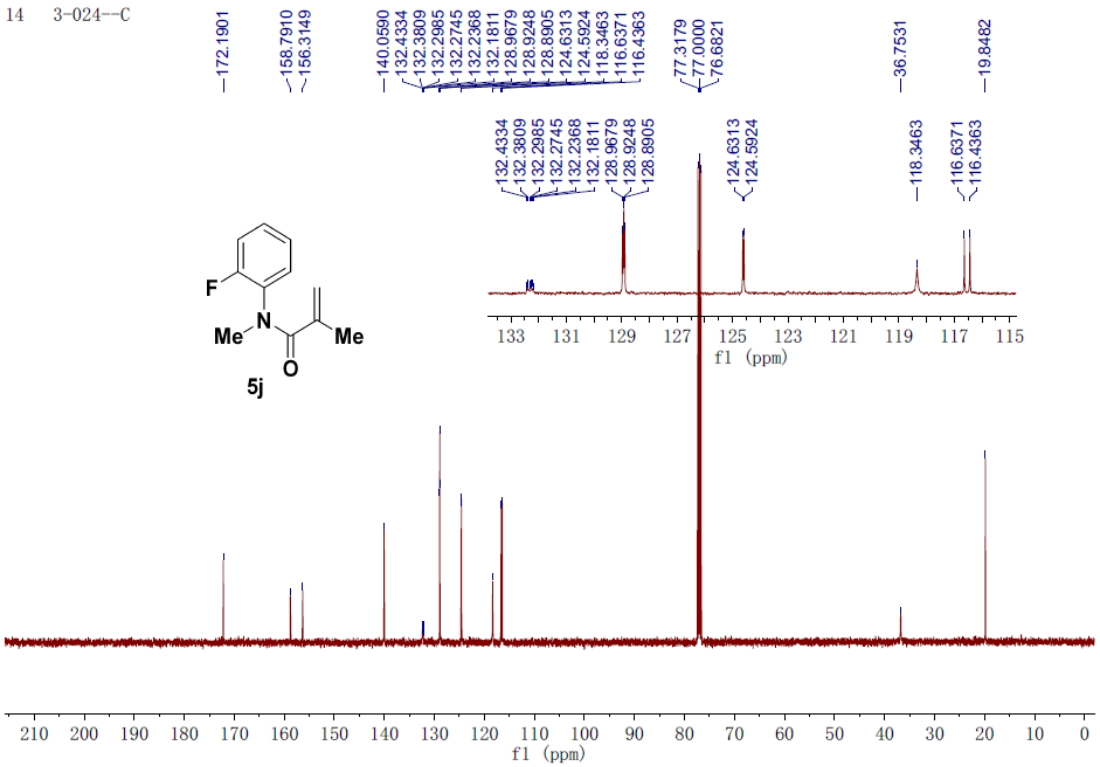
^{19}F NMR of **5i** (376 M, $CDCl_3$)



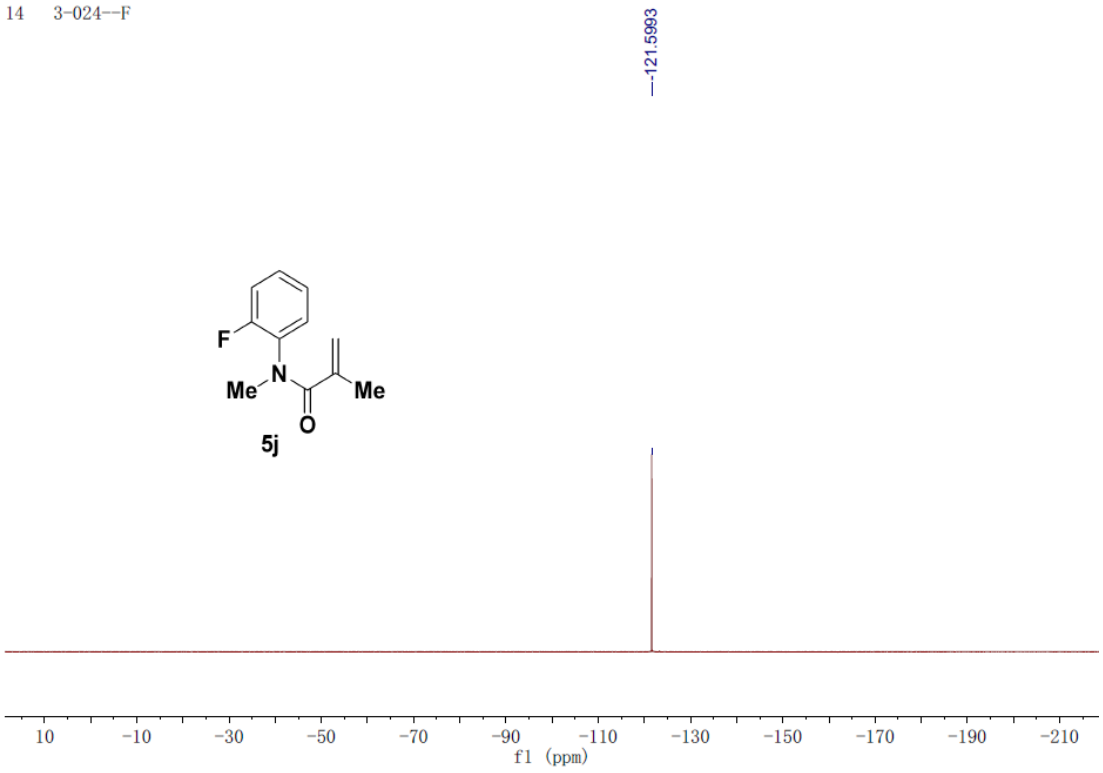
^{1}H NMR of **5j** (400 M, $CDCl_3$)



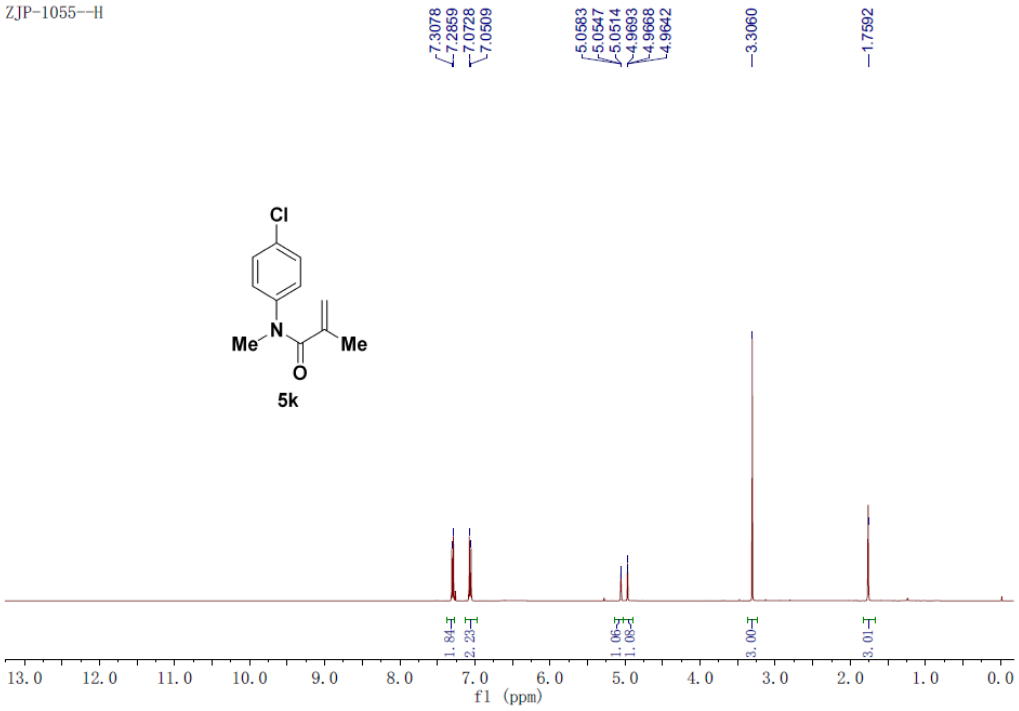
^{13}C NMR of **5j** (100 M, $CDCl_3$)



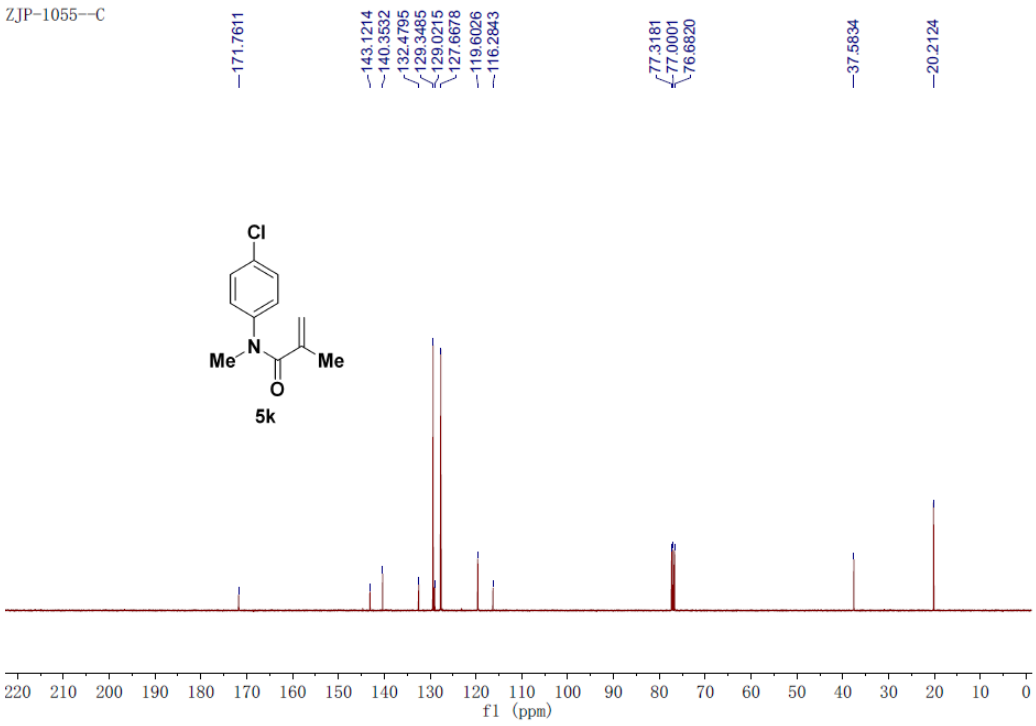
^{19}F NMR of **5j** (376 M, $CDCl_3$)



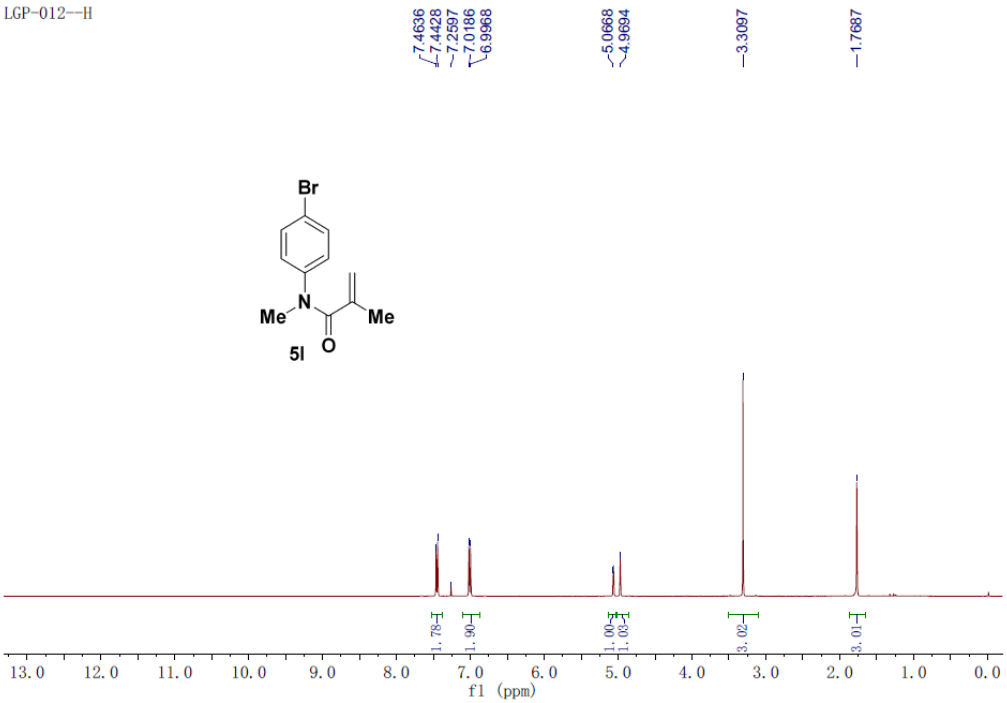
^{1}H NMR of **5k** (400 M, $CDCl_3$)



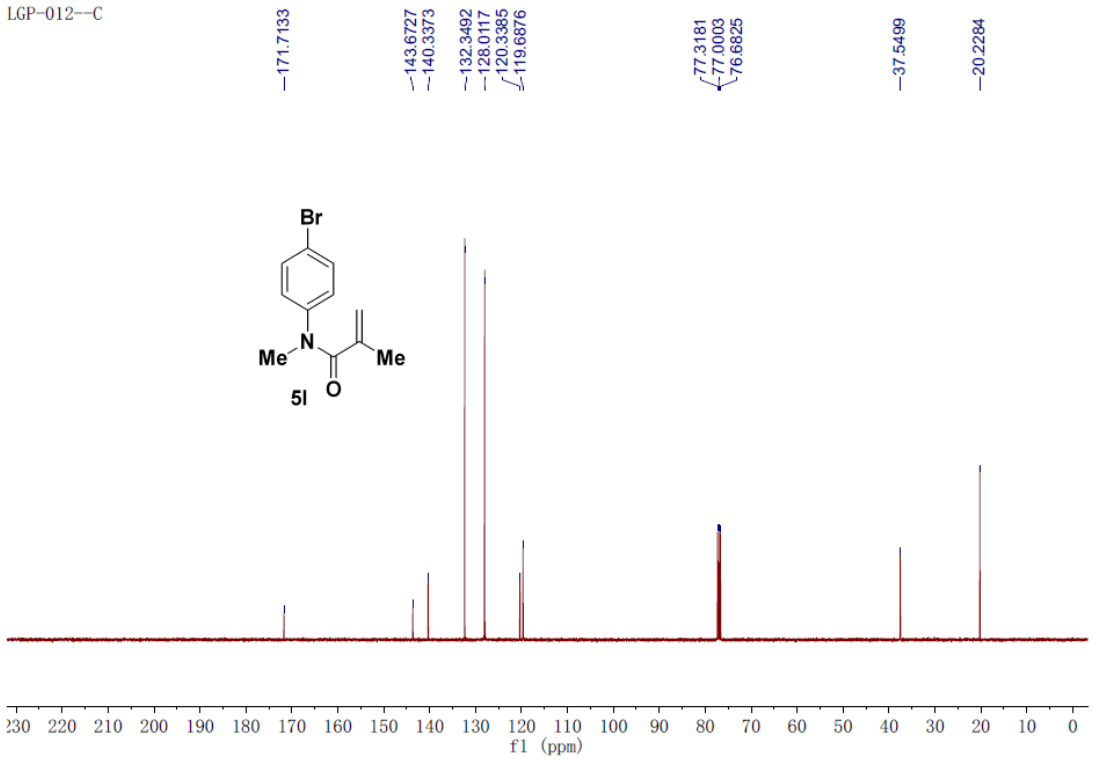
^{13}C NMR of **5k** (100 M, $CDCl_3$)



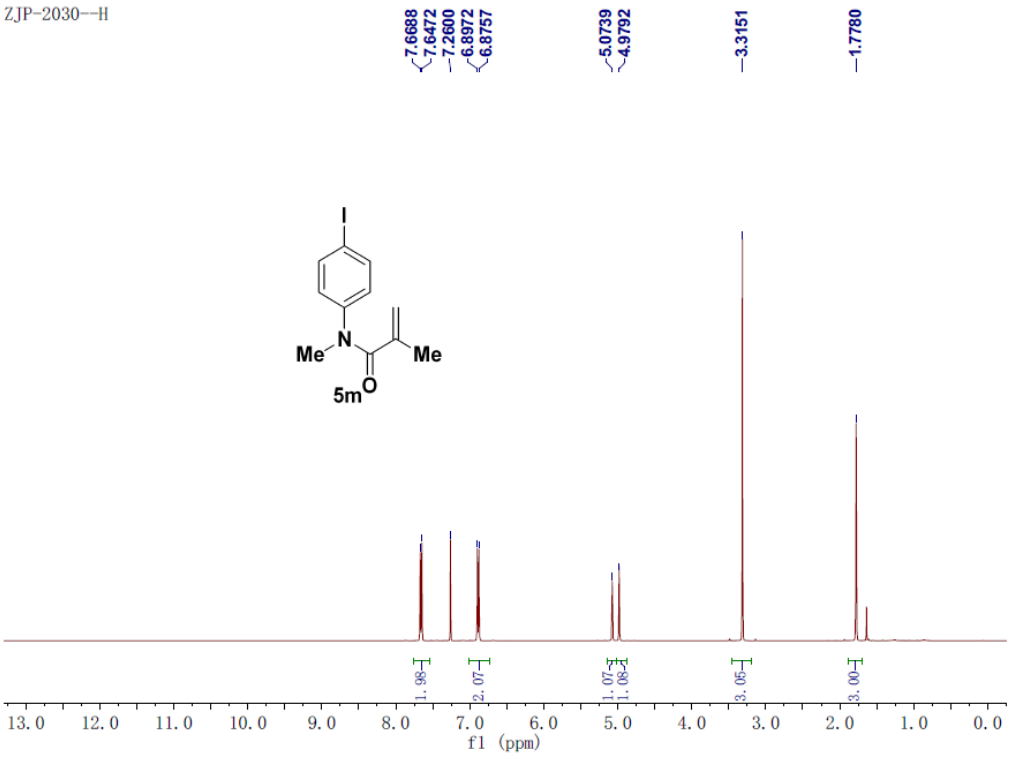
^{1}H NMR of **5l** (400 M, $CDCl_3$)



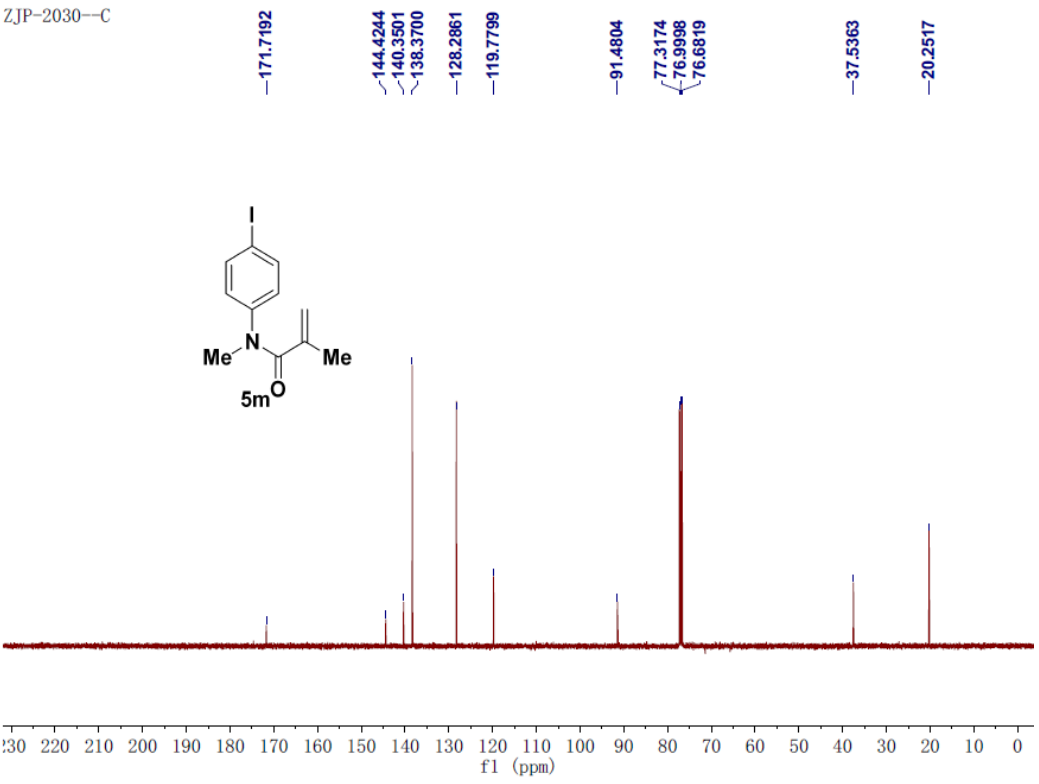
^{13}C NMR of **5l** (100 M, $CDCl_3$)



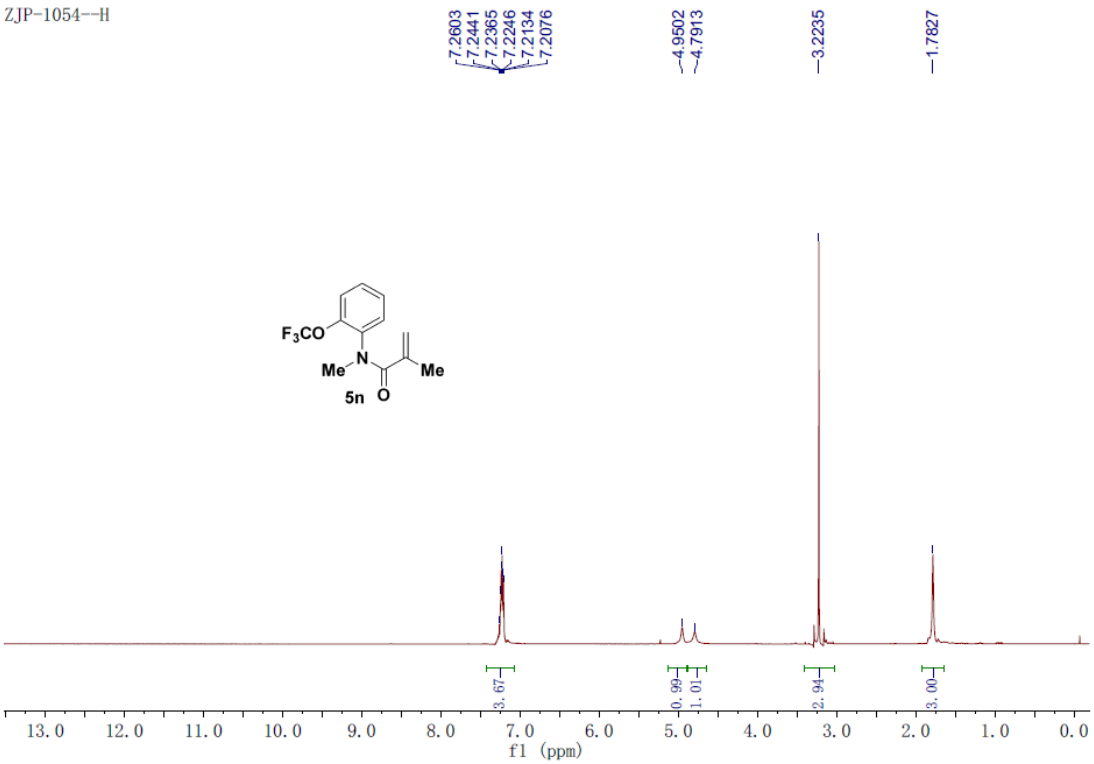
^{1}H NMR of **5m** (400 M, $CDCl_3$)



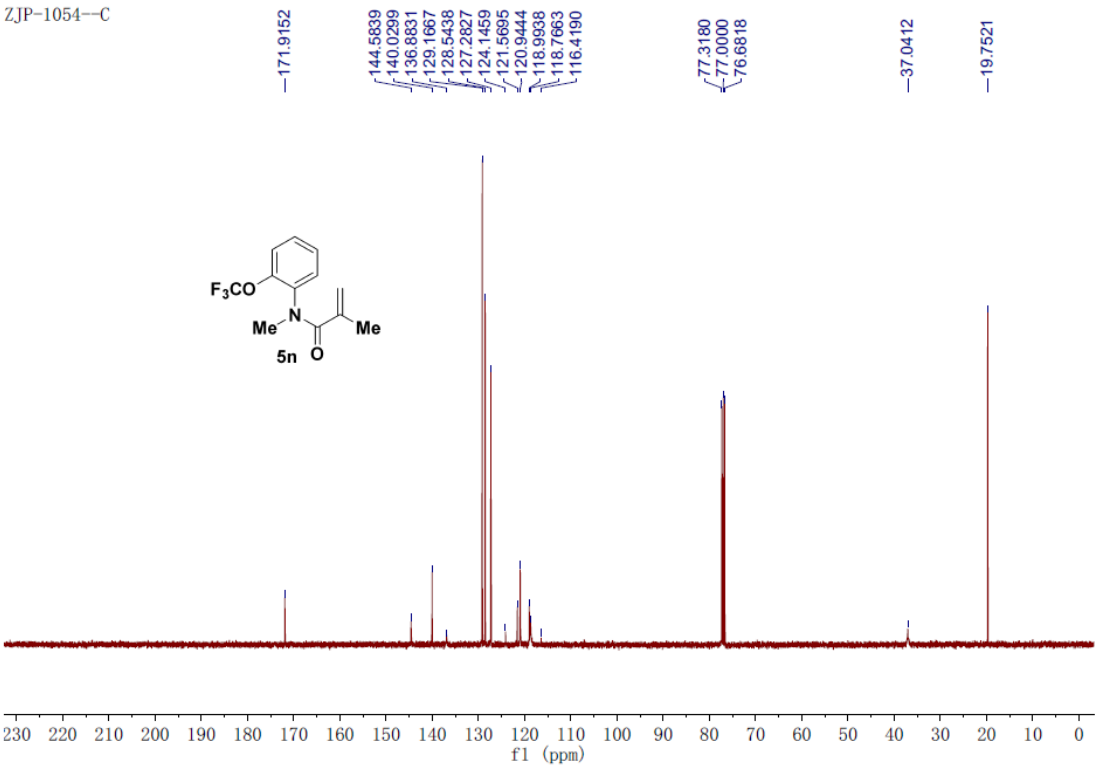
^{13}C NMR of **5m** (100 M, $CDCl_3$)



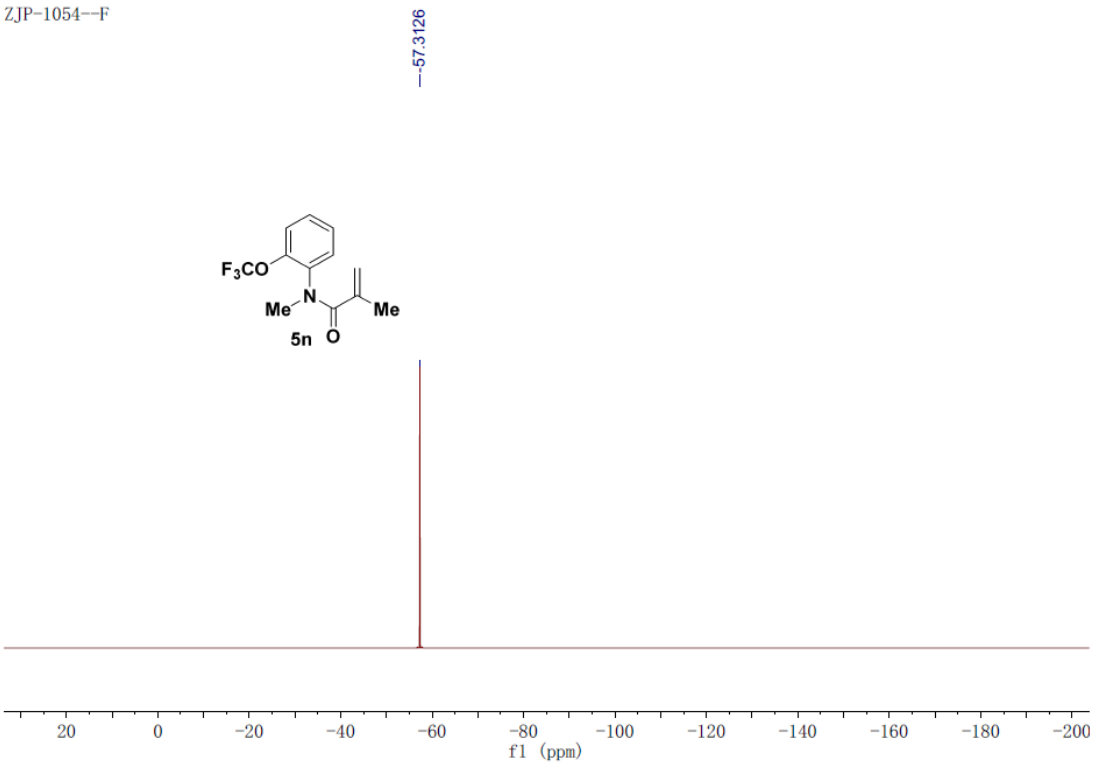
^{1}H NMR of **5n** (400 M, $CDCl_3$)



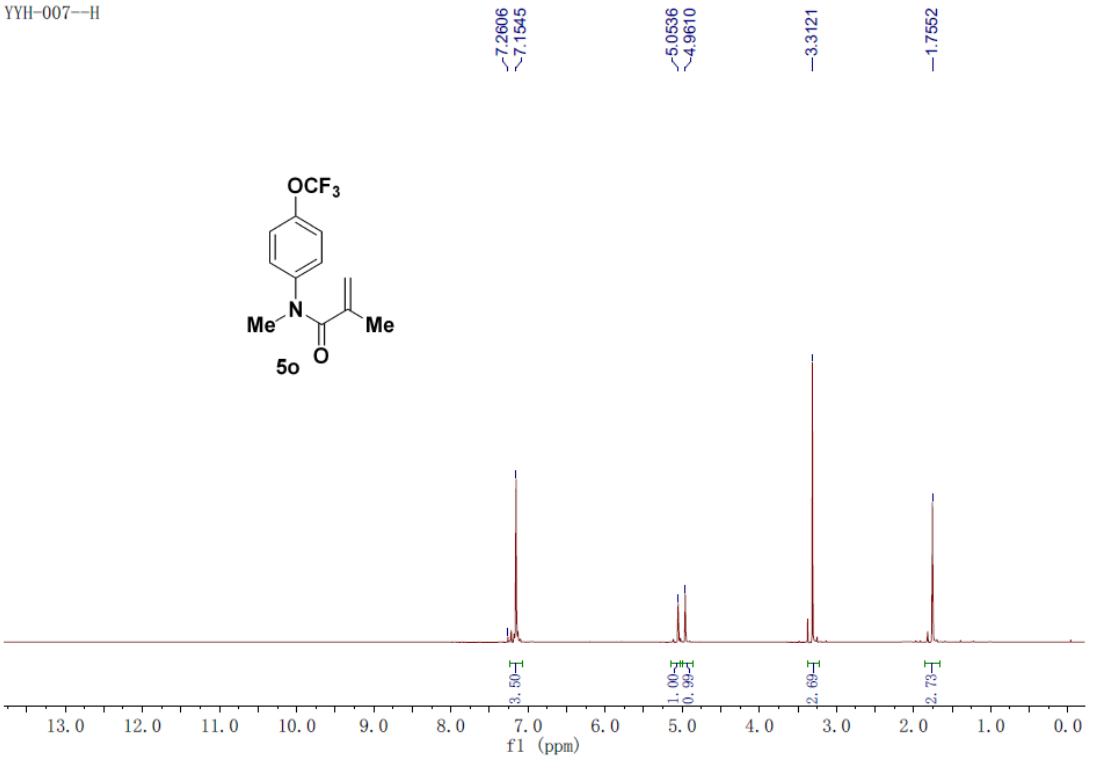
^{13}C NMR of **5n** (100 M, $CDCl_3$)



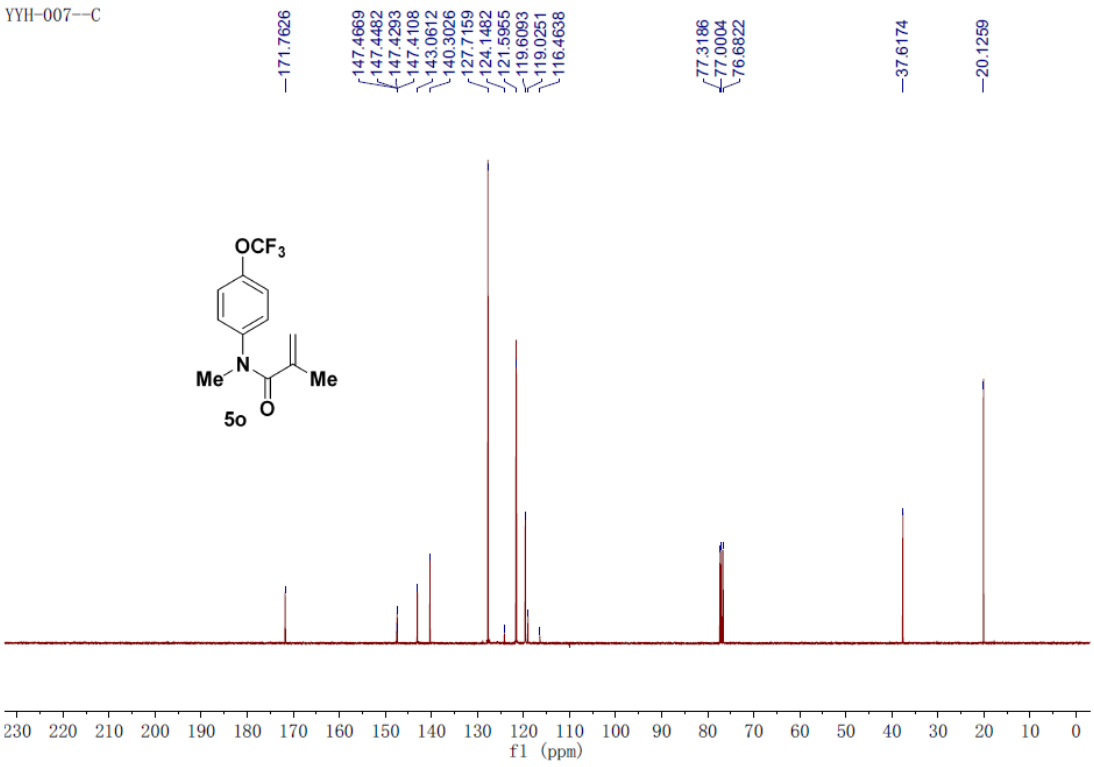
^{19}F NMR of **5n** (376 M, $CDCl_3$)



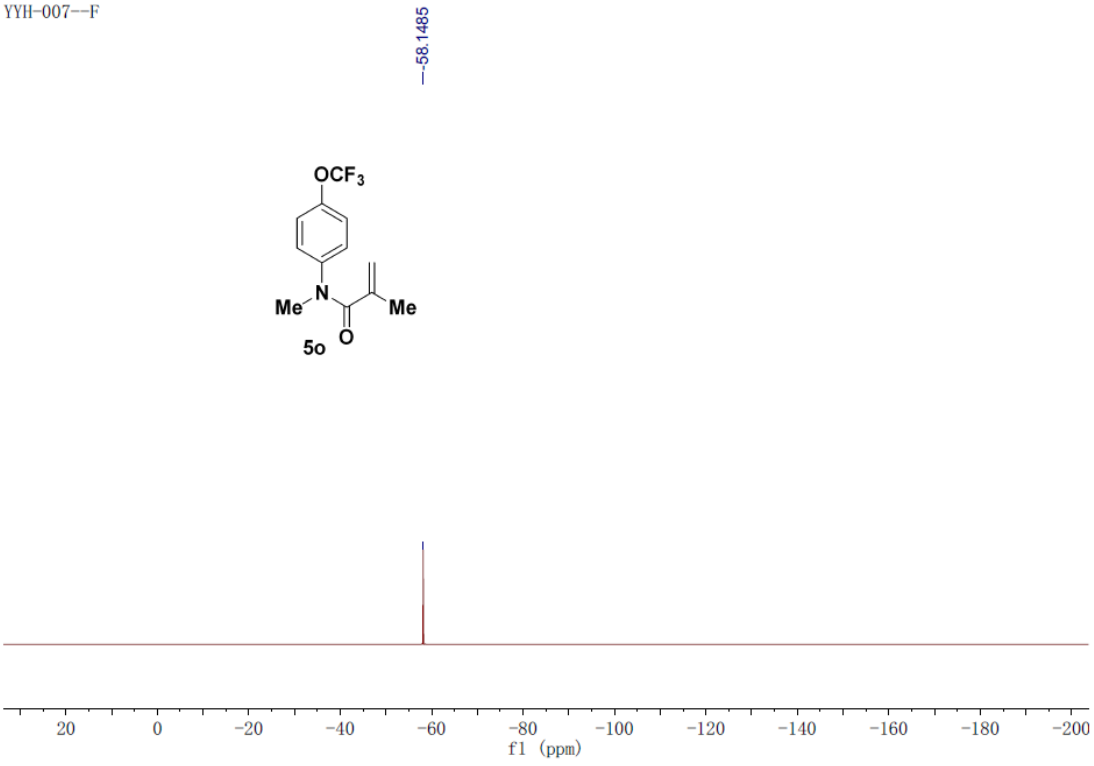
^{1}H NMR of **5o** (400 M, $CDCl_3$)



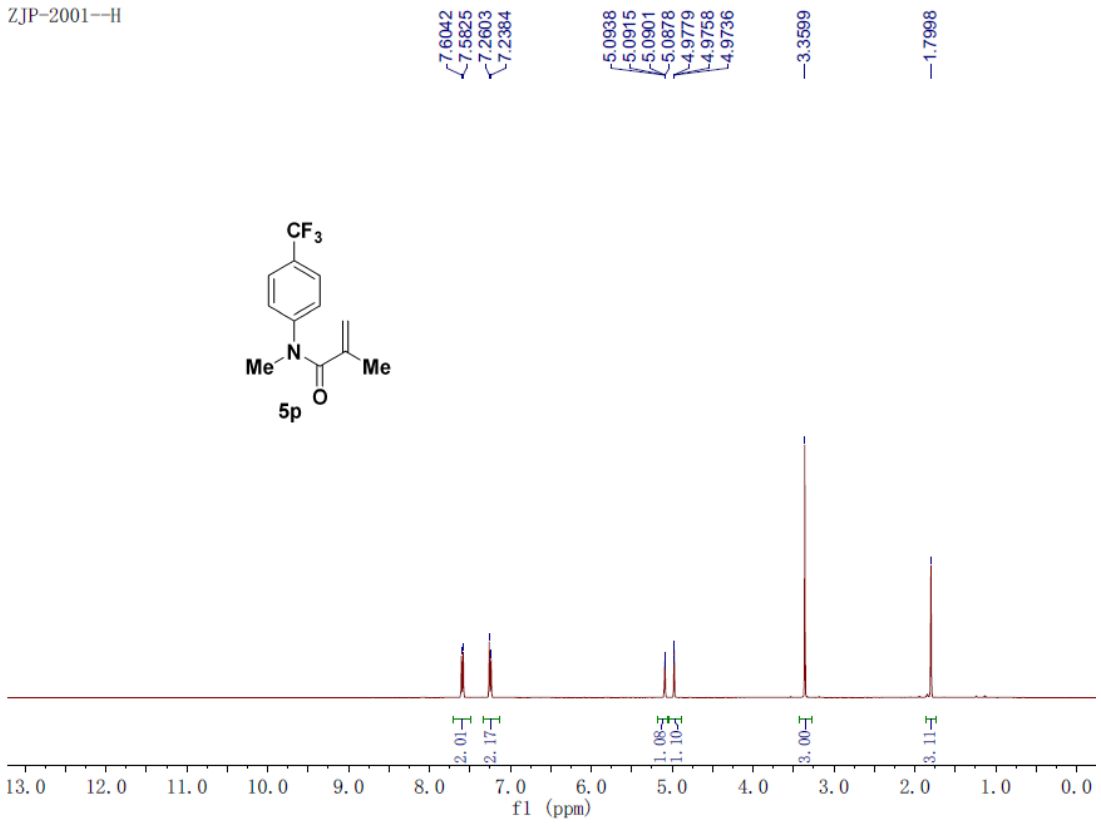
^{13}C NMR of **5o** (100 M, $CDCl_3$)



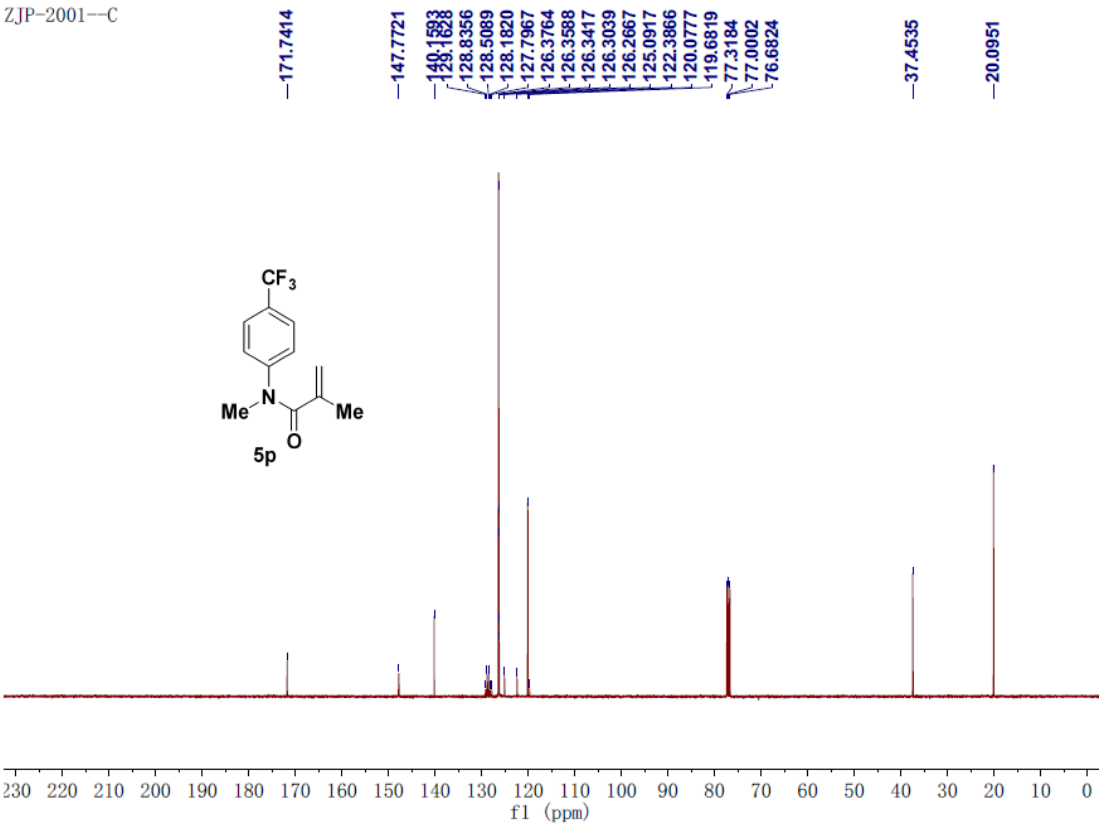
^{19}F NMR of **5o** (376 M, $CDCl_3$)



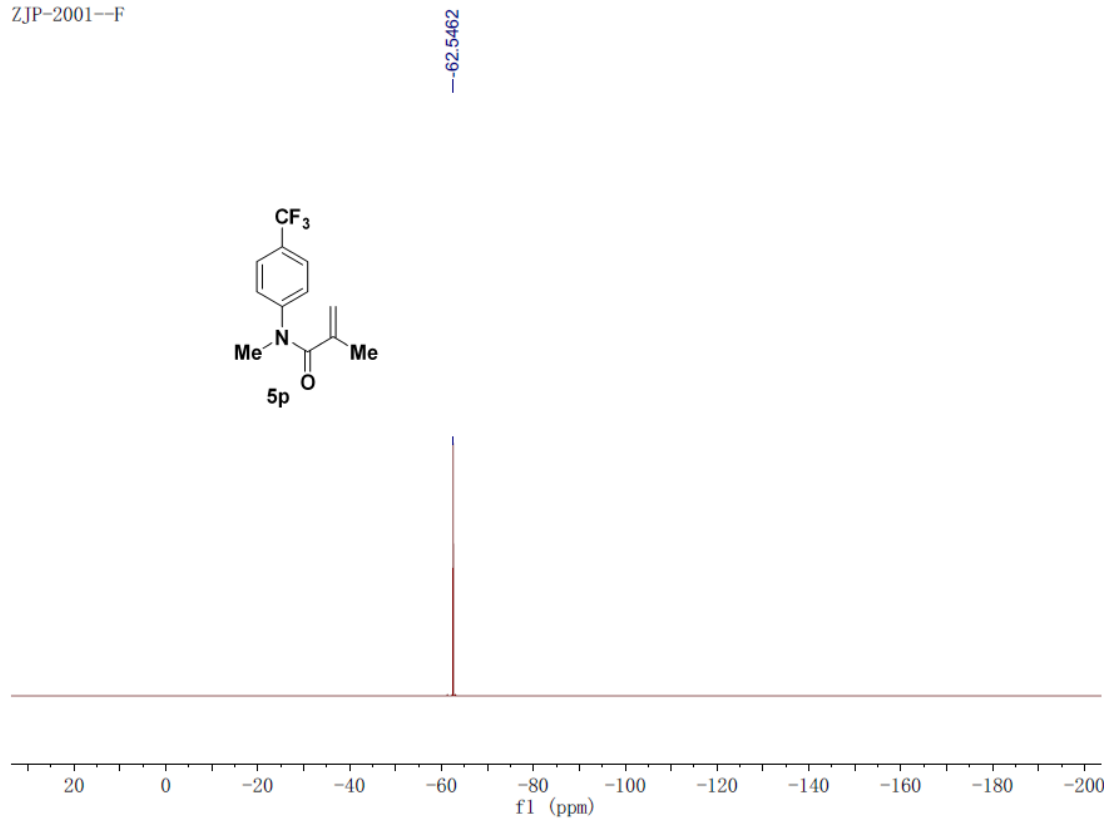
^{1}H NMR of **5p** (400 M, $CDCl_3$)



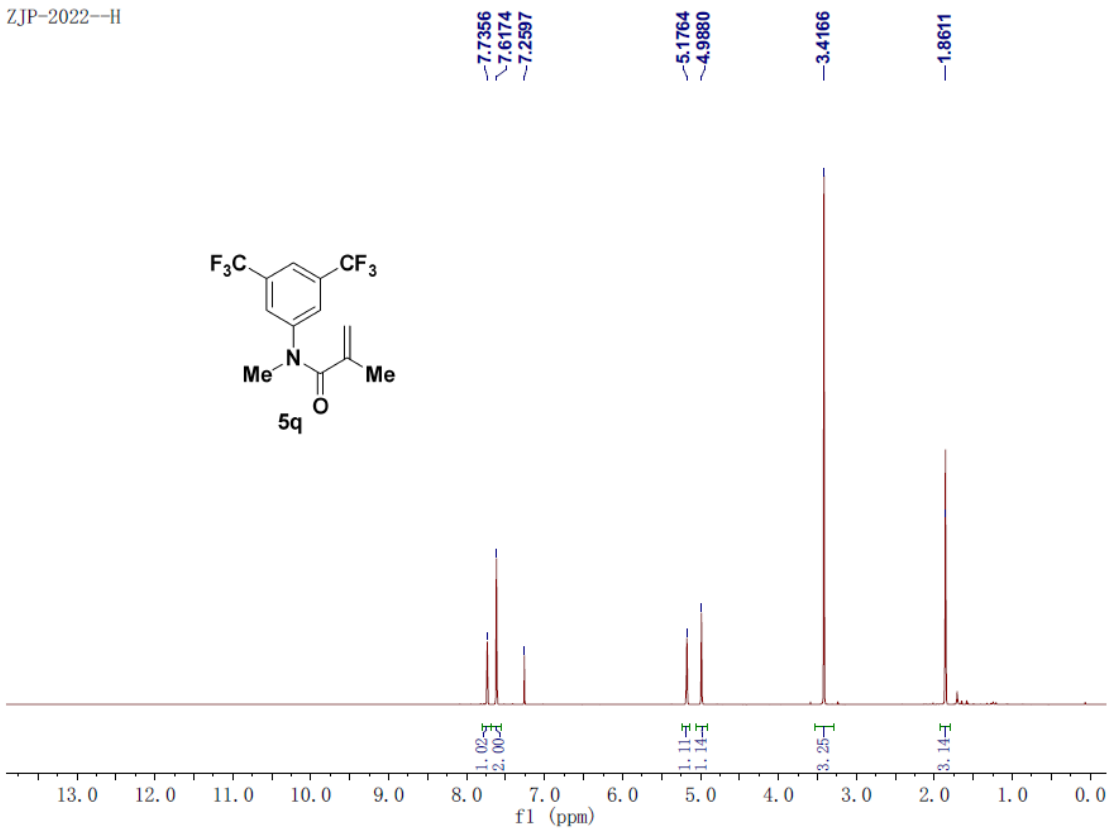
^{13}C NMR of **5p** (100 M, $CDCl_3$)



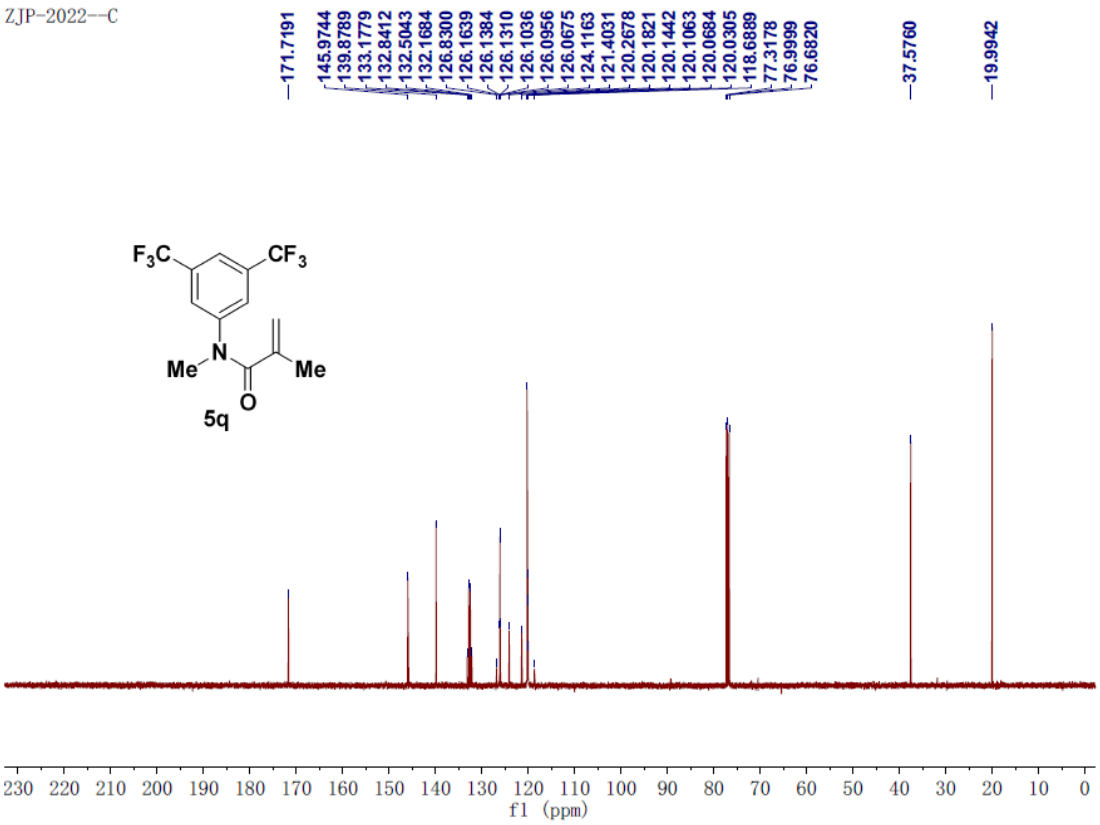
^{19}F NMR of **5p** (376 M, $CDCl_3$)



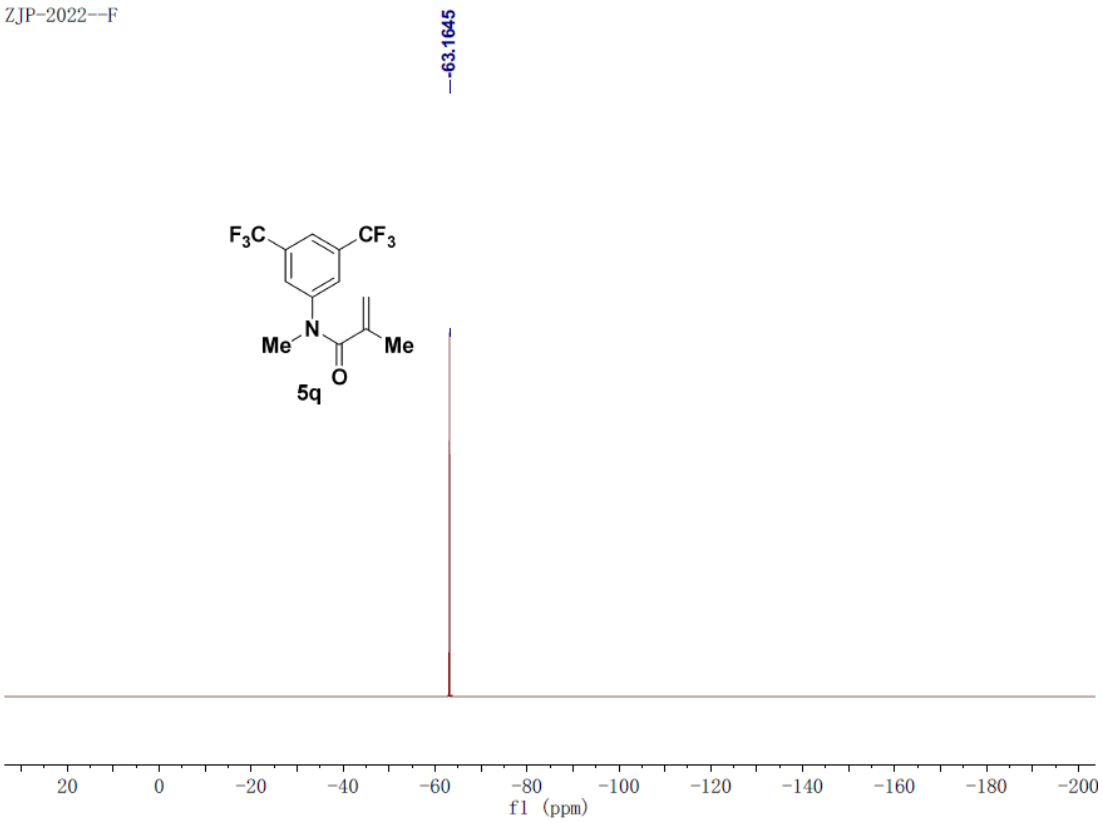
^{1}H NMR of **5q** (400 M, $CDCl_3$)



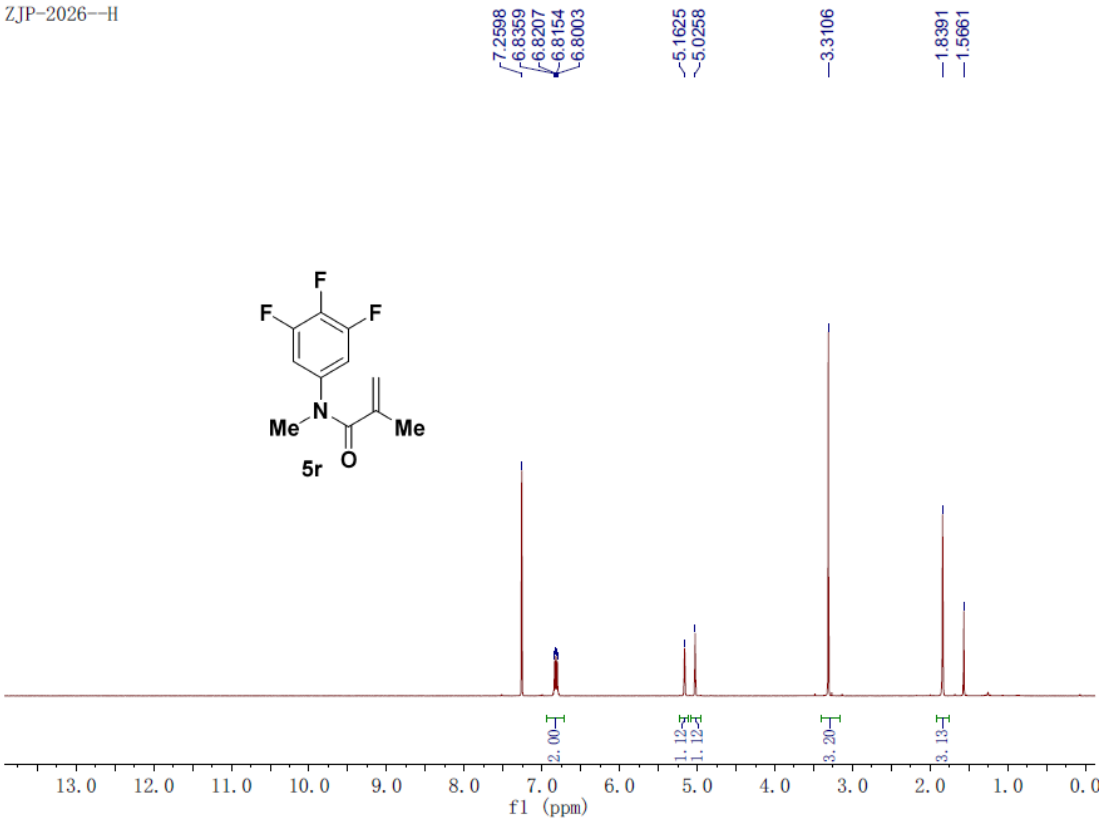
^{13}C NMR of **5q** (100 M, $CDCl_3$)



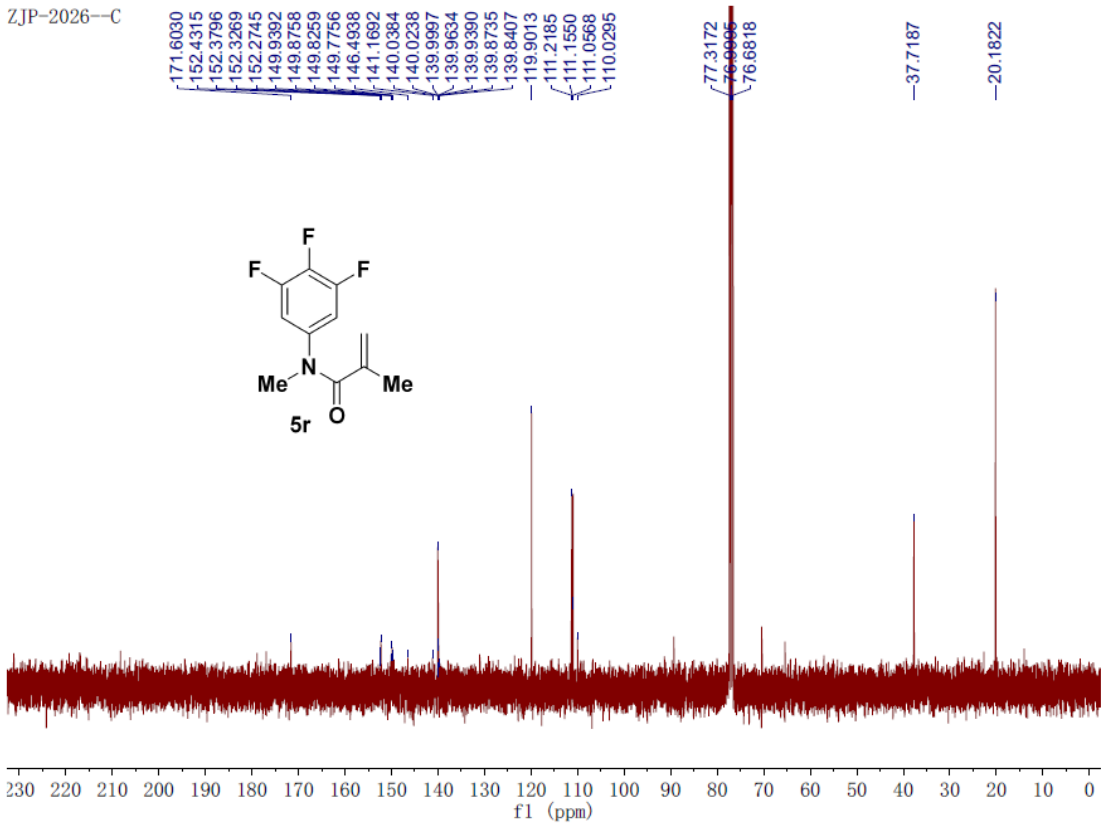
^{19}F NMR of **5q** (376 M, $CDCl_3$)



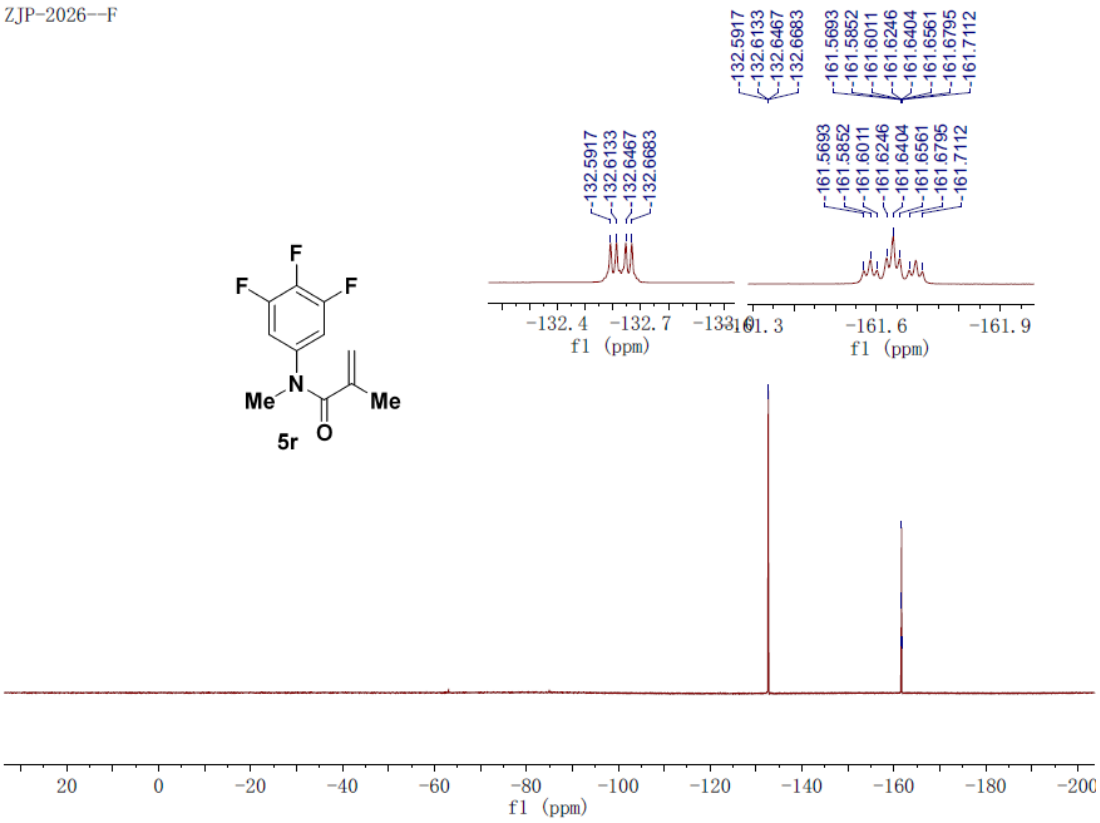
^{1}H NMR of **5r** (400 M, $CDCl_3$)



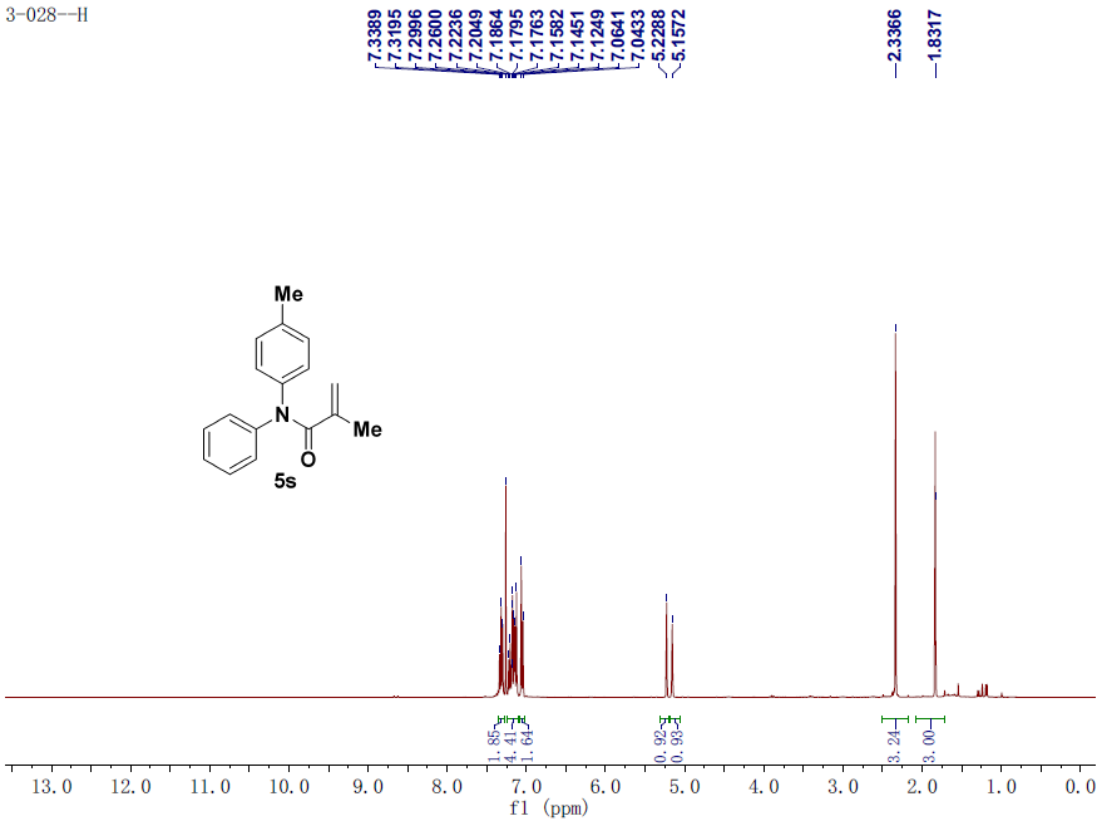
^{13}C NMR of **5r** (100 M, $CDCl_3$)



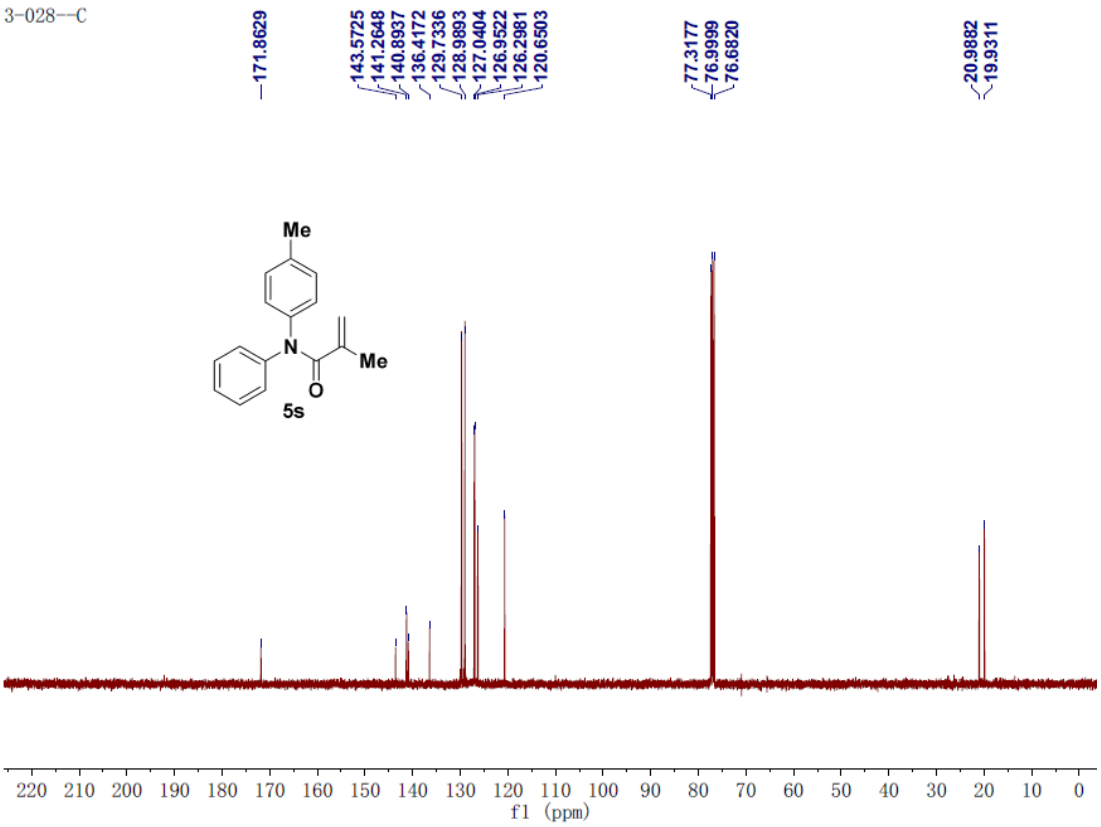
^{19}F NMR of **5r** (376 M, $CDCl_3$)



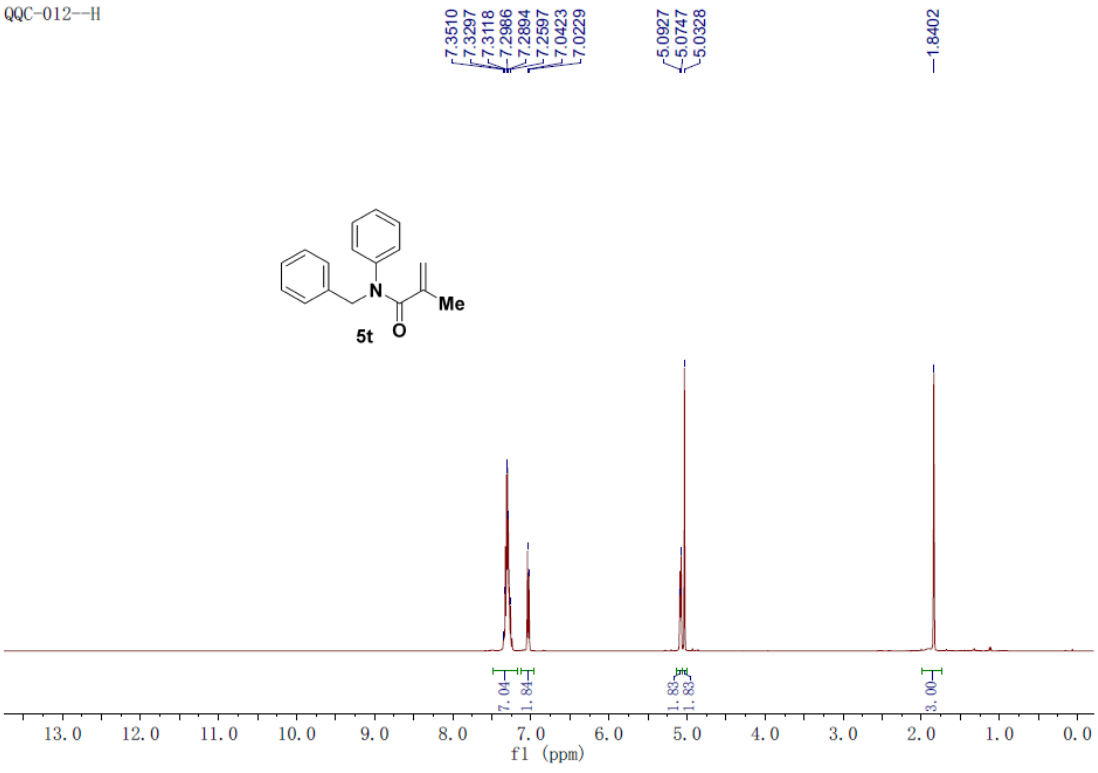
^{1}H NMR of **5s** (400 M, $CDCl_3$)



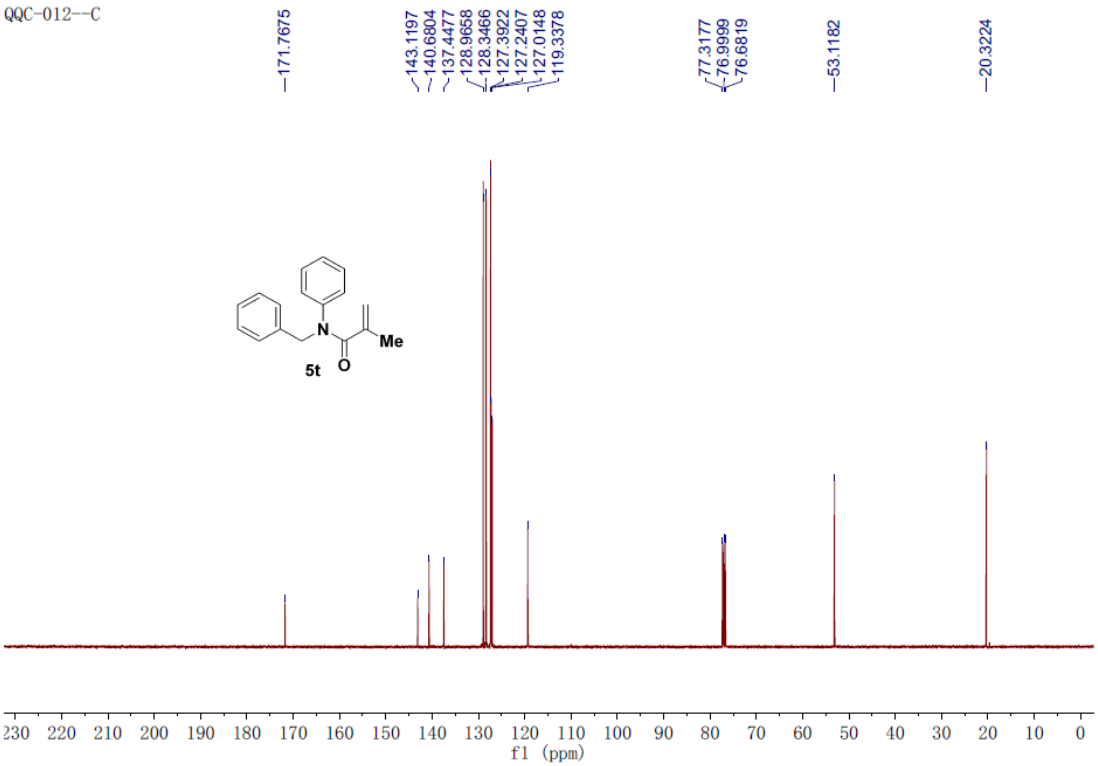
^{13}C NMR of **5s** (100 M, $CDCl_3$)



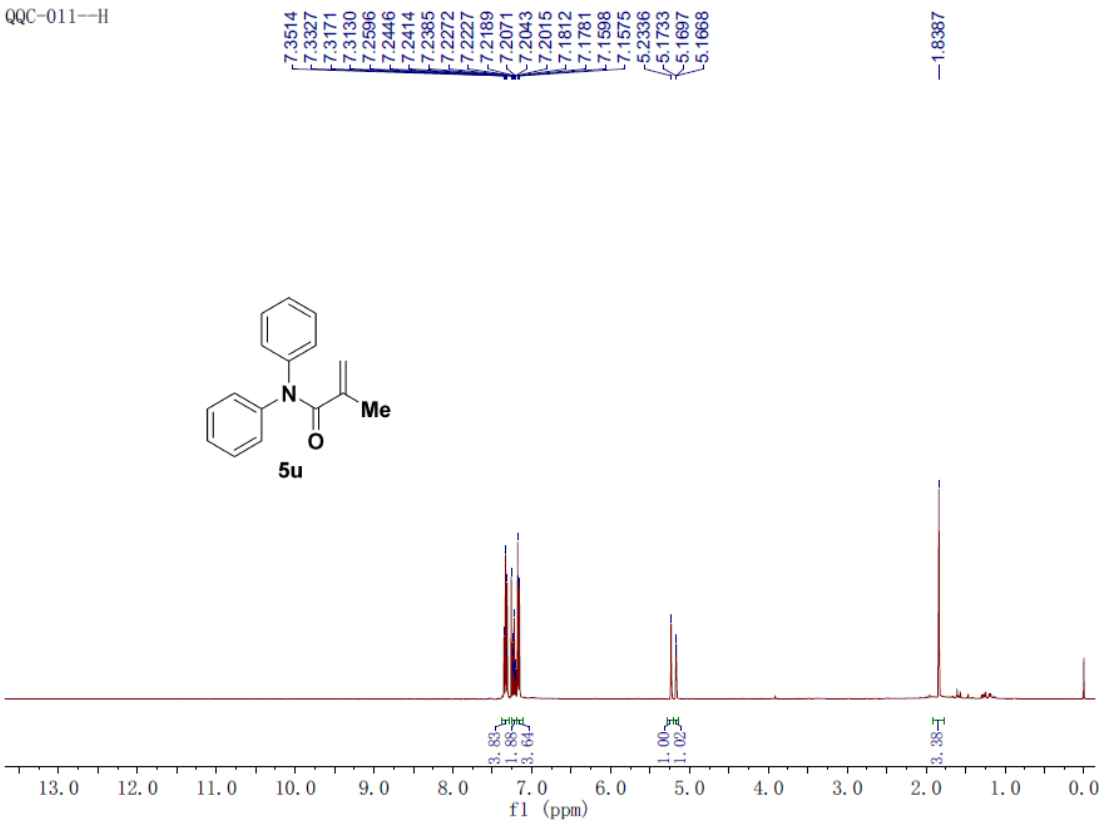
^{1}H NMR of **5t** (400 M, $CDCl_3$)



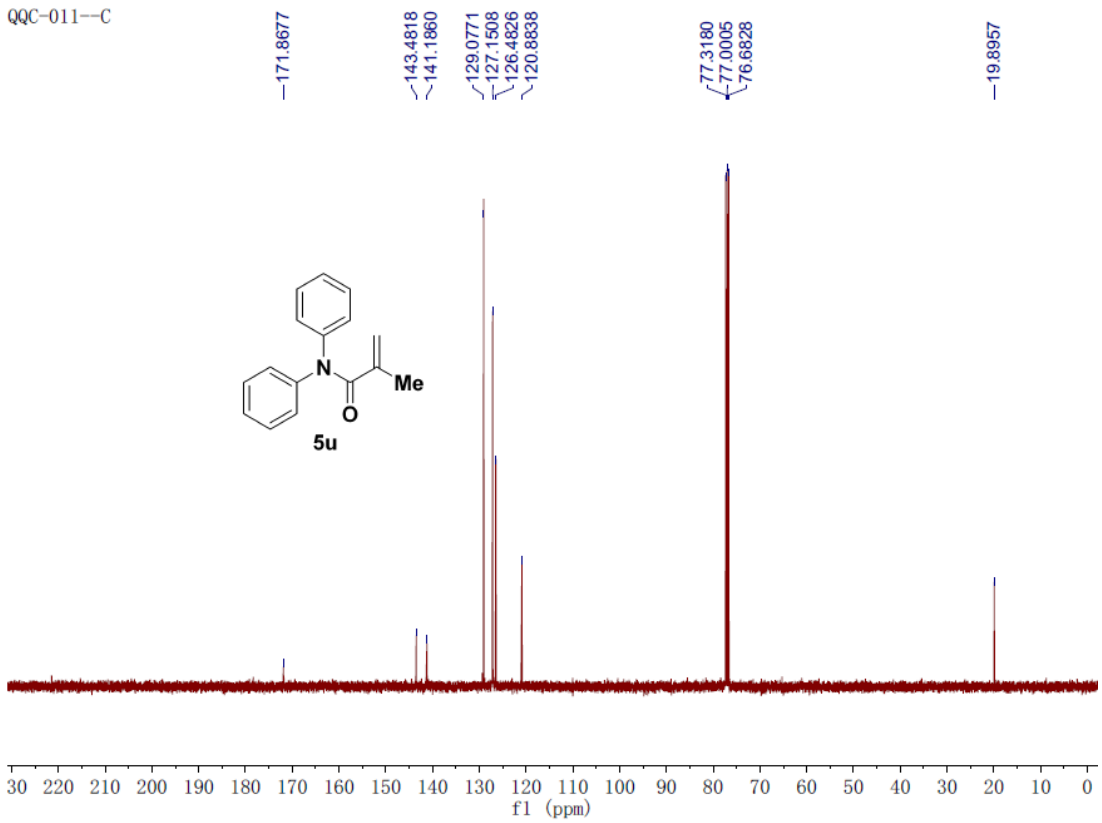
^{13}C NMR of **5t** (100 M, $CDCl_3$)



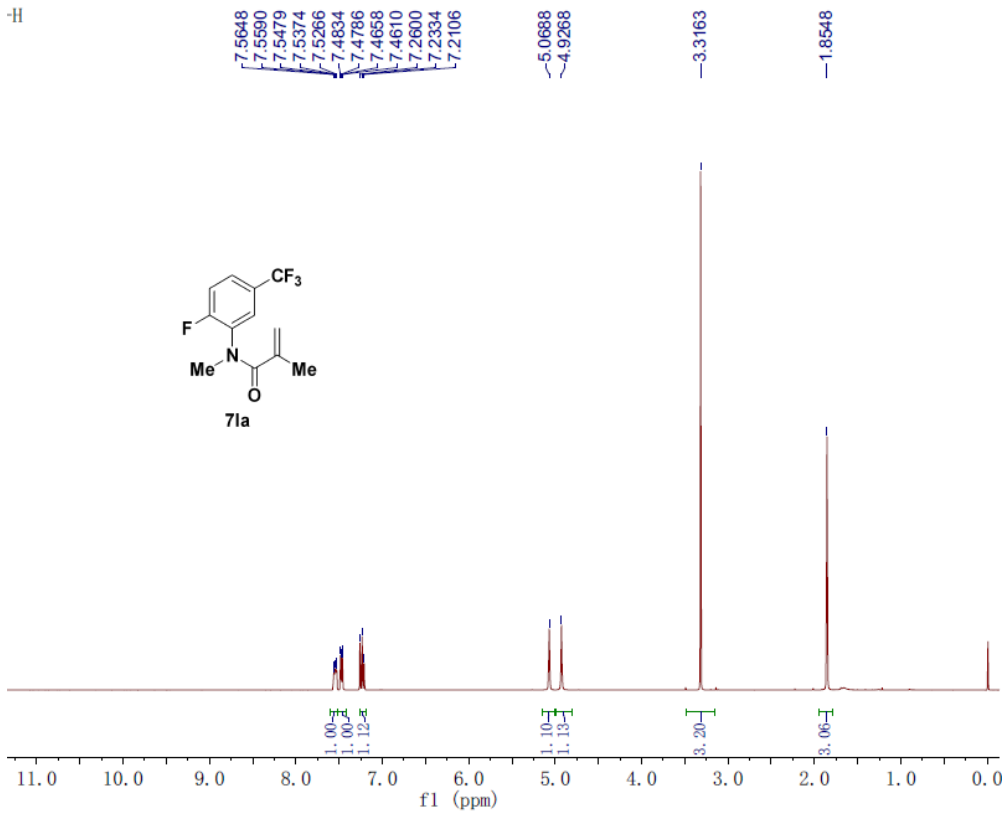
^{1}H NMR of **5u** (400 M, $CDCl_3$)



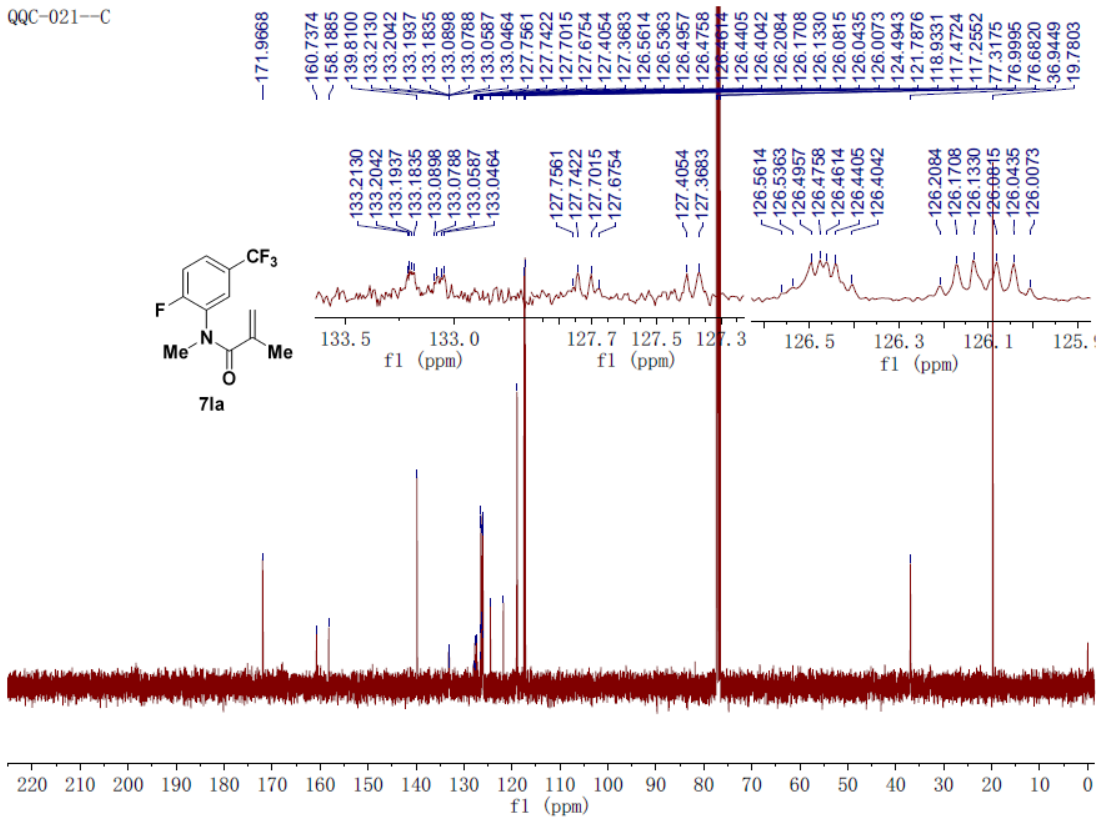
^{13}C NMR of **5u** (100 M, $CDCl_3$)



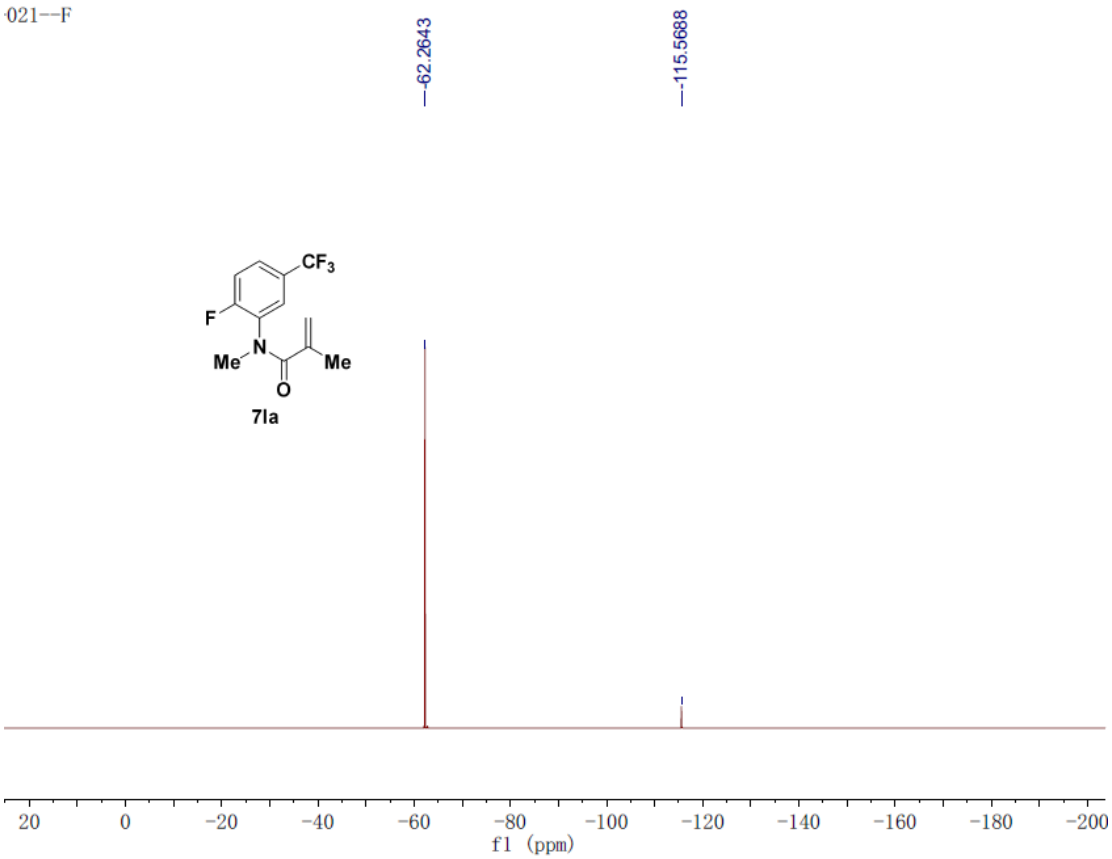
^{1}H NMR of **7la** (400 M, $CDCl_3$)



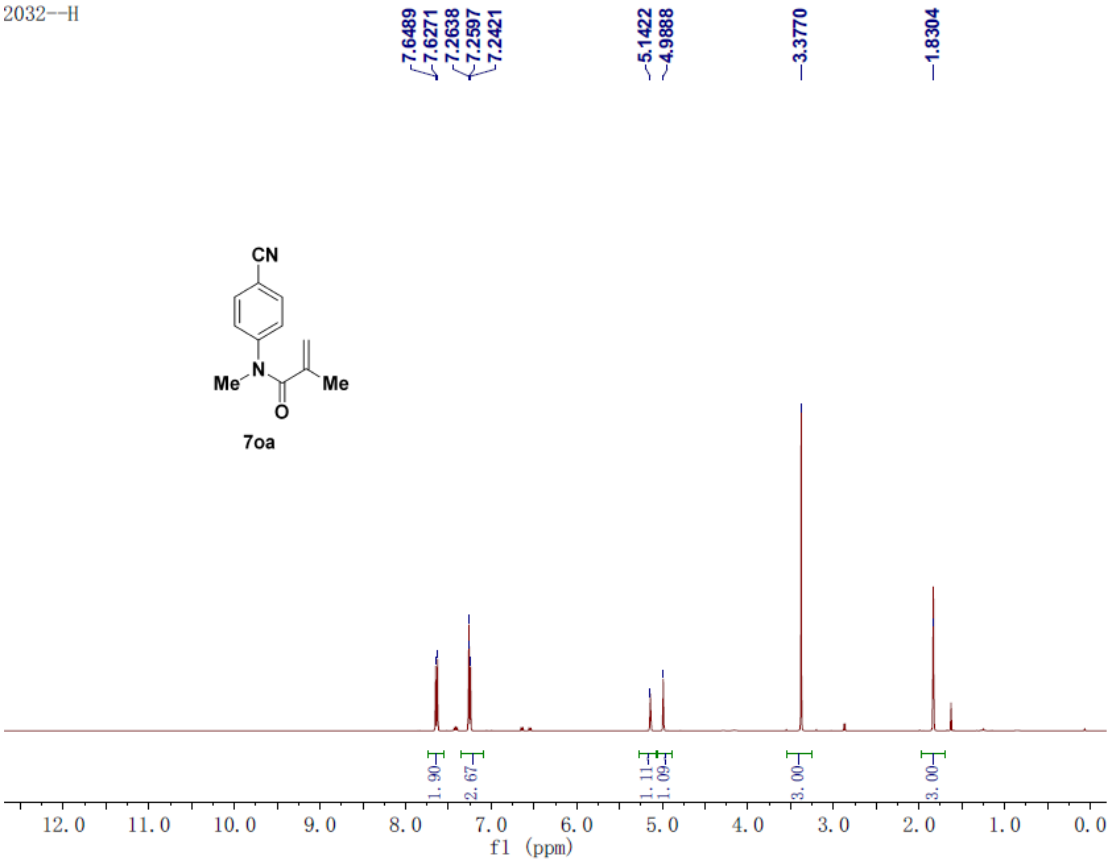
^{13}C NMR of **7la** (100 M, $CDCl_3$)



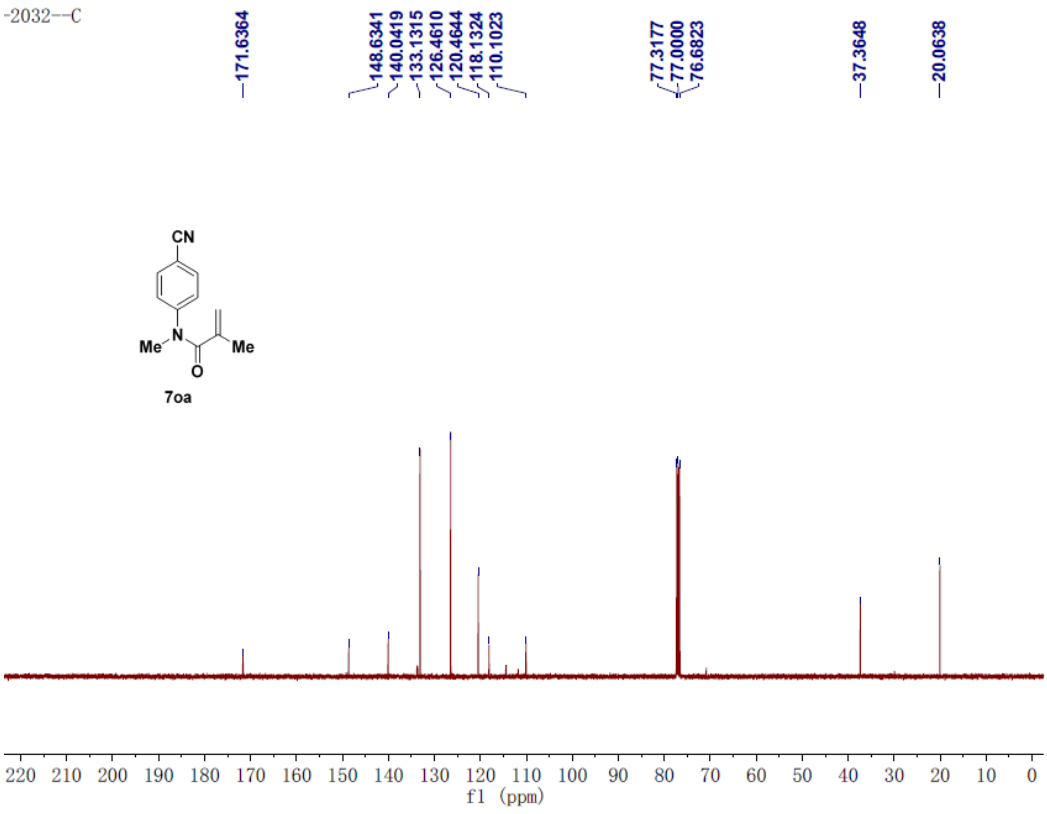
^{19}F NMR of **7la** (376 M, $CDCl_3$)



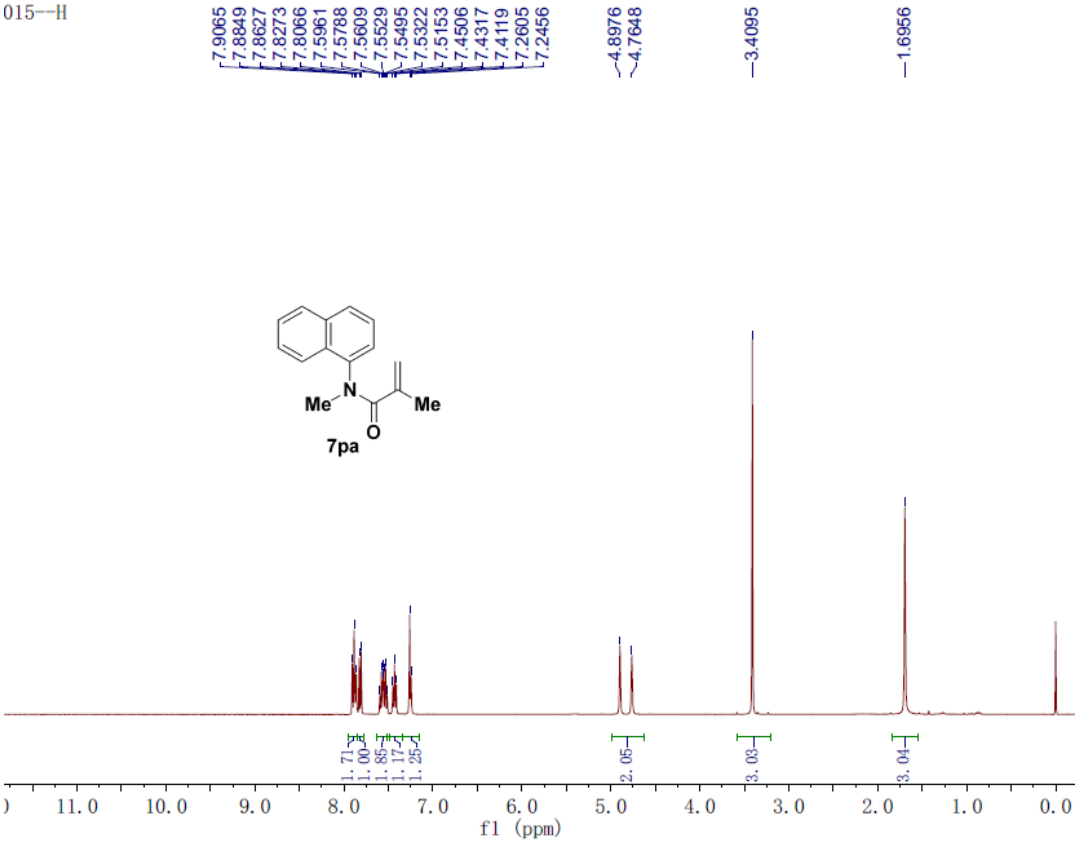
^{1}H NMR of **7oa** (400 M, $CDCl_3$)



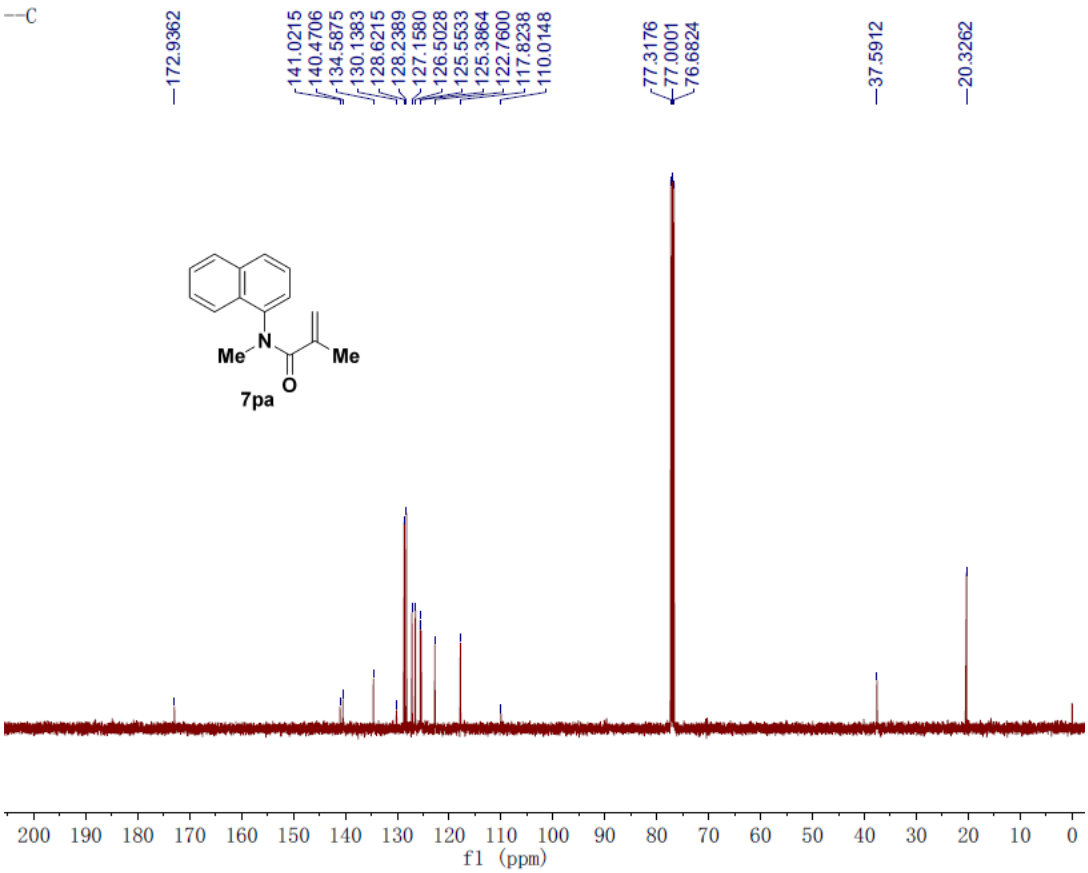
^{13}C NMR of **7oa** (100 M, $CDCl_3$)



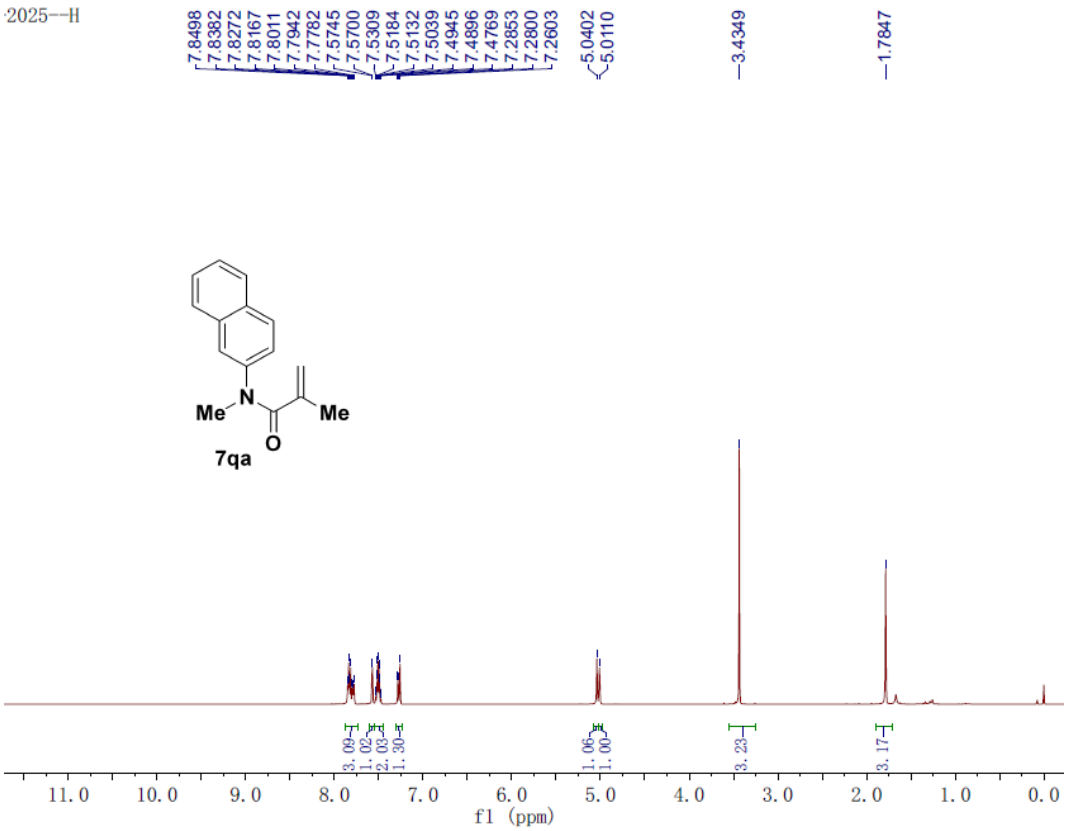
^{1}H NMR of **7pa** (400 M, $CDCl_3$)



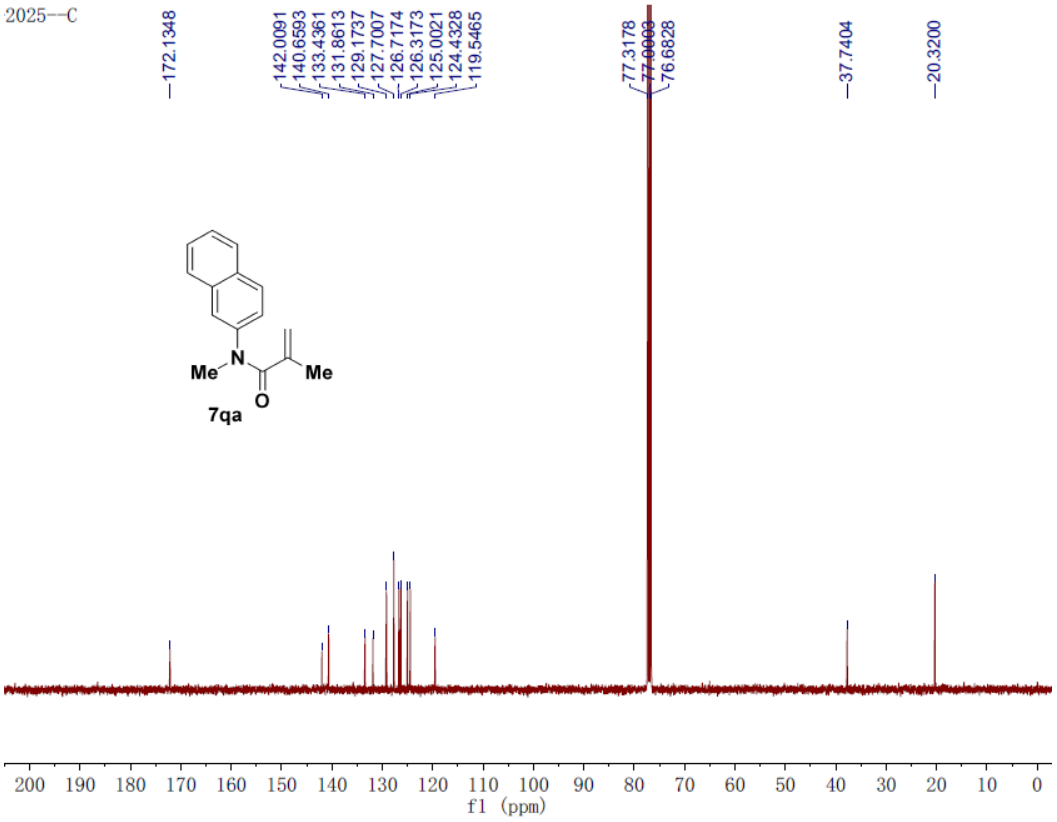
^{13}C NMR of **7pa** (100 M, $CDCl_3$)



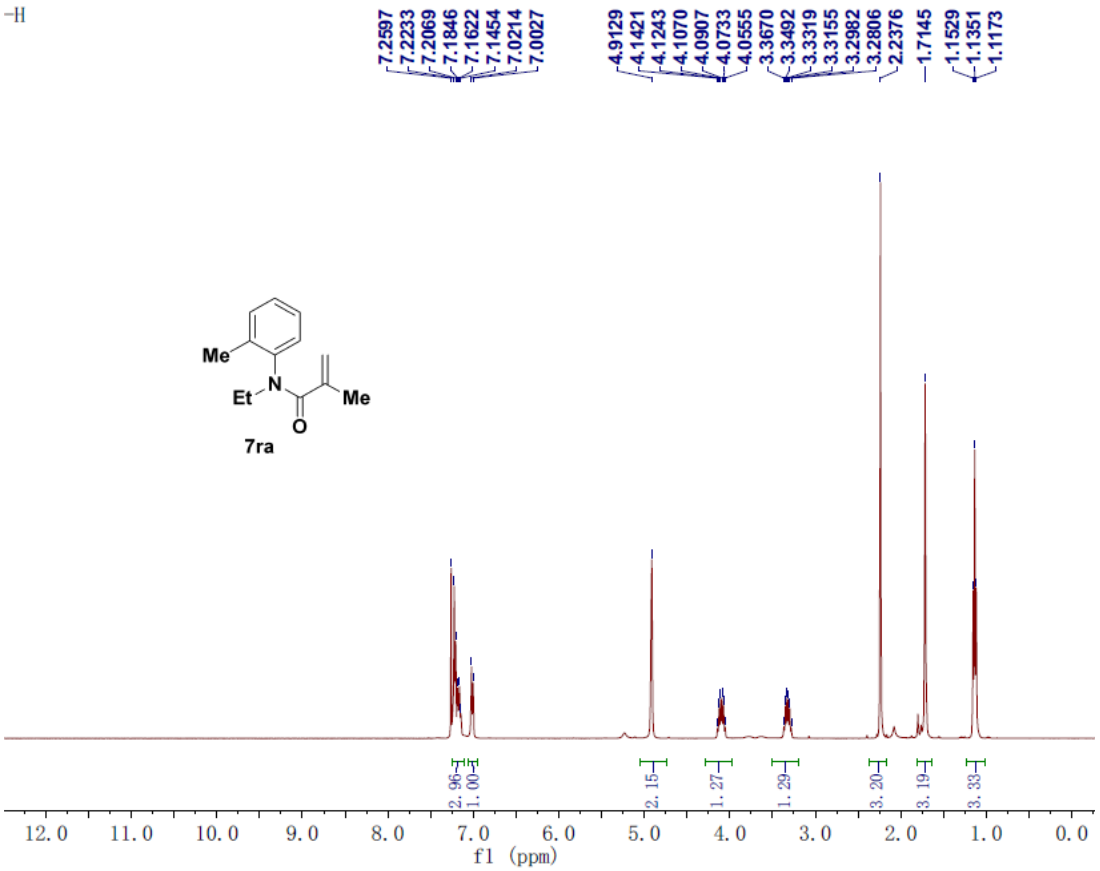
^{1}H NMR of **7qa** (400 M, $CDCl_3$)



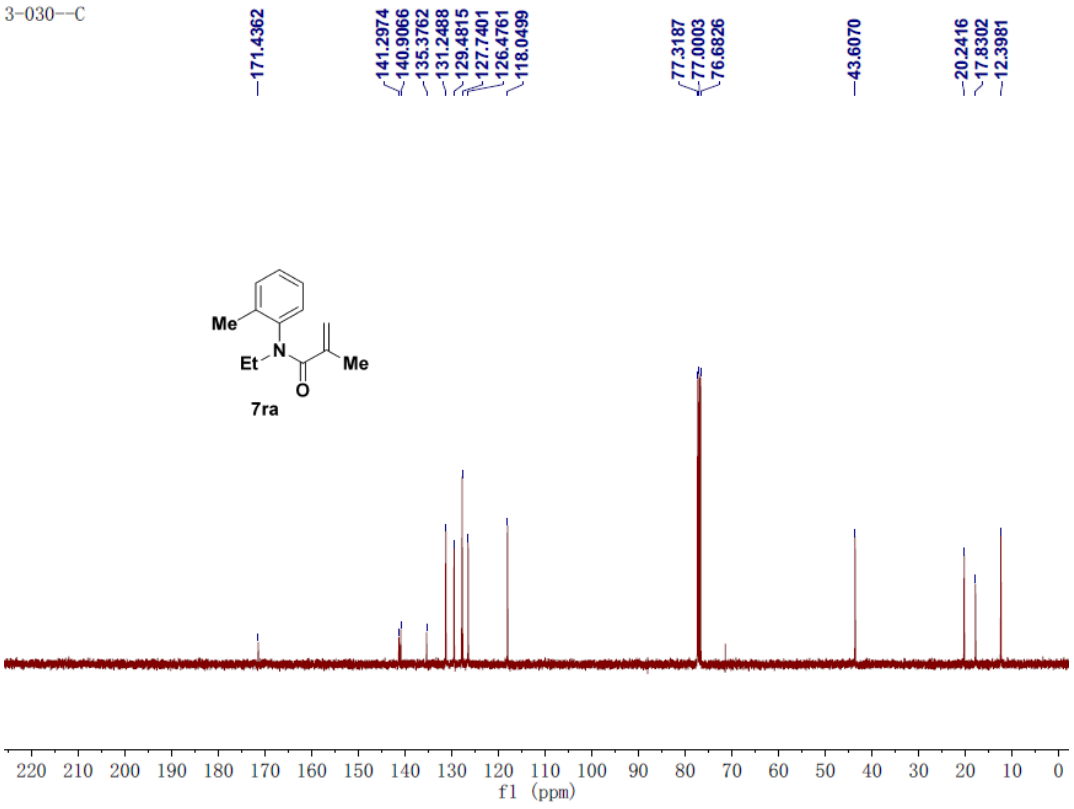
^{13}C NMR of **7qa** (100 M, $CDCl_3$)



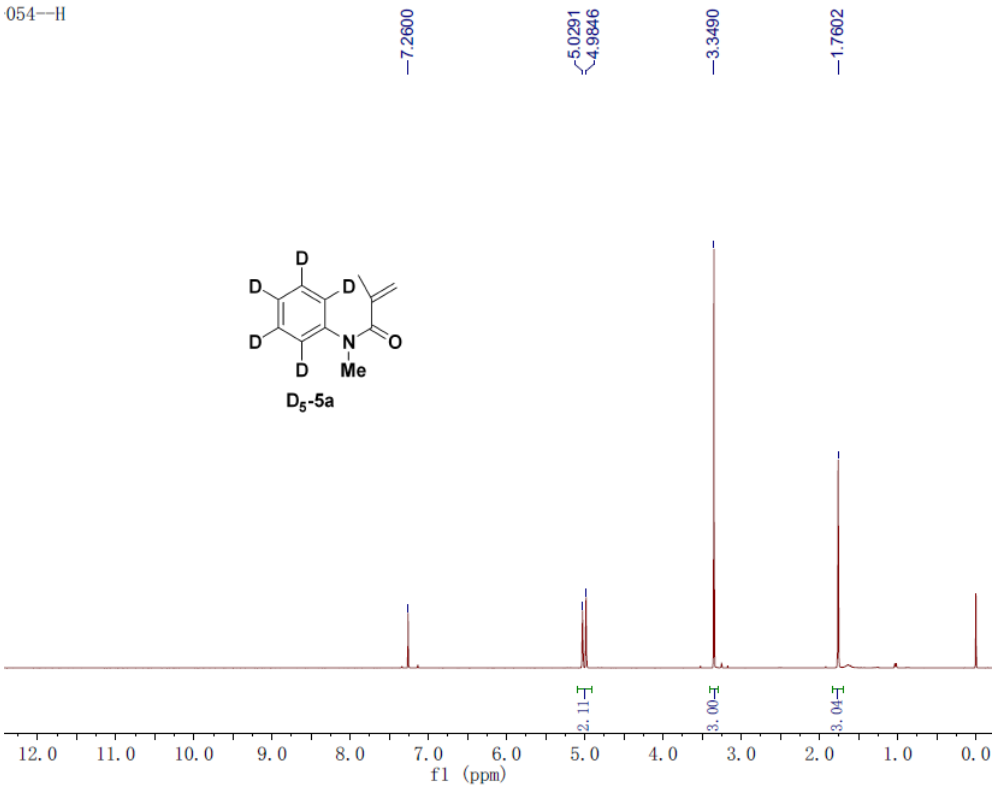
^{1}H NMR of **7ra** (400 M, $CDCl_3$)



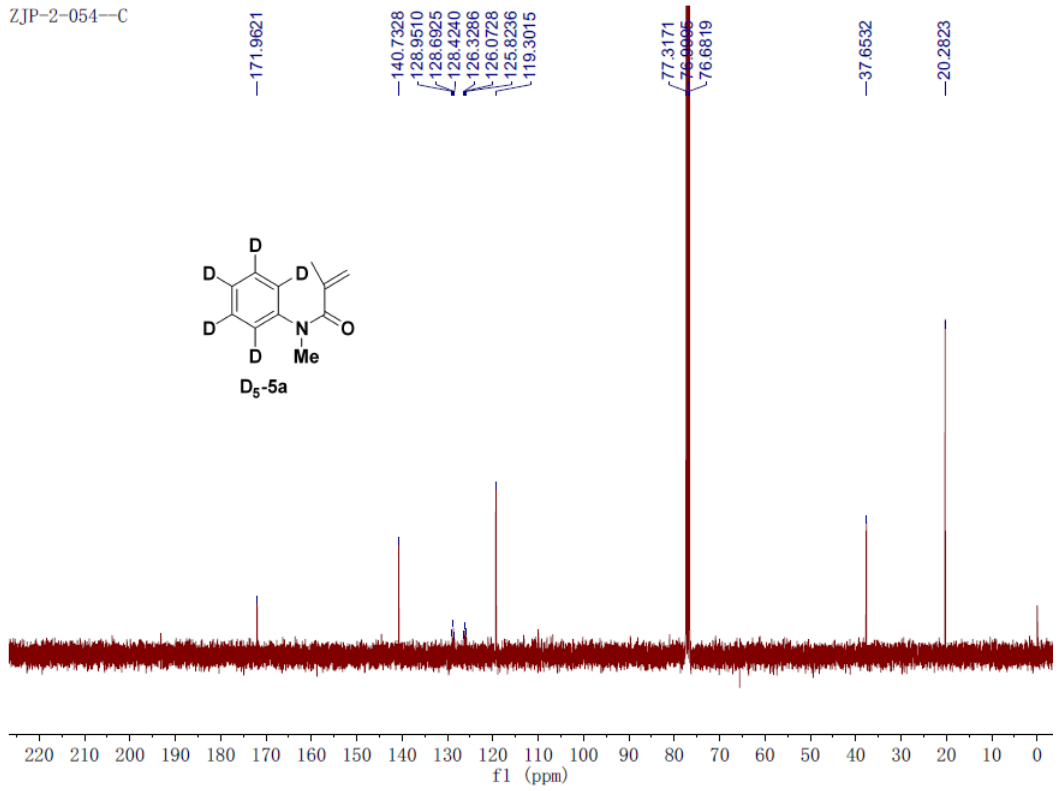
^{13}C NMR of **7ra** (100 M, $CDCl_3$)



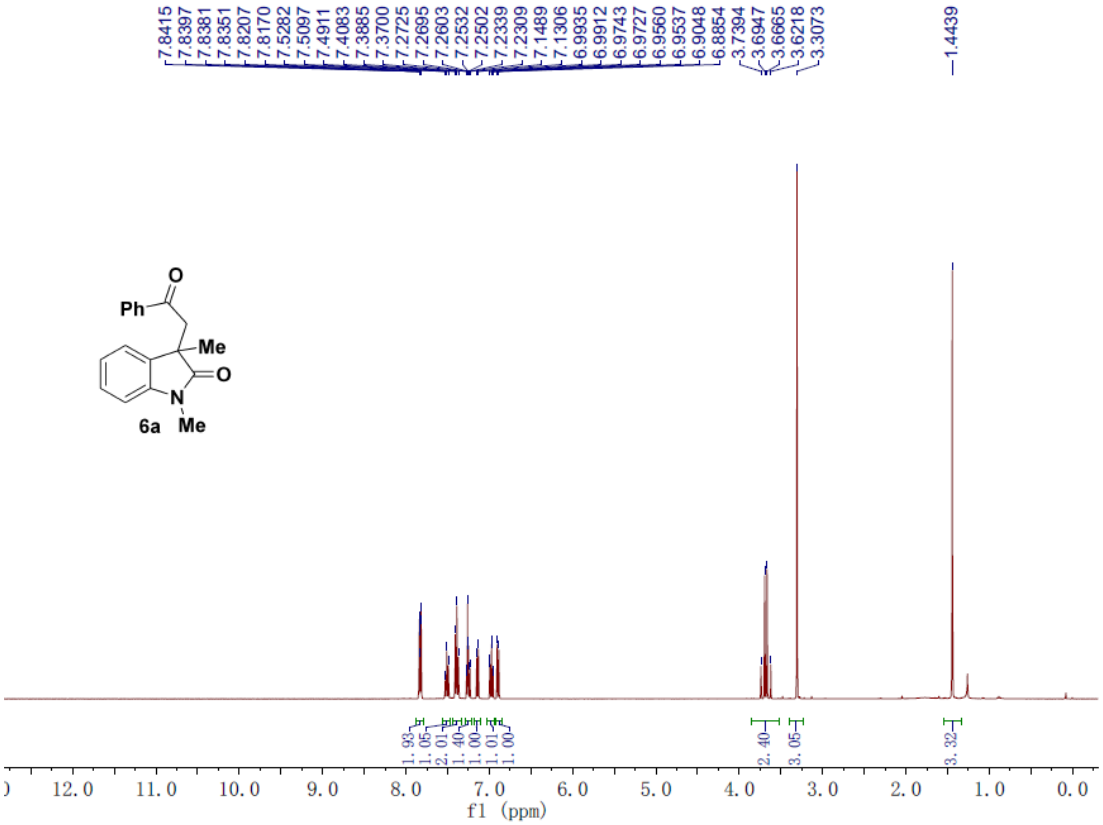
^{1}H NMR of D-**5a** (400 M, $CDCl_3$)



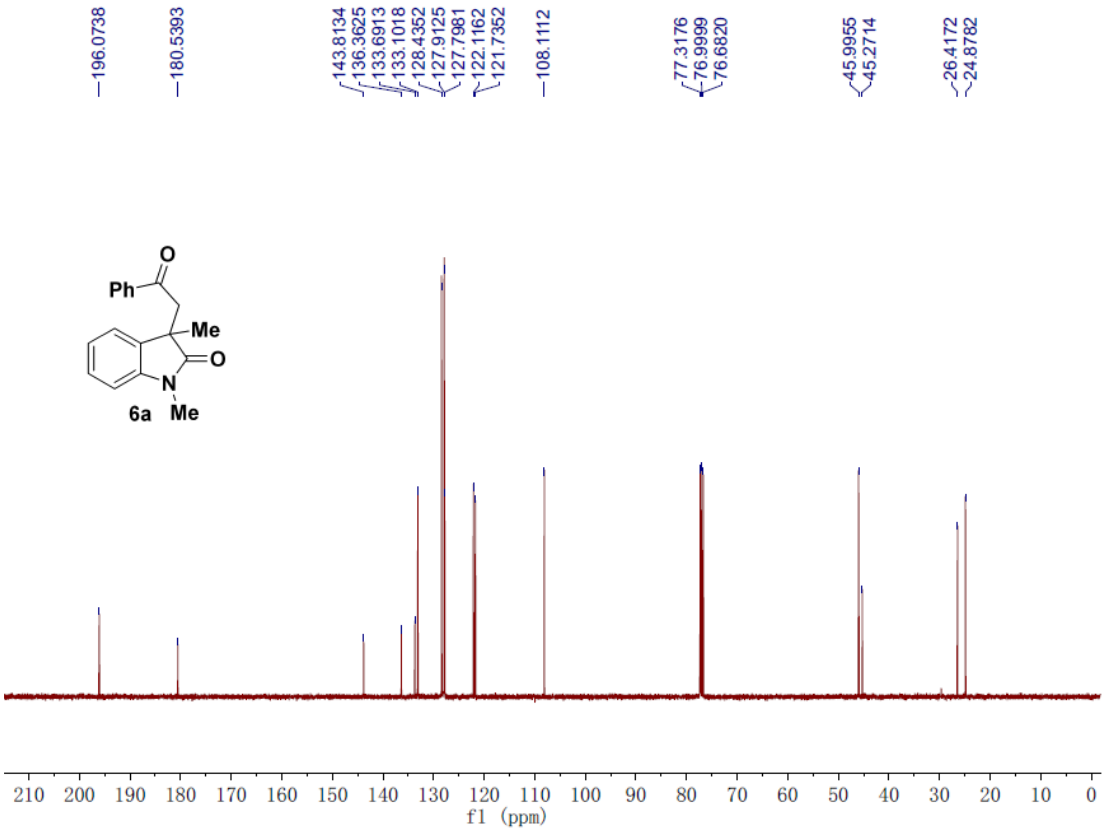
^{13}C NMR of D-**5a** (100 M, $CDCl_3$)



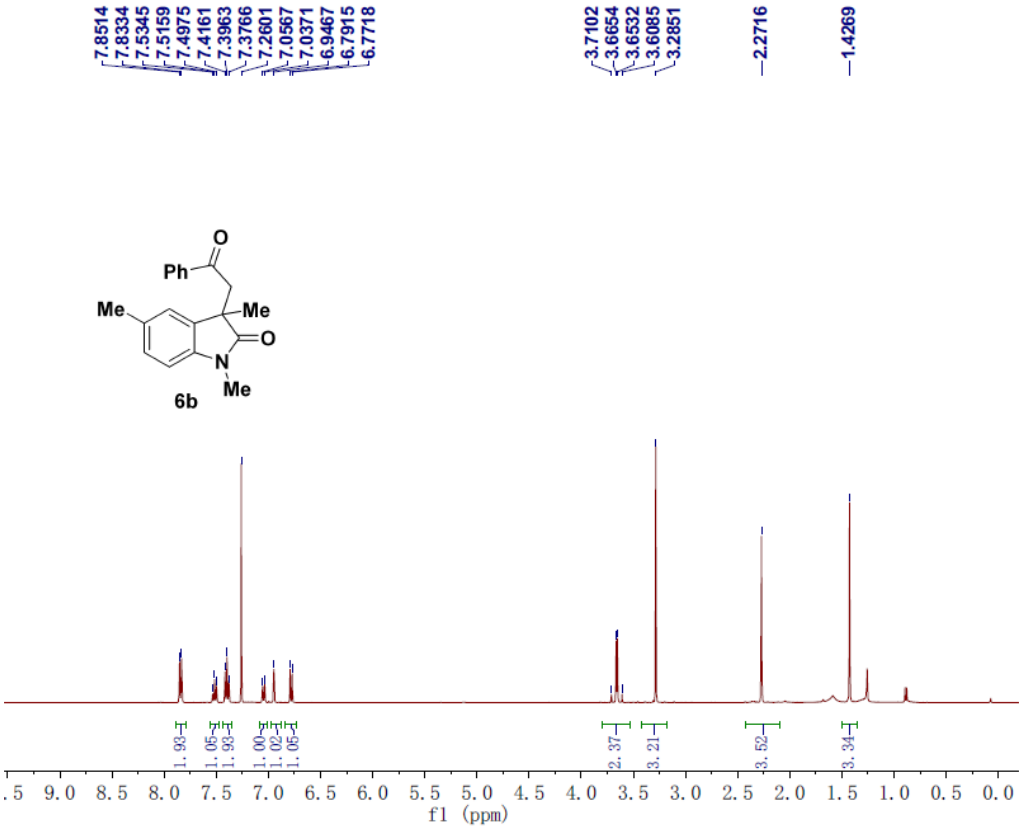
^{1}H NMR of **6a** (400 M, $CDCl_3$)



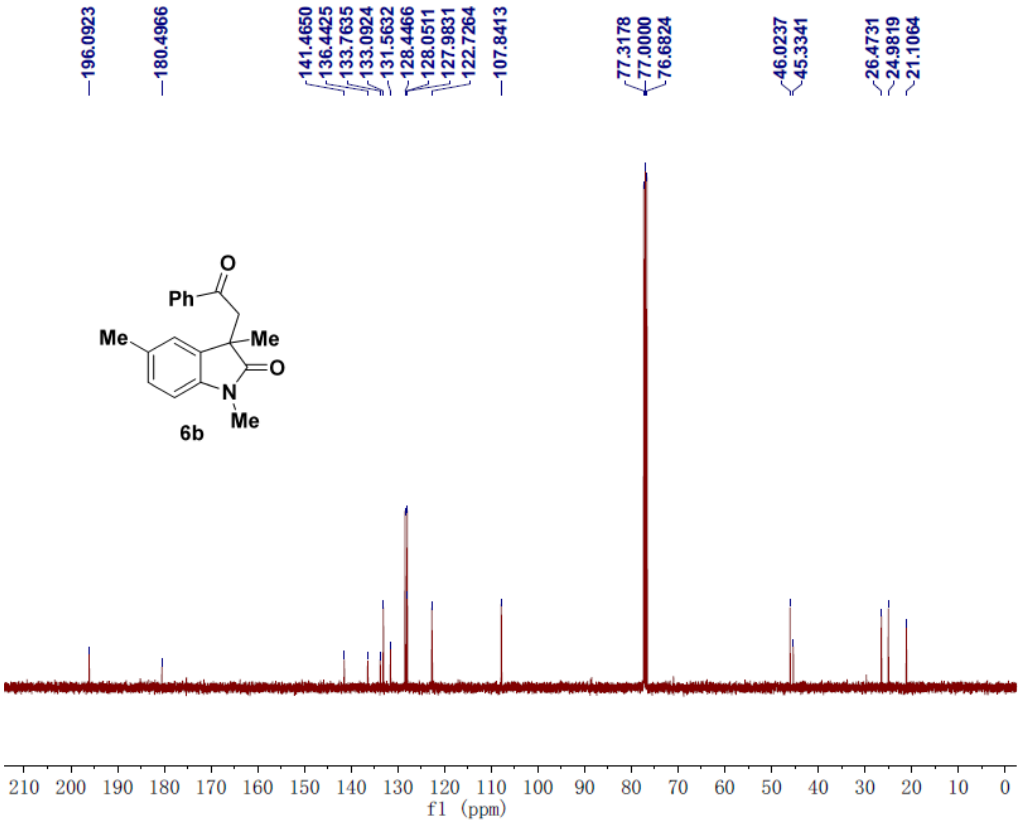
^{13}C NMR of **6a** (100 M, $CDCl_3$)



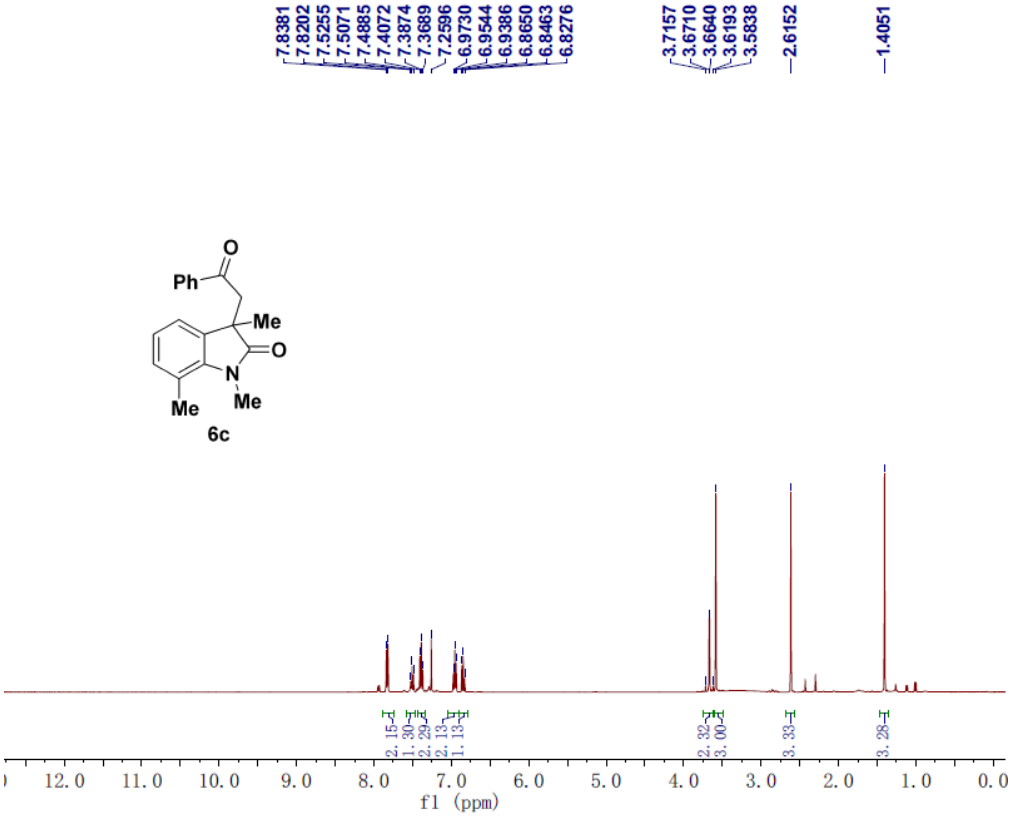
^{1}H NMR of **6b** (400 M, $CDCl_3$)



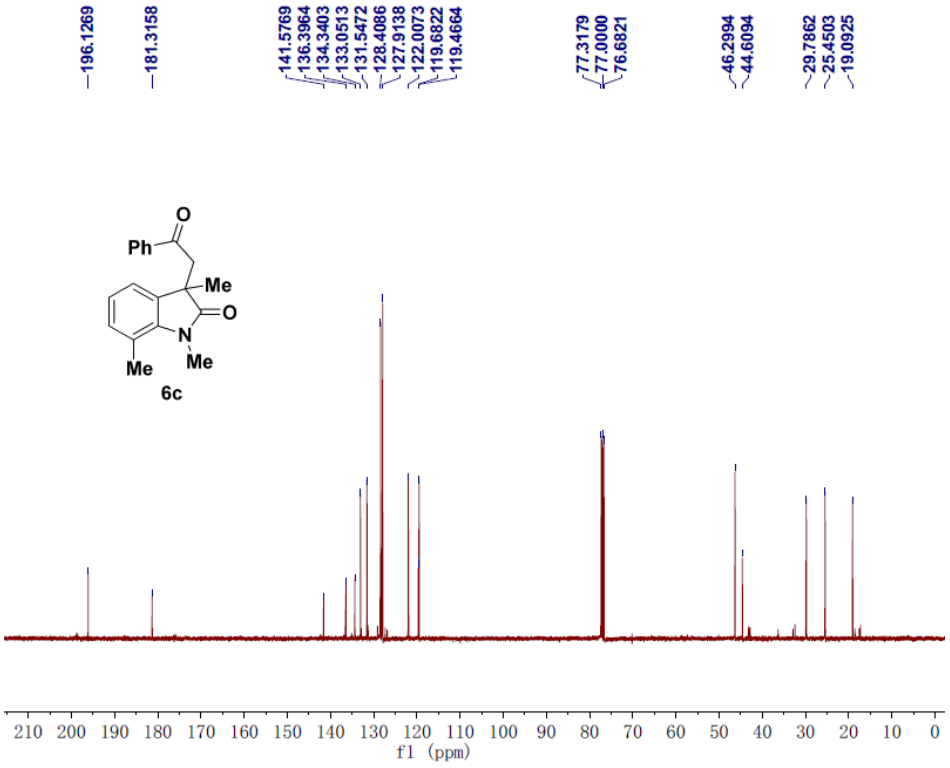
^{13}C NMR of **6b** (100 M, $CDCl_3$)



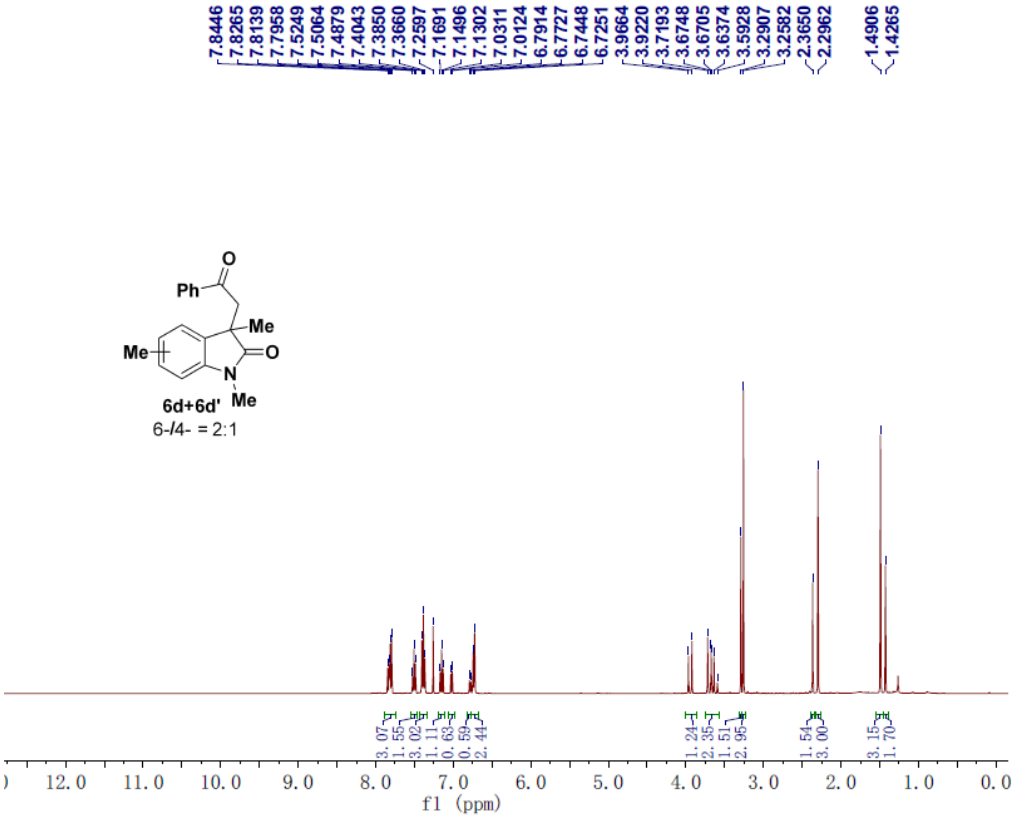
^{1}H NMR of **6c** (400 M, $CDCl_3$)



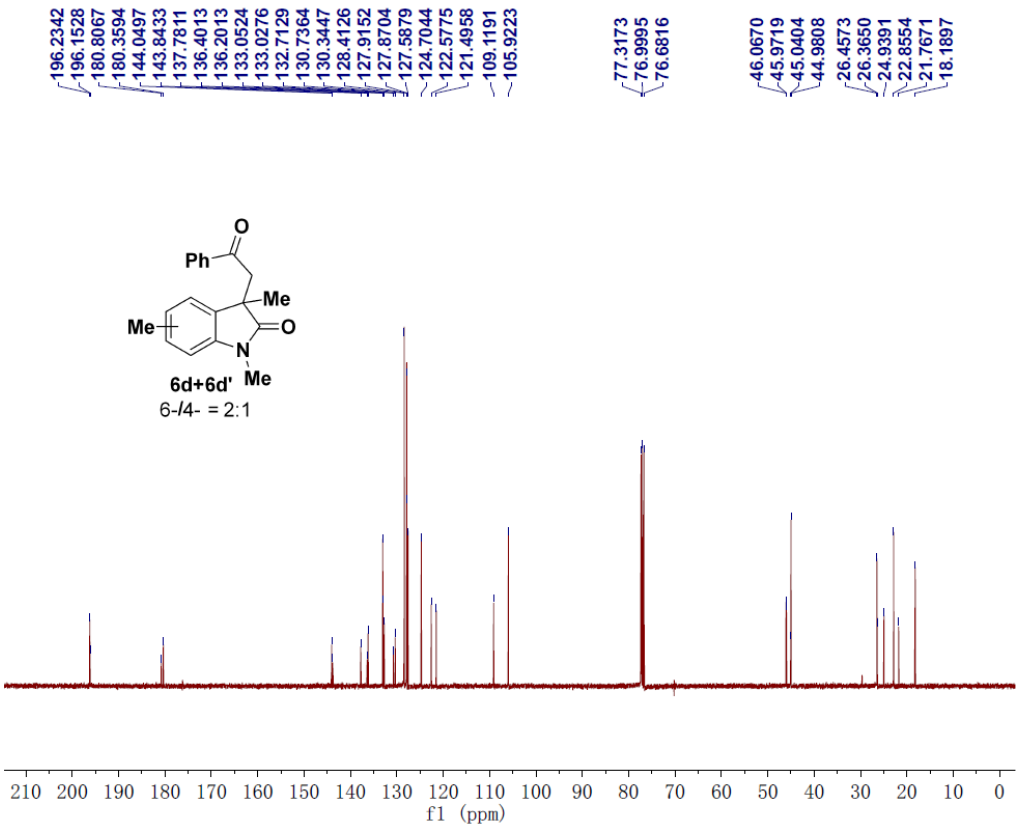
^{13}C NMR of **6c** (100 M, $CDCl_3$)



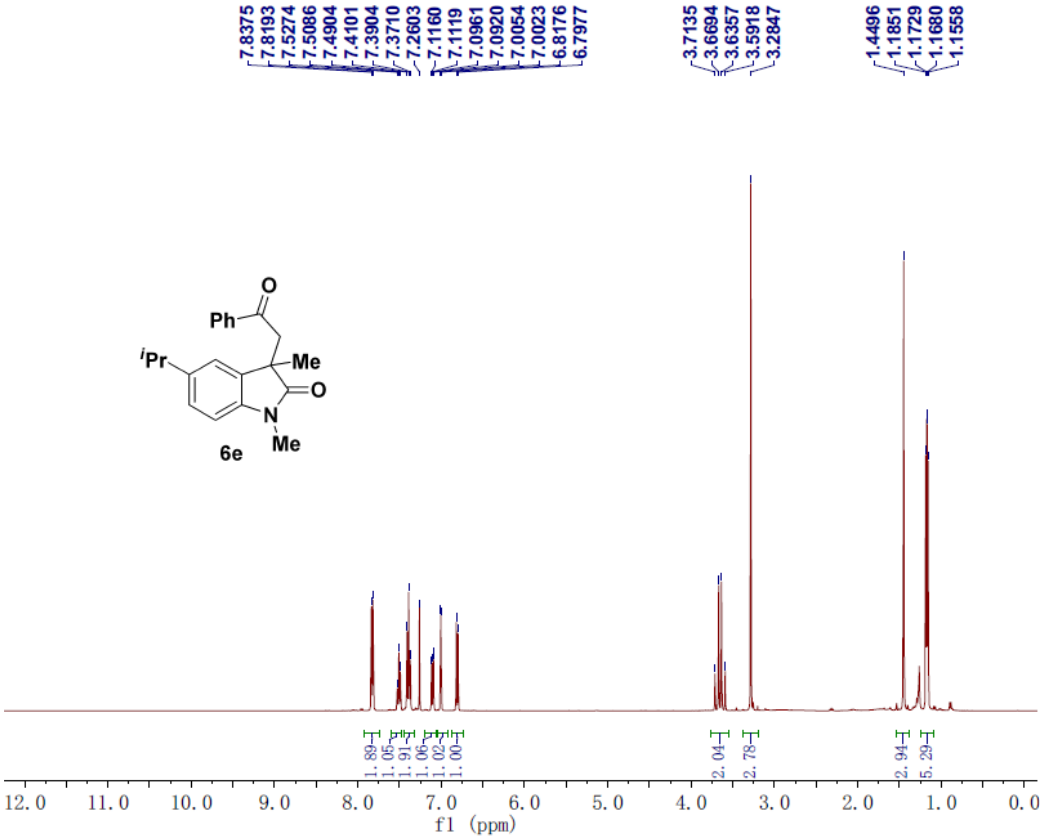
^{1}H NMR of **6d** (400 M, $CDCl_3$)



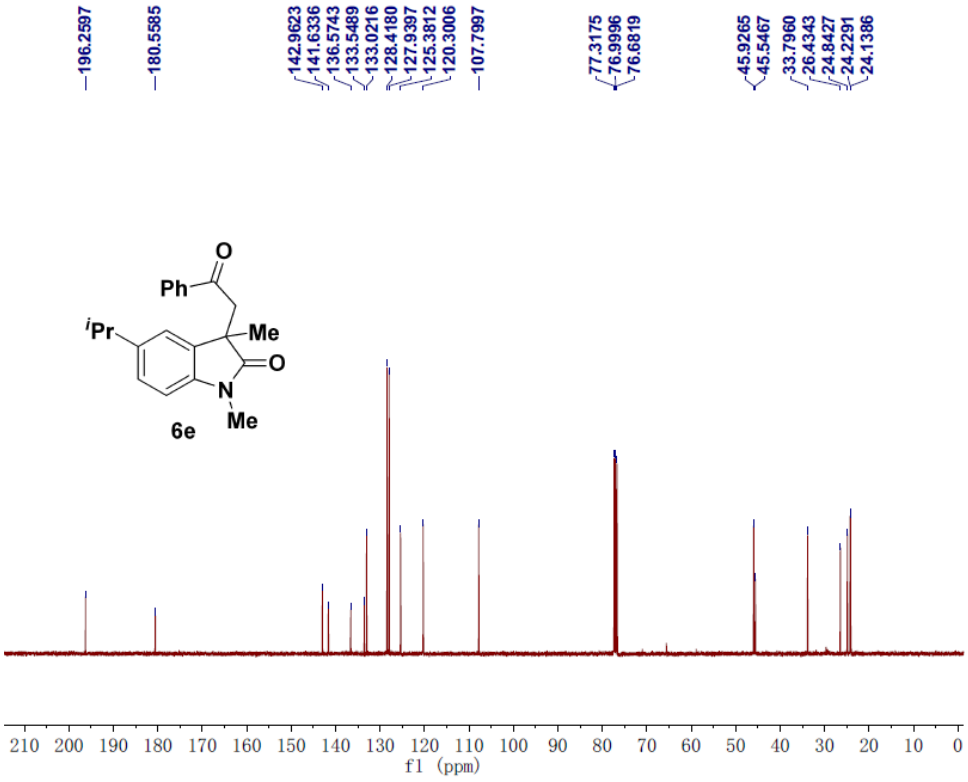
^{13}C NMR of **6d** (100 M, $CDCl_3$)



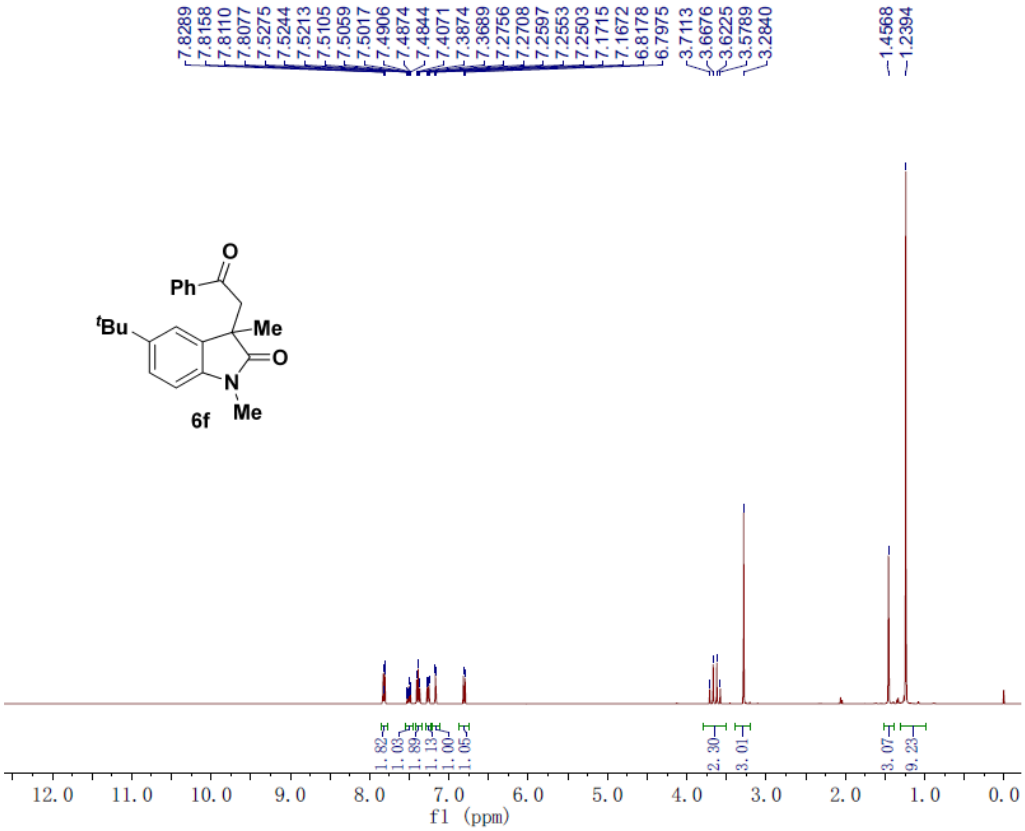
^{1}H NMR of **6e** (400 M, $CDCl_3$)



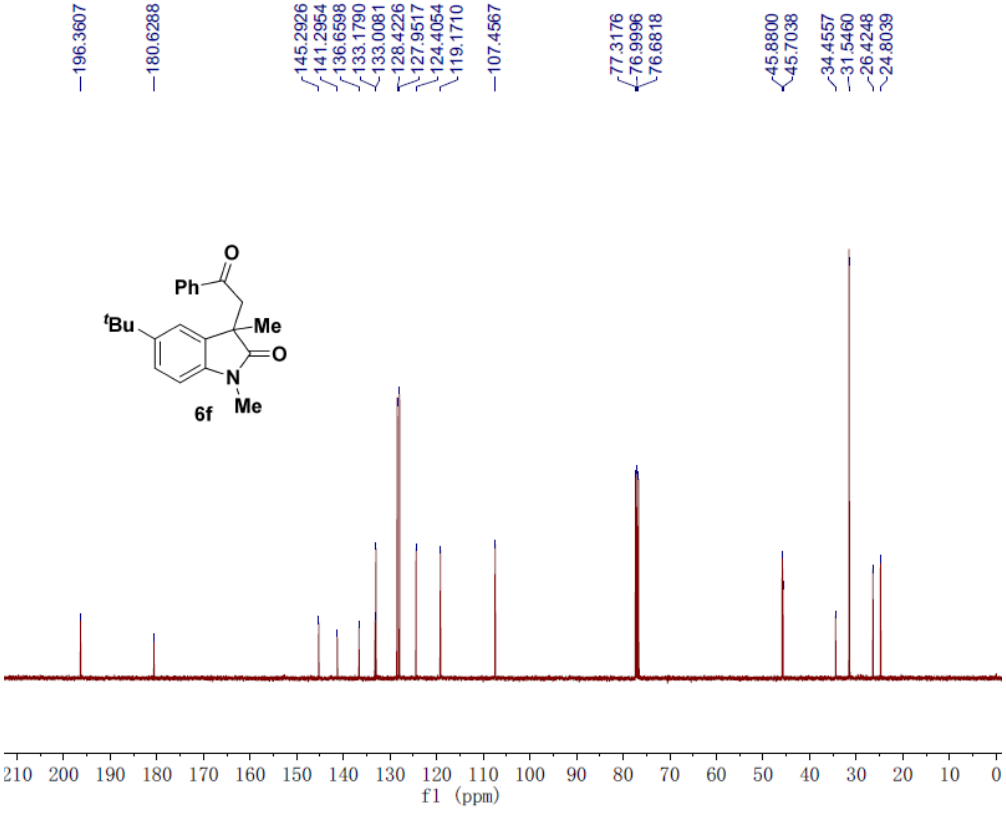
^{13}C NMR of **6e** (100 M, $CDCl_3$)



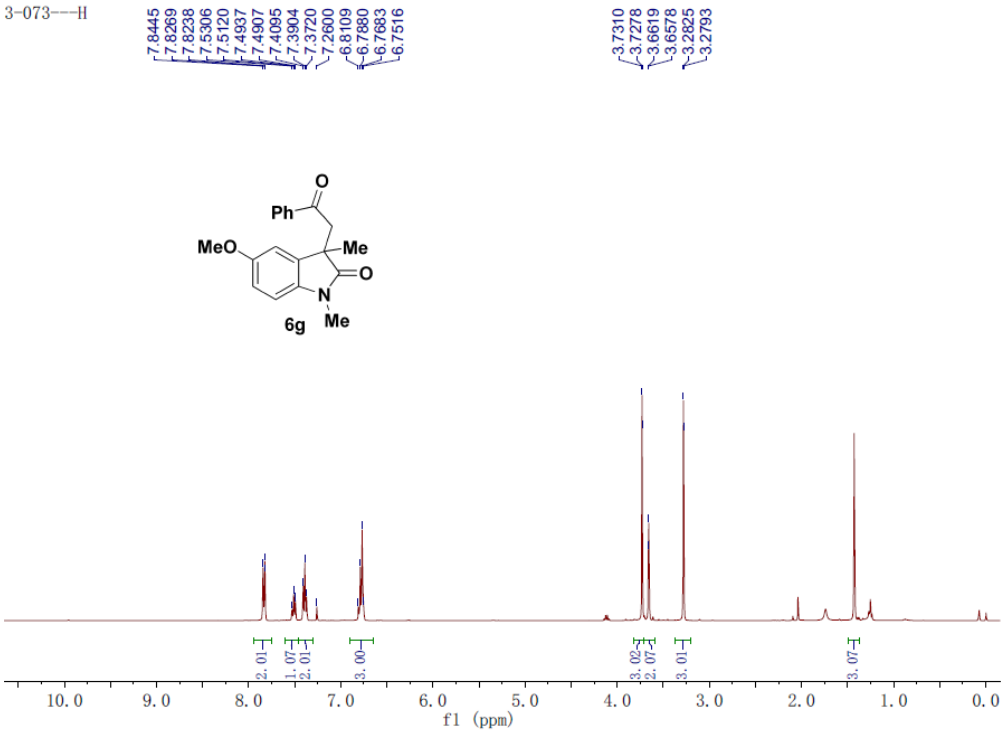
^{1}H NMR of **6f** (400 M, $CDCl_3$)



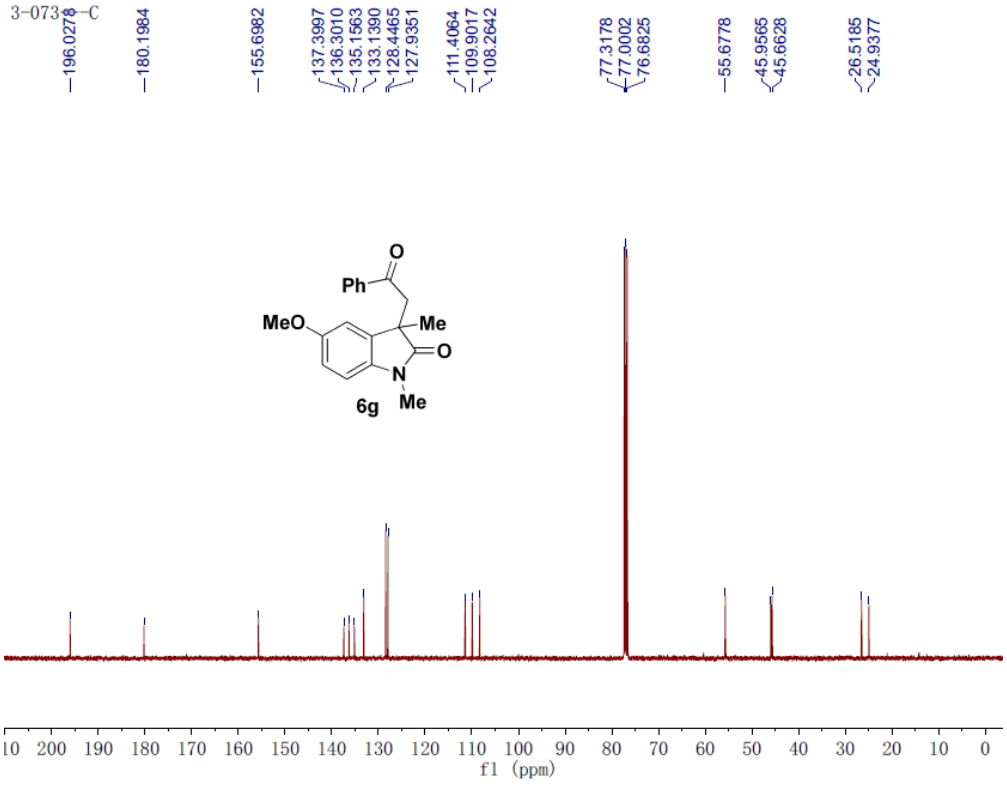
^{13}C NMR of **6f** (100 M, $CDCl_3$)



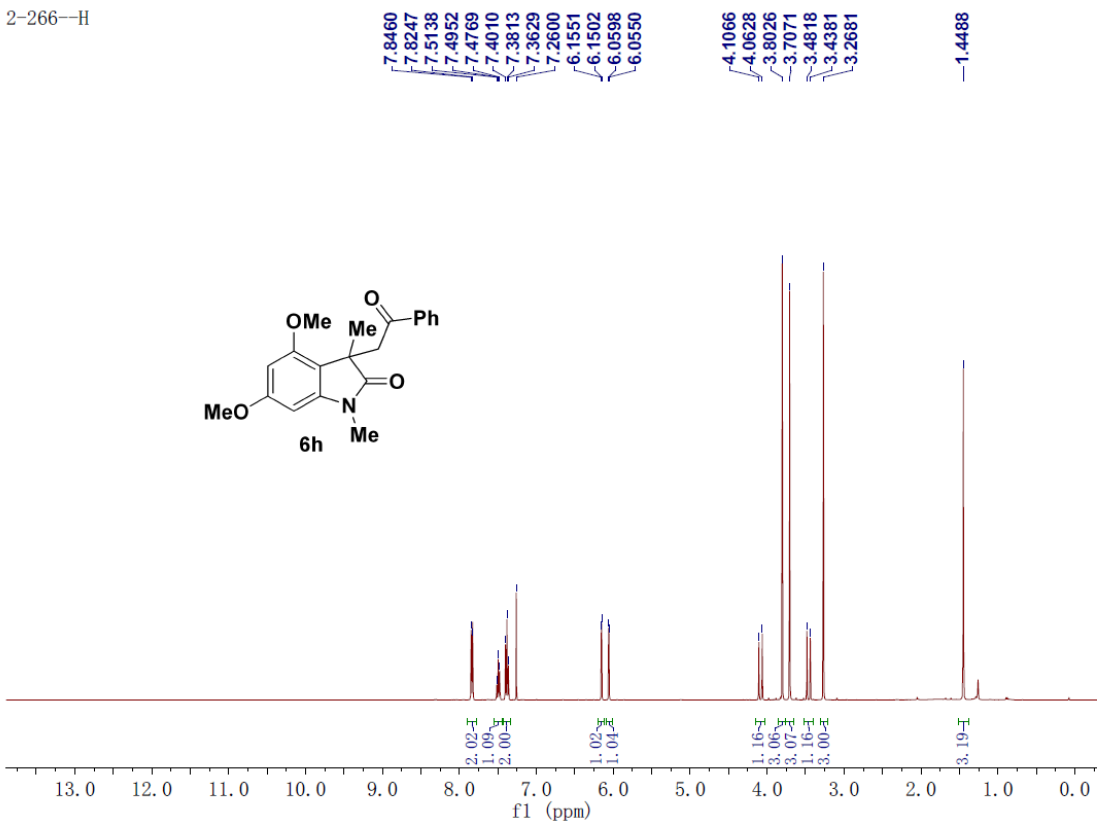
^{1}H NMR of **6g** (400 M, $CDCl_3$)



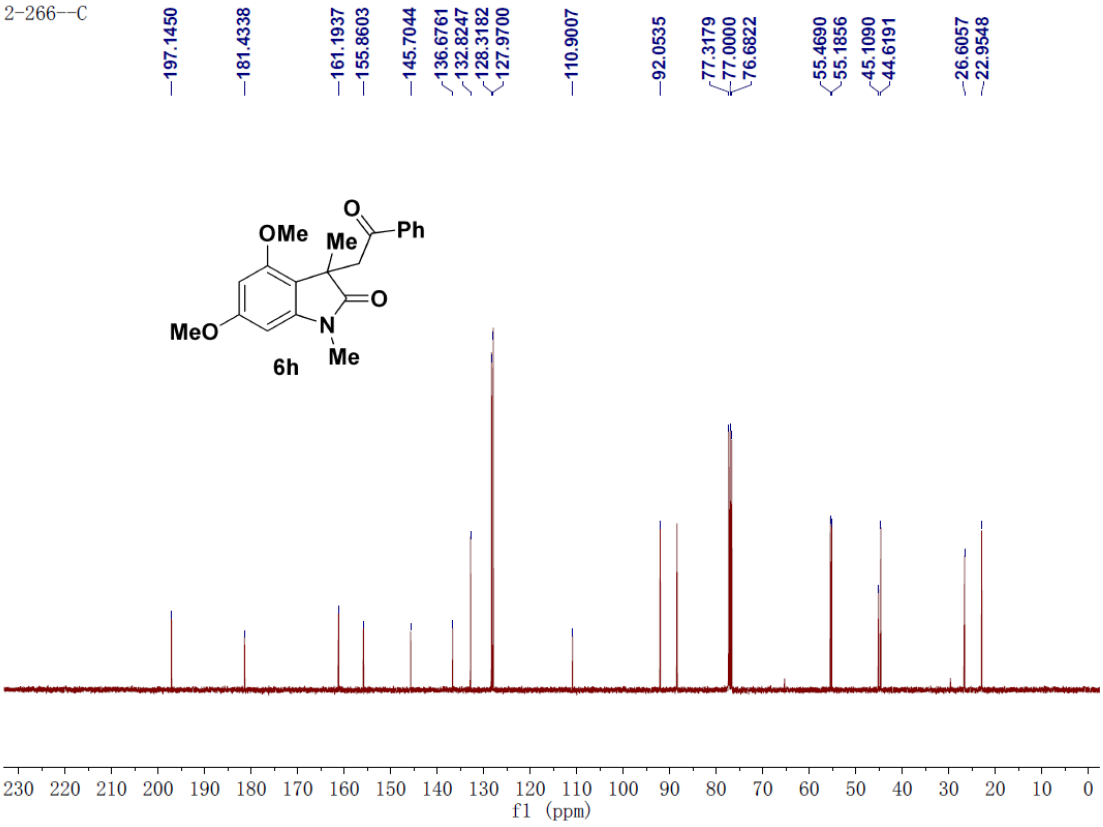
^{13}C NMR of **6g** (100 M, $CDCl_3$)



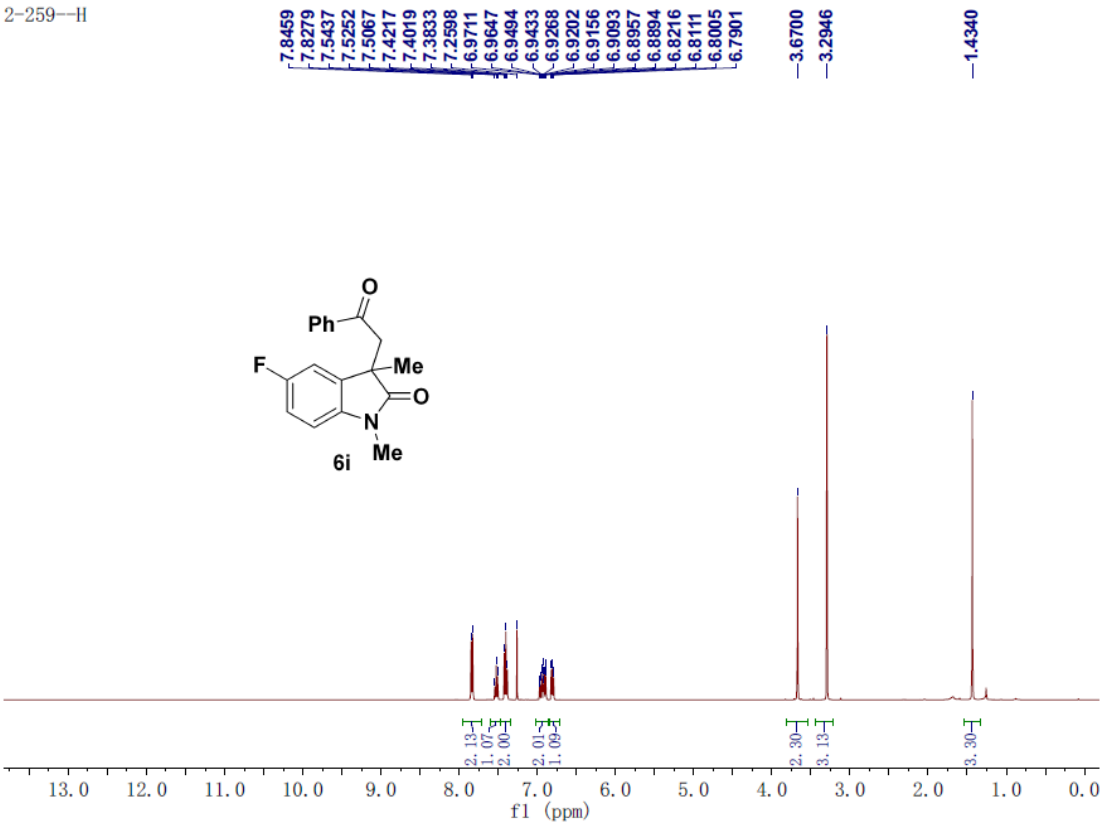
^{1}H NMR of **6h** (400 M, $CDCl_3$)



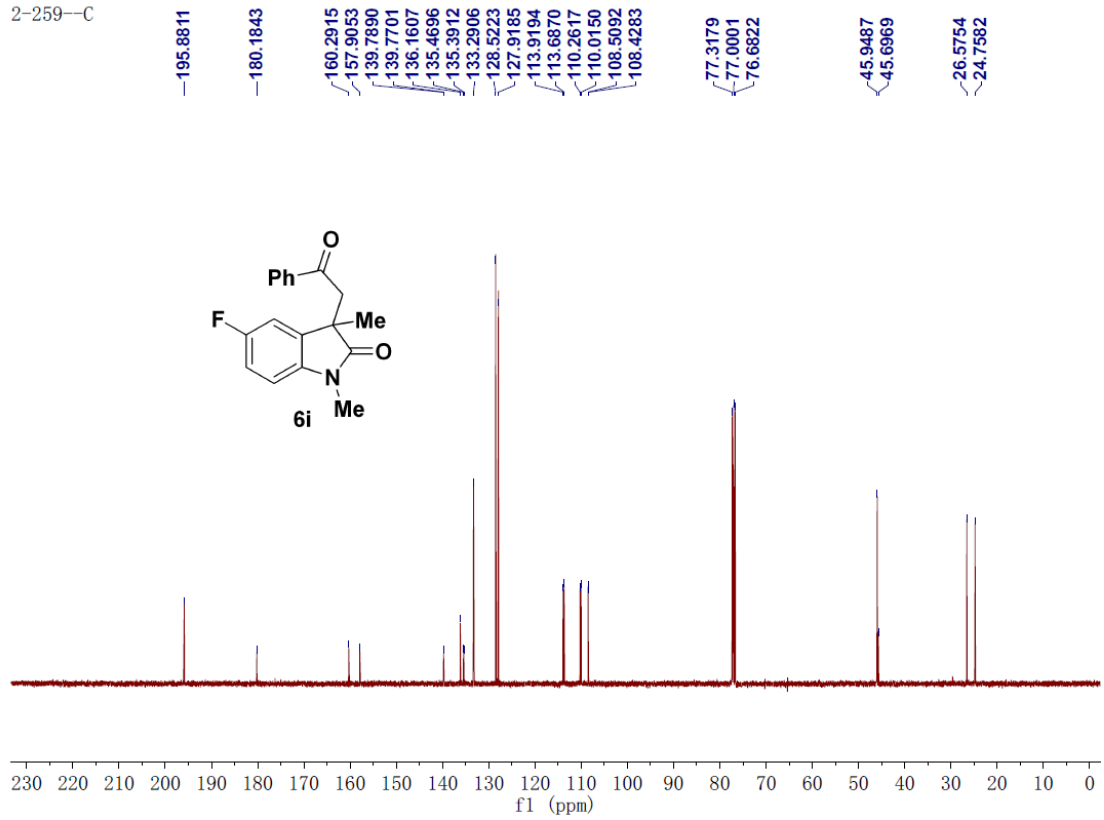
^{13}C NMR of **6h** (100 M, $CDCl_3$)



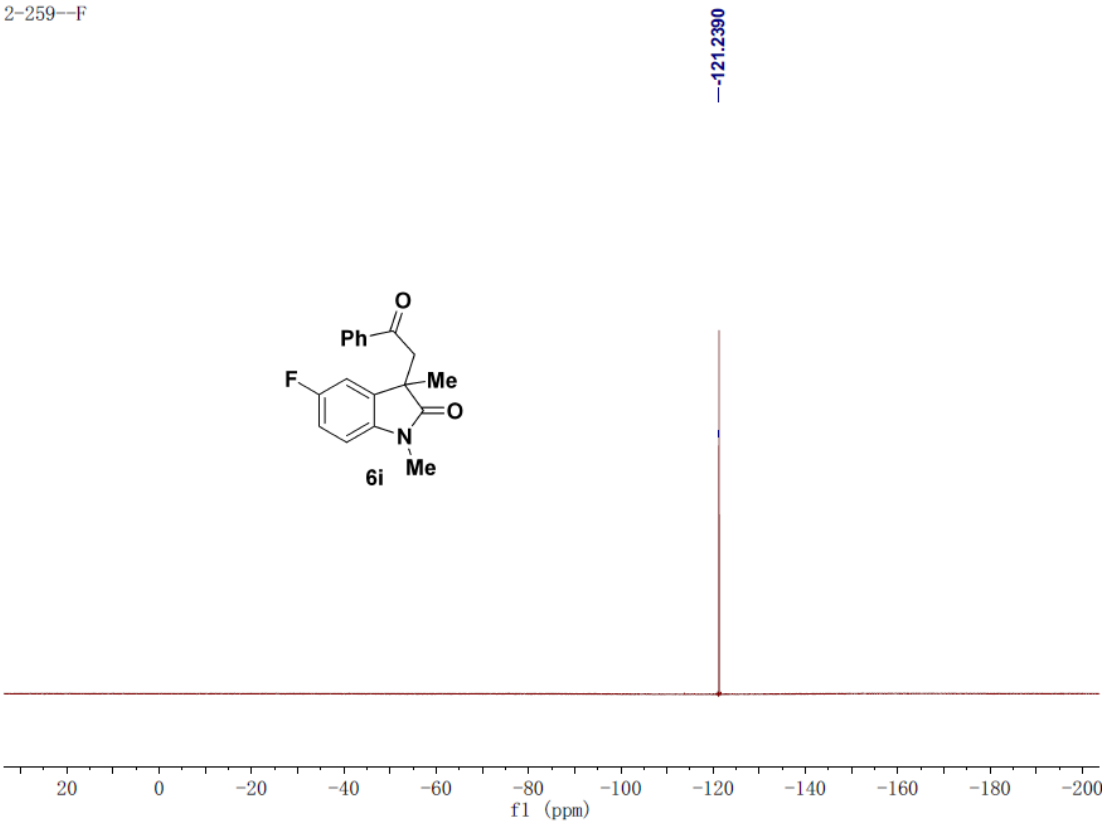
^{1}H NMR of **6i** (400 M, $CDCl_3$)



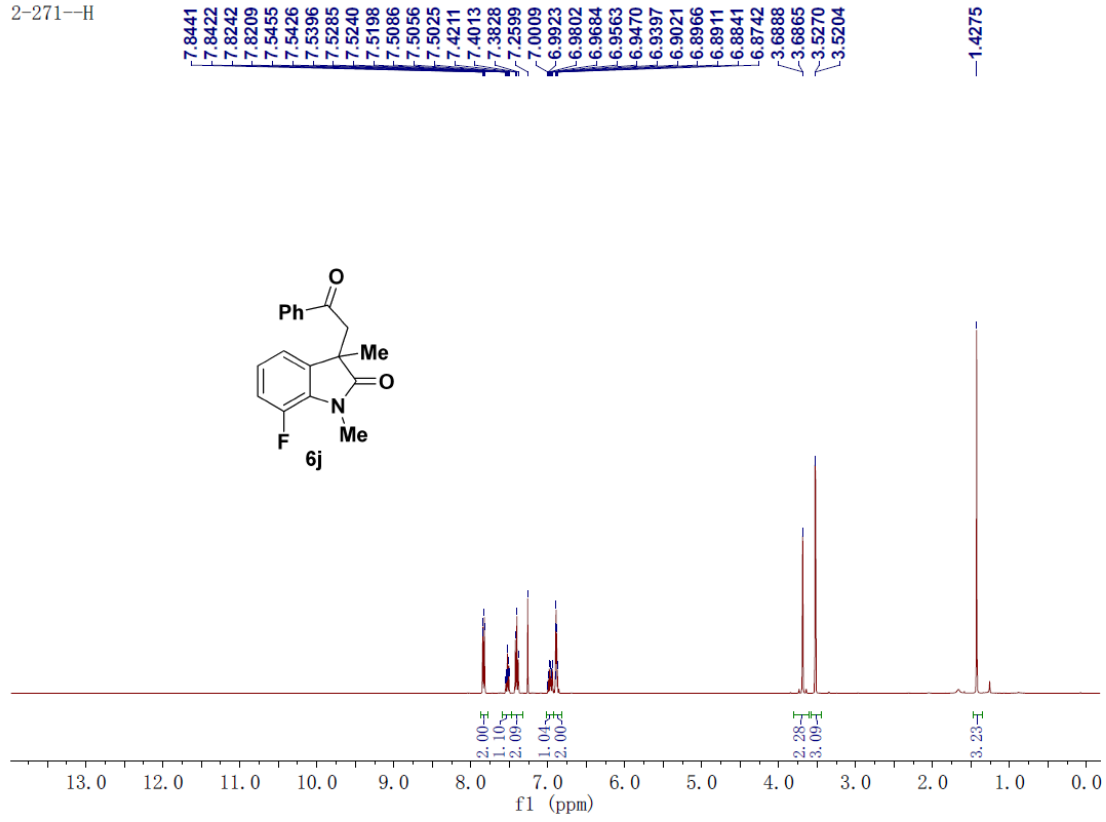
^{13}C NMR of **6i** (100 M, $CDCl_3$)



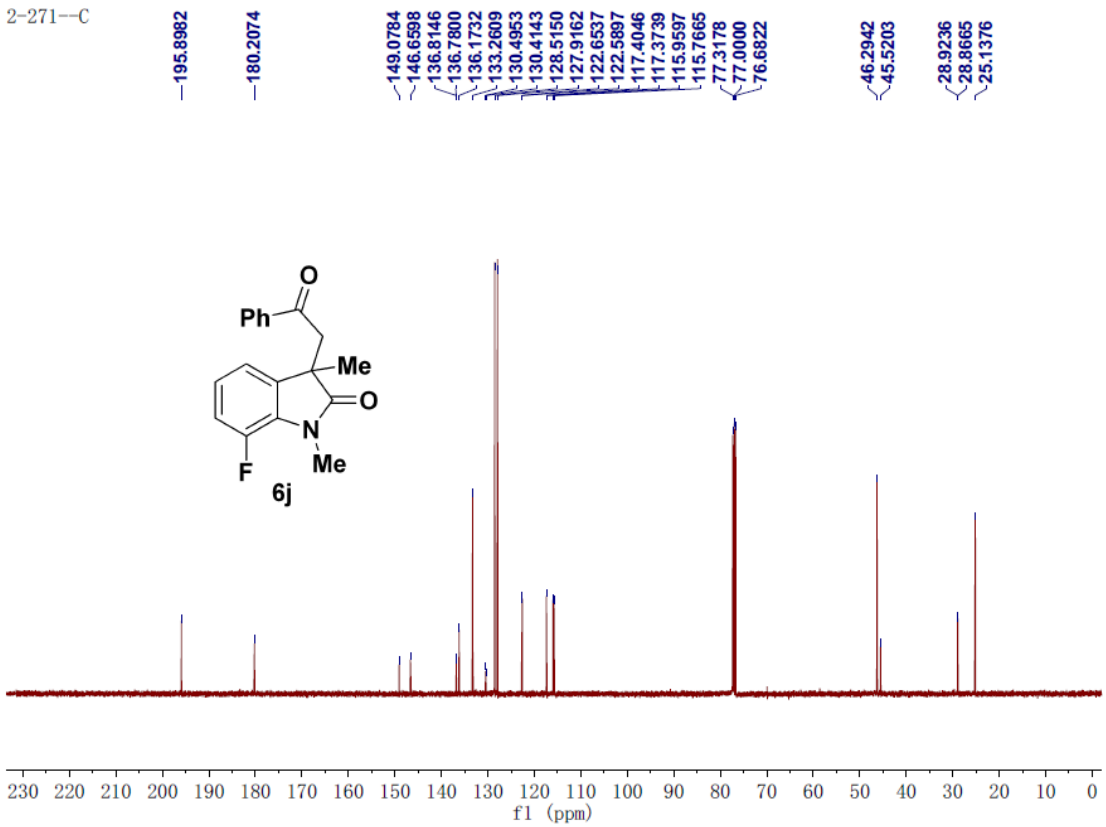
^{19}FNMR of **6i** (376M, $CDCl_3$)



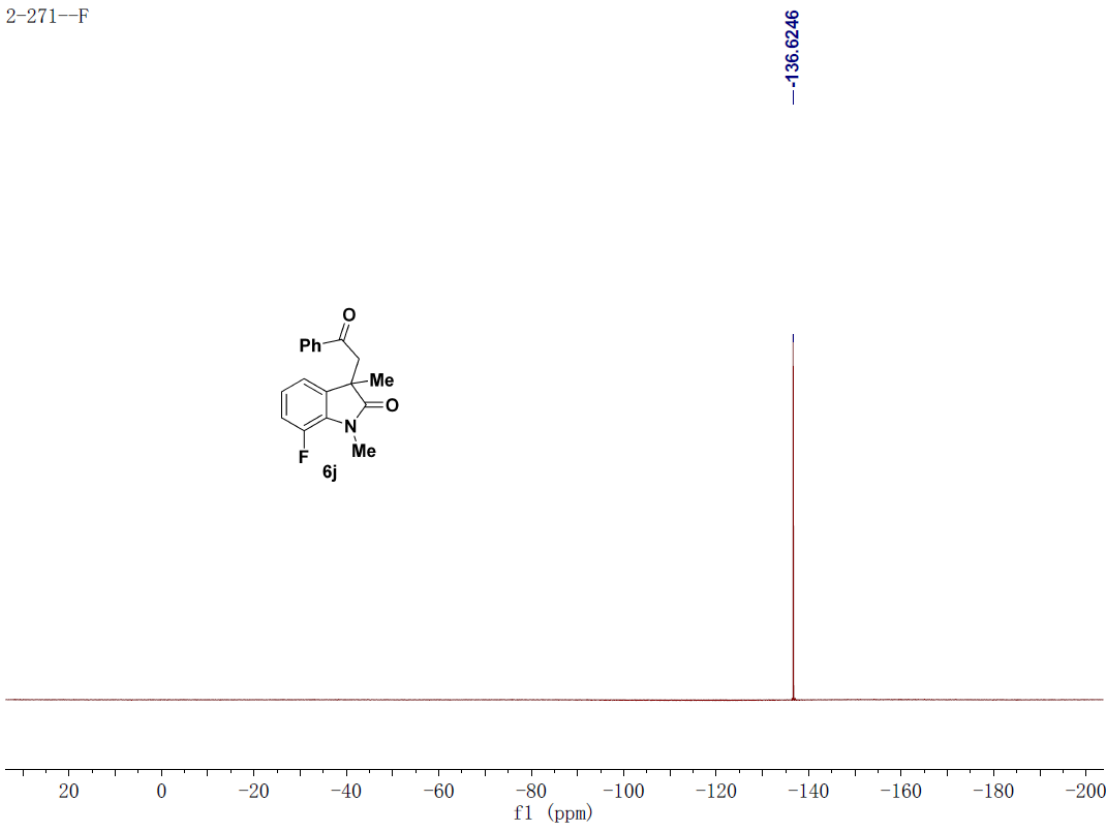
^{1}H NMR of **6j** (400 M, $CDCl_3$)



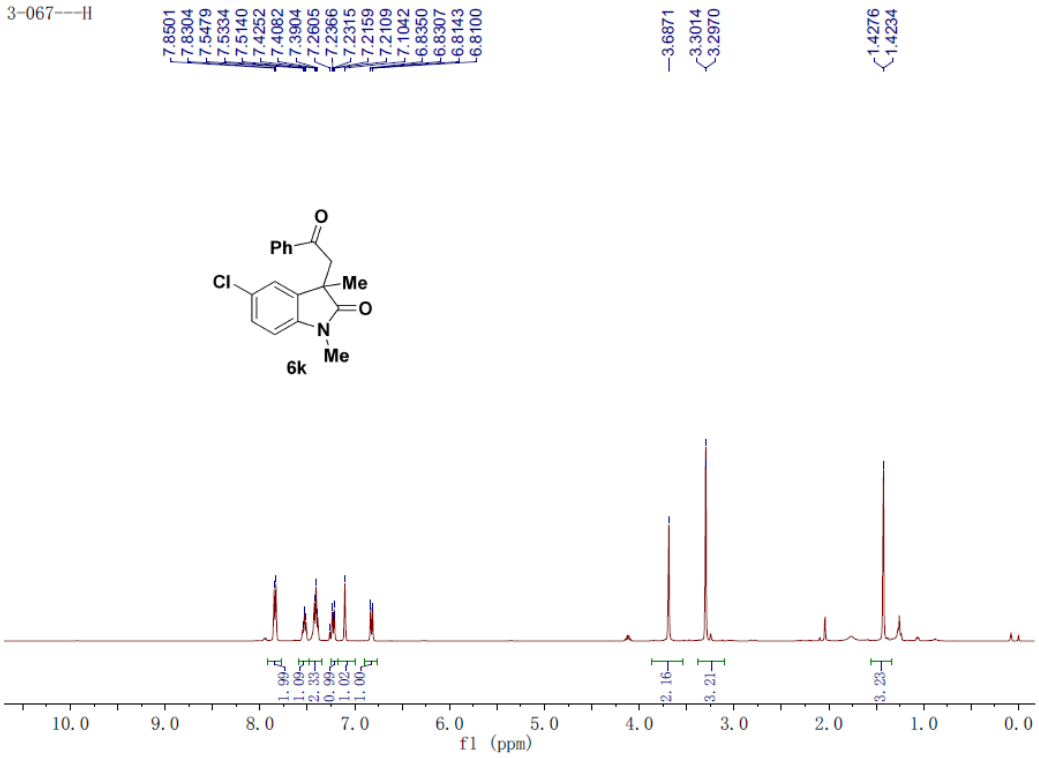
^{13}C NMR of **6j** (100 M, $CDCl_3$)



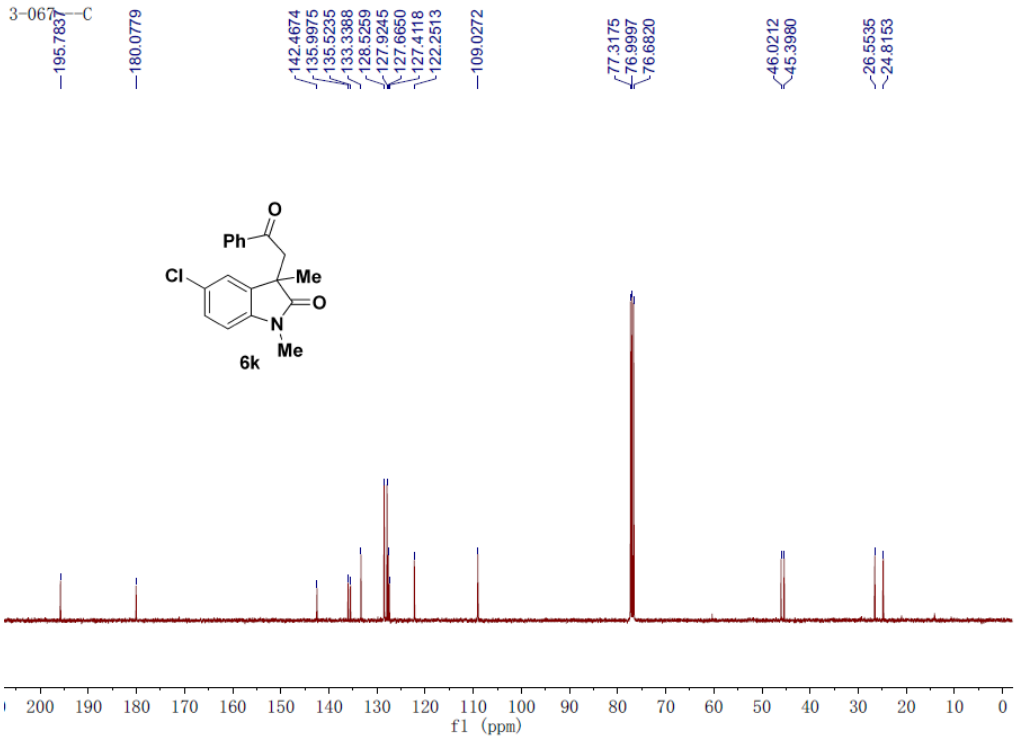
^{19}FNMR of **6j** (376M, $CDCl_3$)



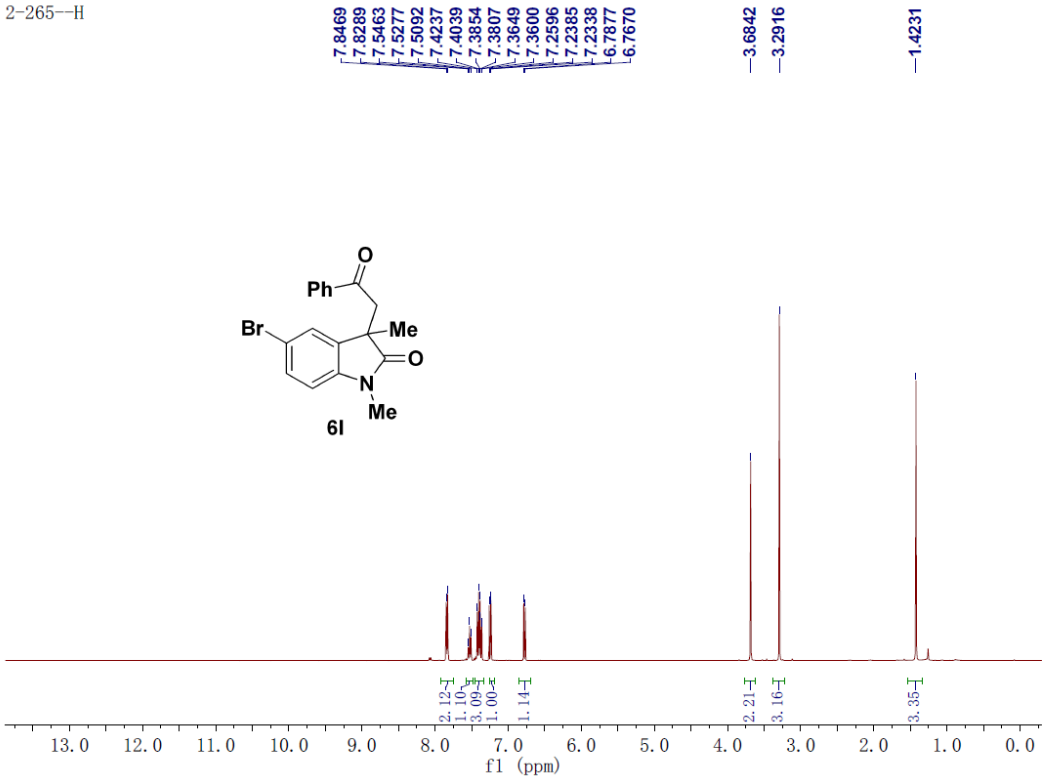
^{1}H NMR of **6k** (400 M, $CDCl_3$)



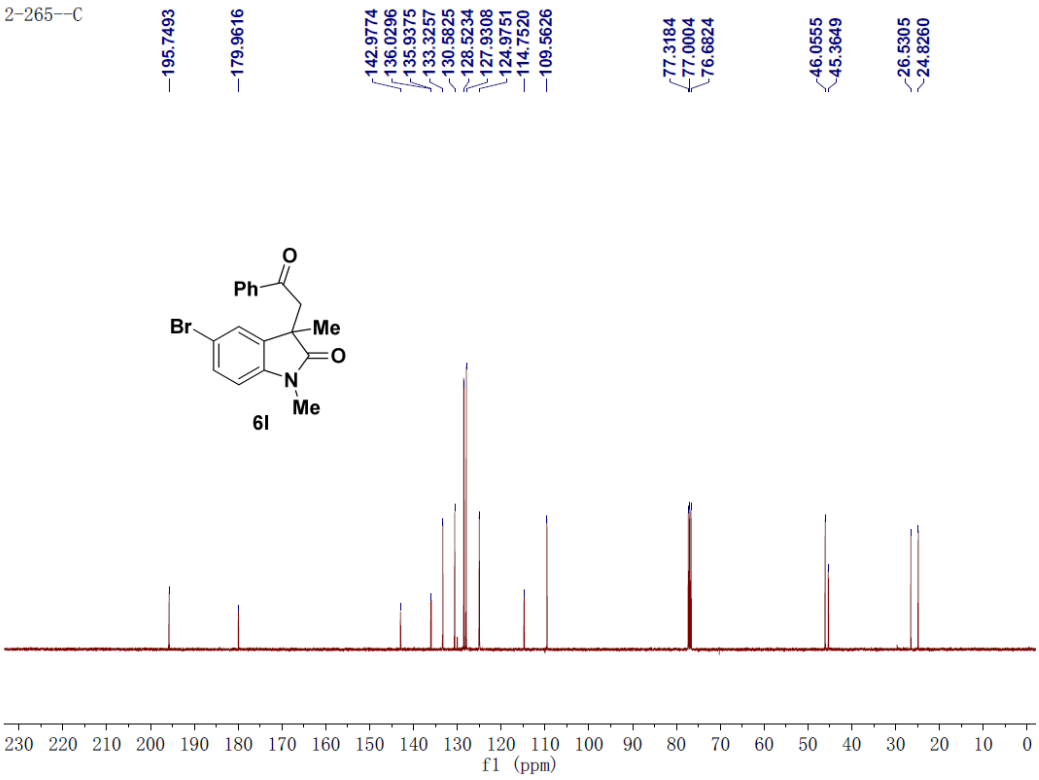
^{13}C NMR of **6k** (100 M, $CDCl_3$)



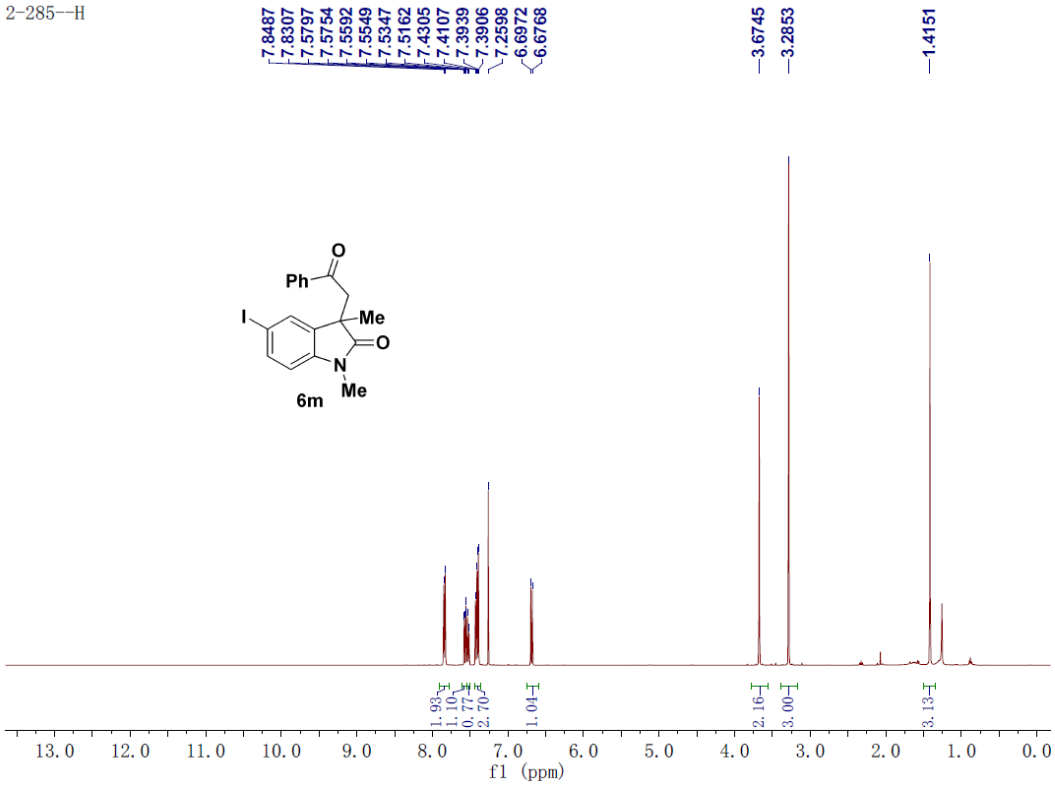
^{1}H NMR of **6l** (400 M, $CDCl_3$)



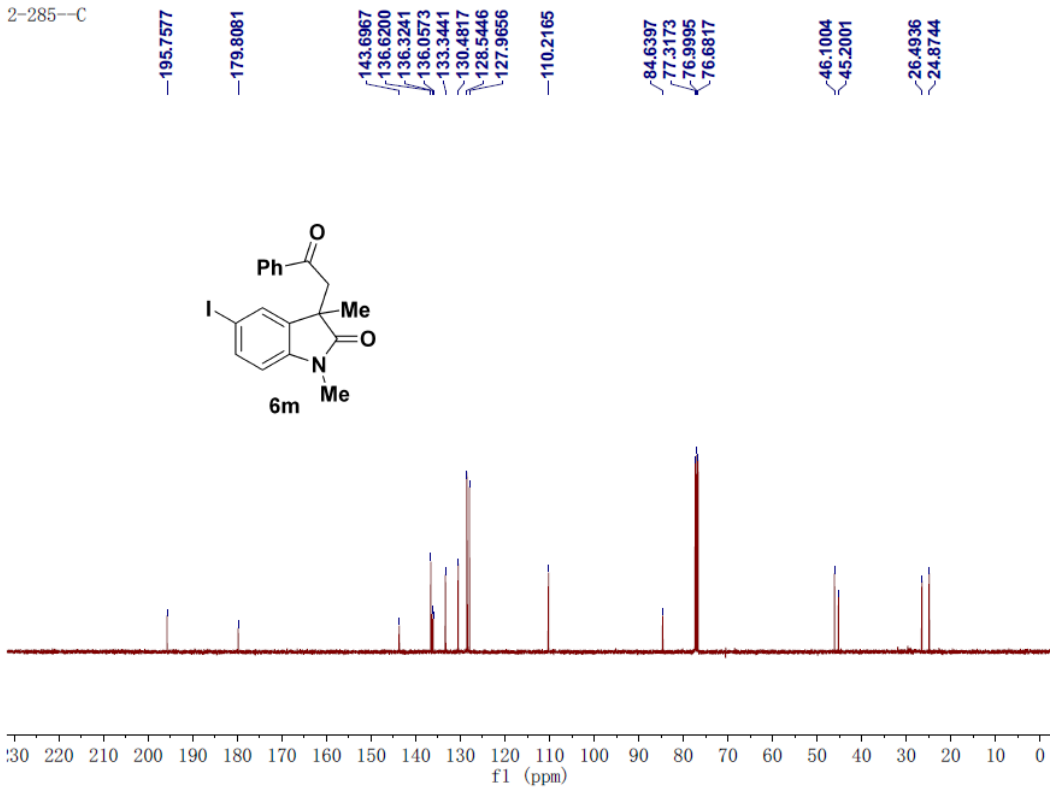
^{13}C NMR of **6l** (100 M, $CDCl_3$)



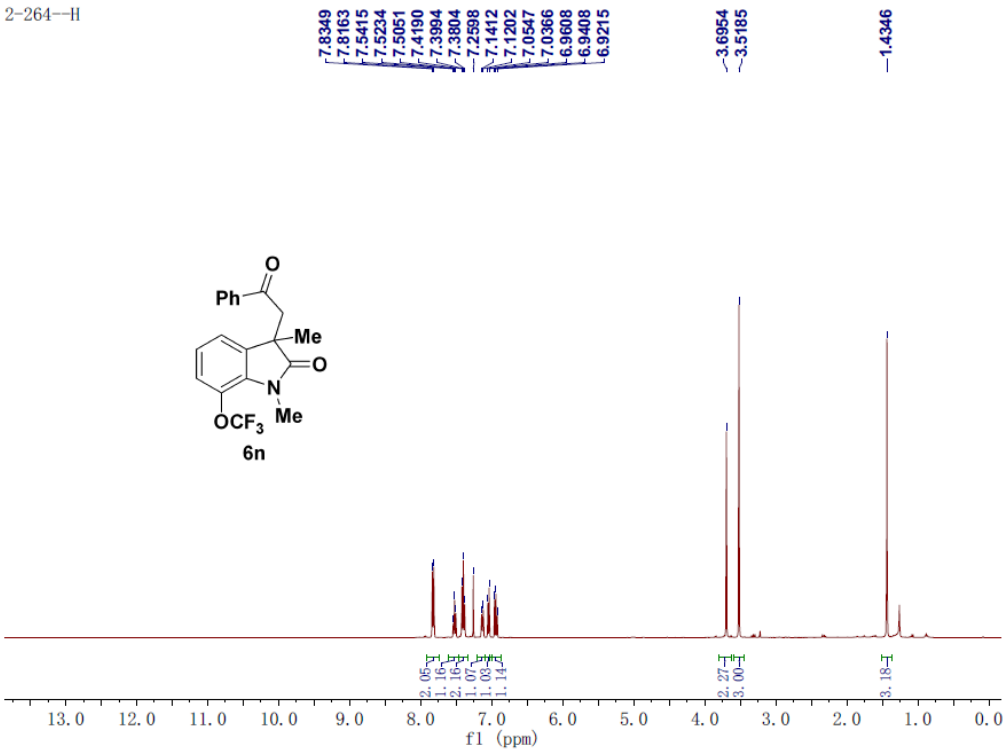
^{1}H NMR of **6m** (400 M, $CDCl_3$)



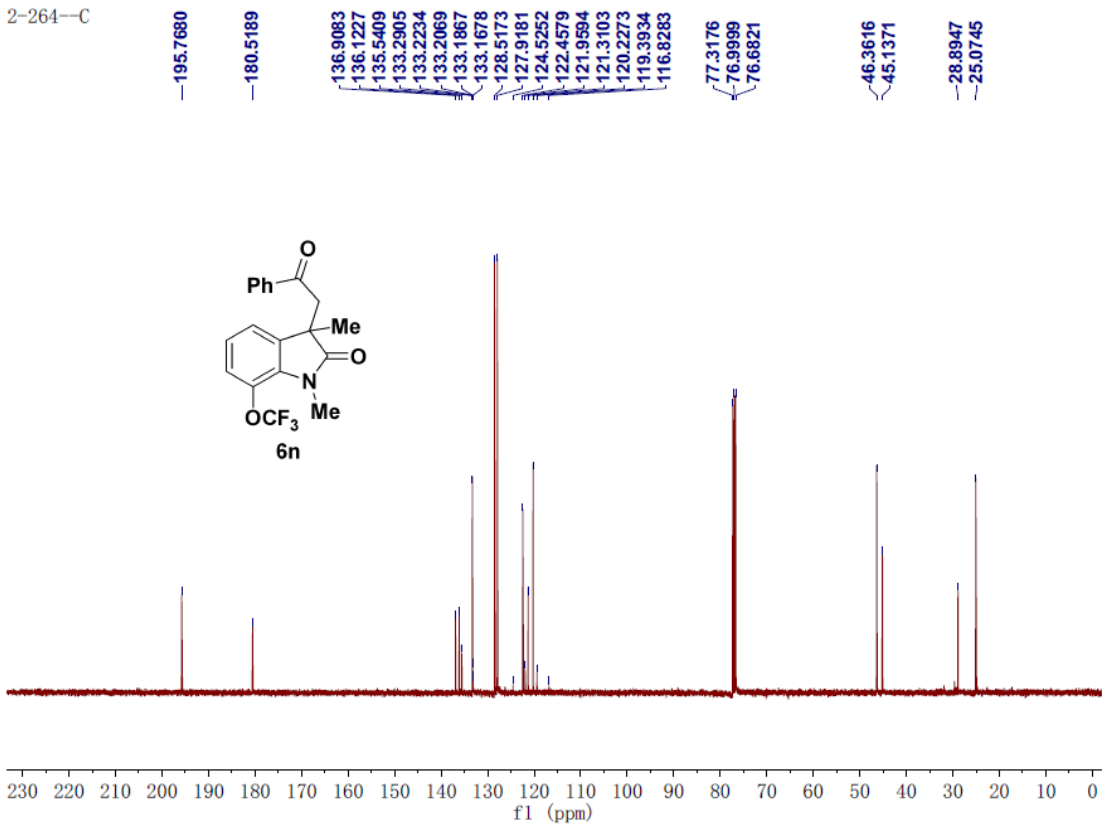
^{13}C NMR of **6m** (100 M, $CDCl_3$)



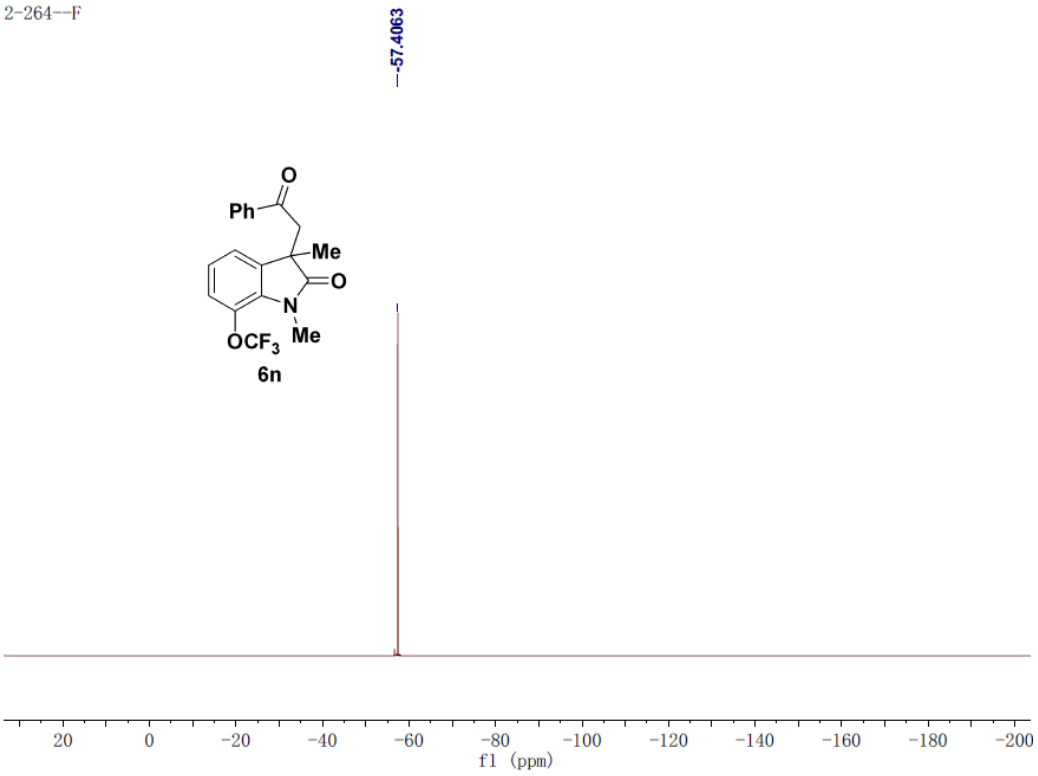
^{1}H NMR of **6n** (400 M, $CDCl_3$)



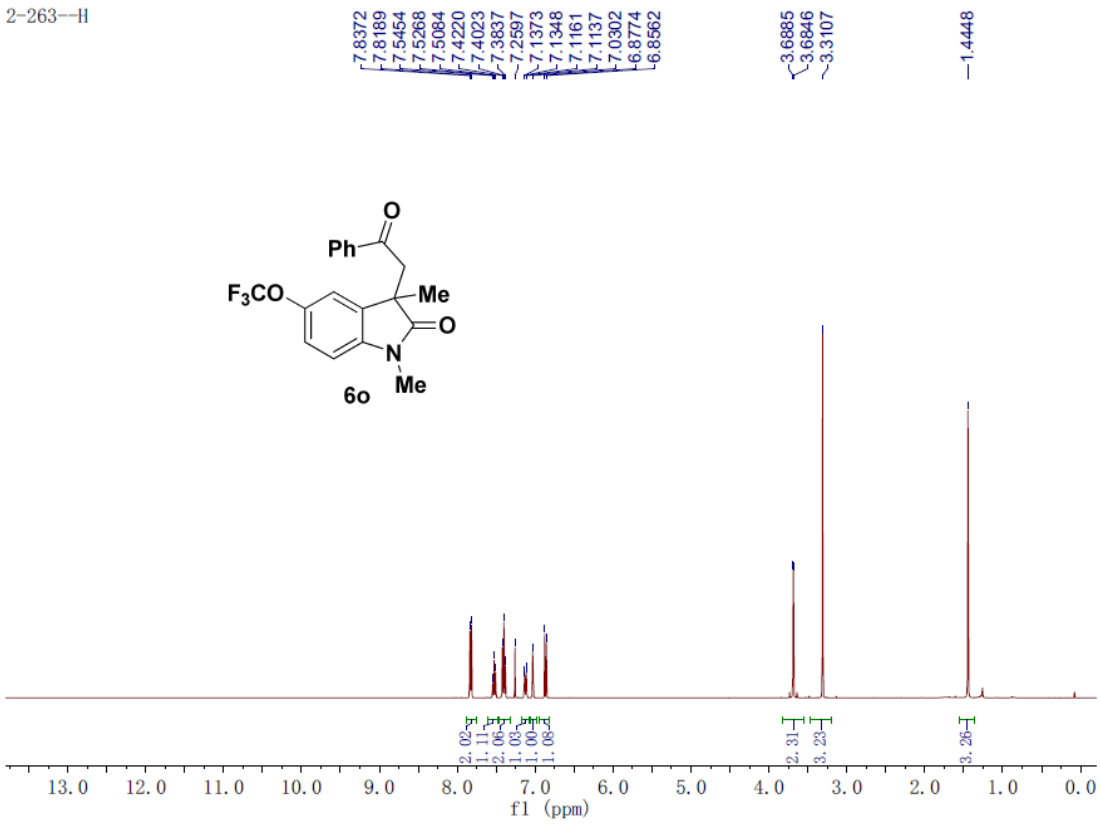
^{13}C NMR of **6n** (100 M, $CDCl_3$)



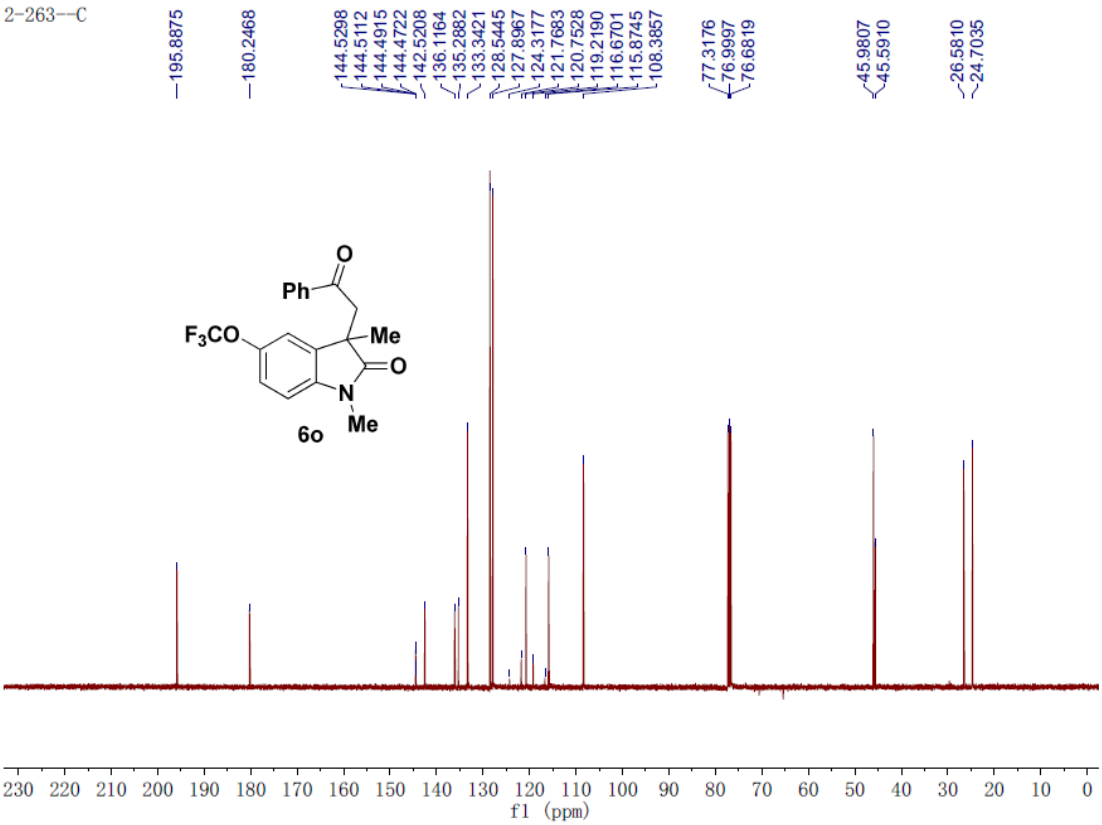
^{19}FNMR of **6n** (376M, $CDCl_3$)



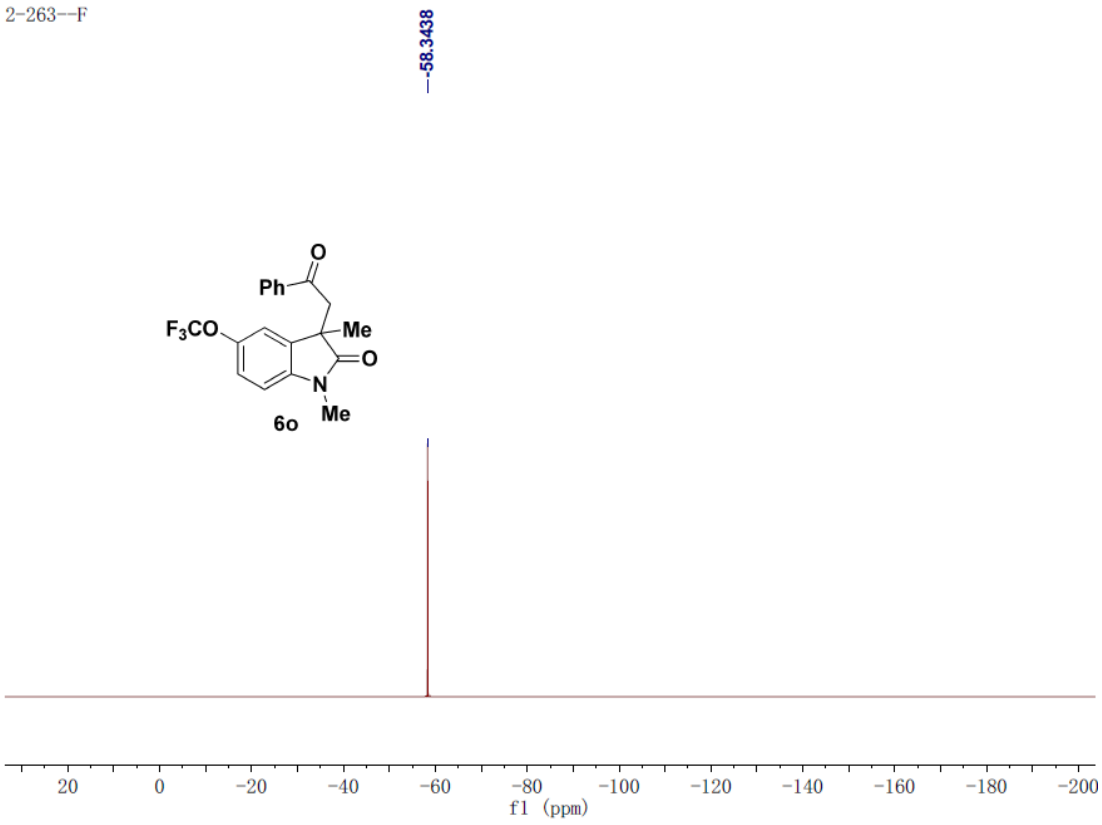
^{1}H NMR of **6o** (400 M, $CDCl_3$)



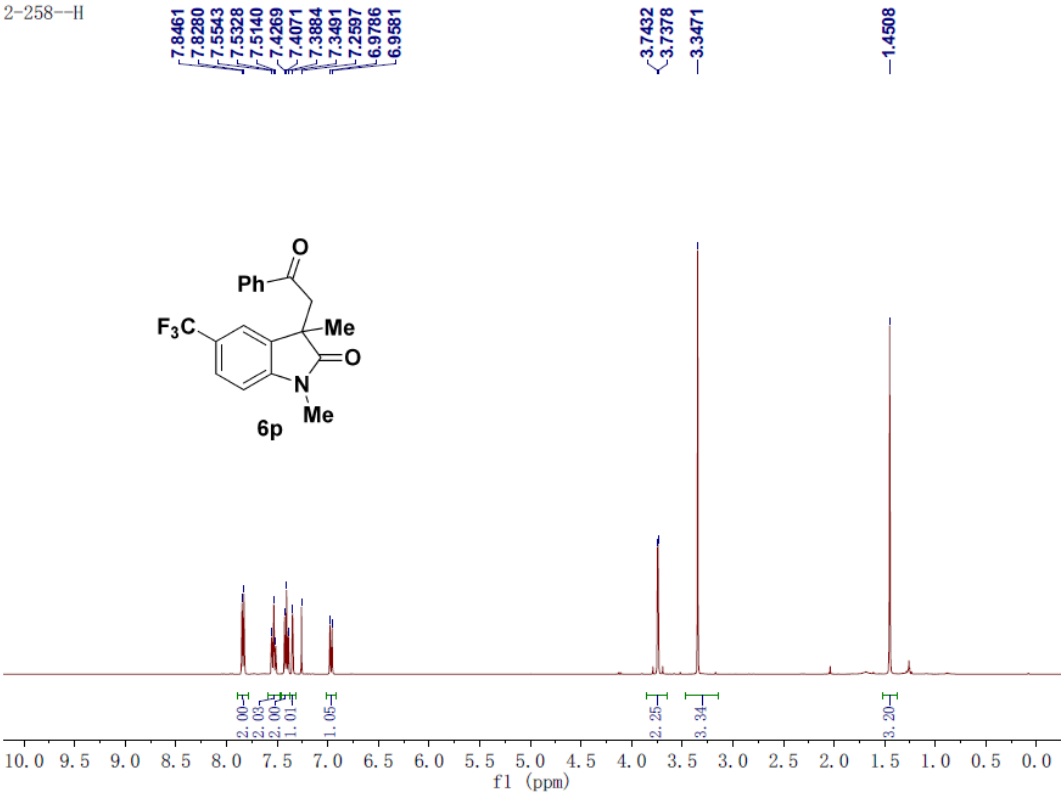
^{13}C NMR of **6o** (100 M, $CDCl_3$)



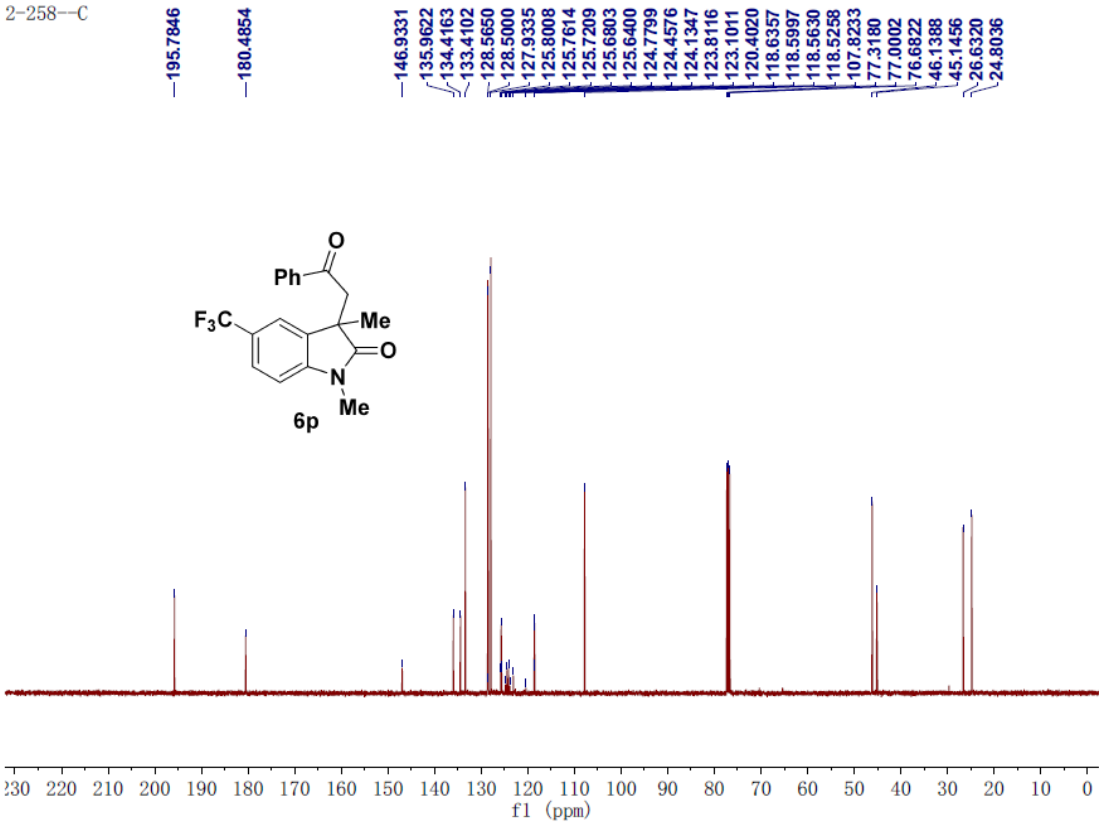
^{19}FNMR of **6o** (376M, $CDCl_3$)



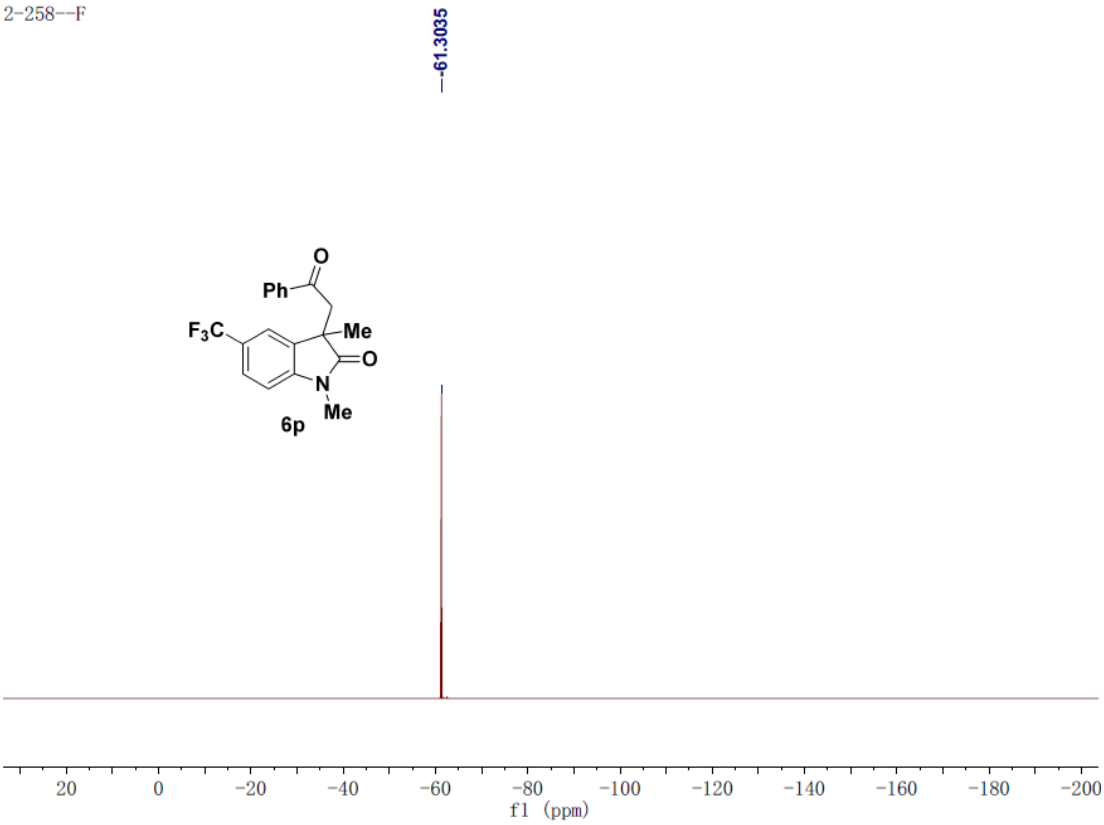
^{1}H NMR of **6p** (400 M, $CDCl_3$)



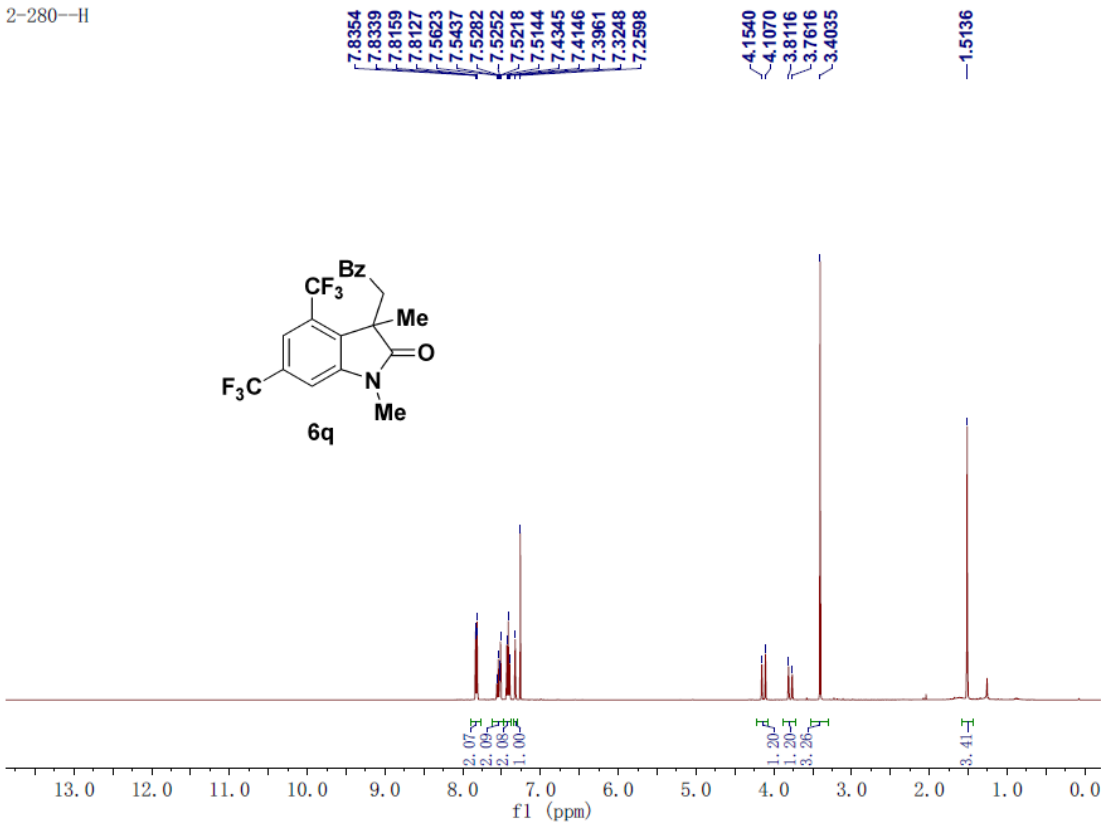
^{13}C NMR of **6p** (100 M, $CDCl_3$)



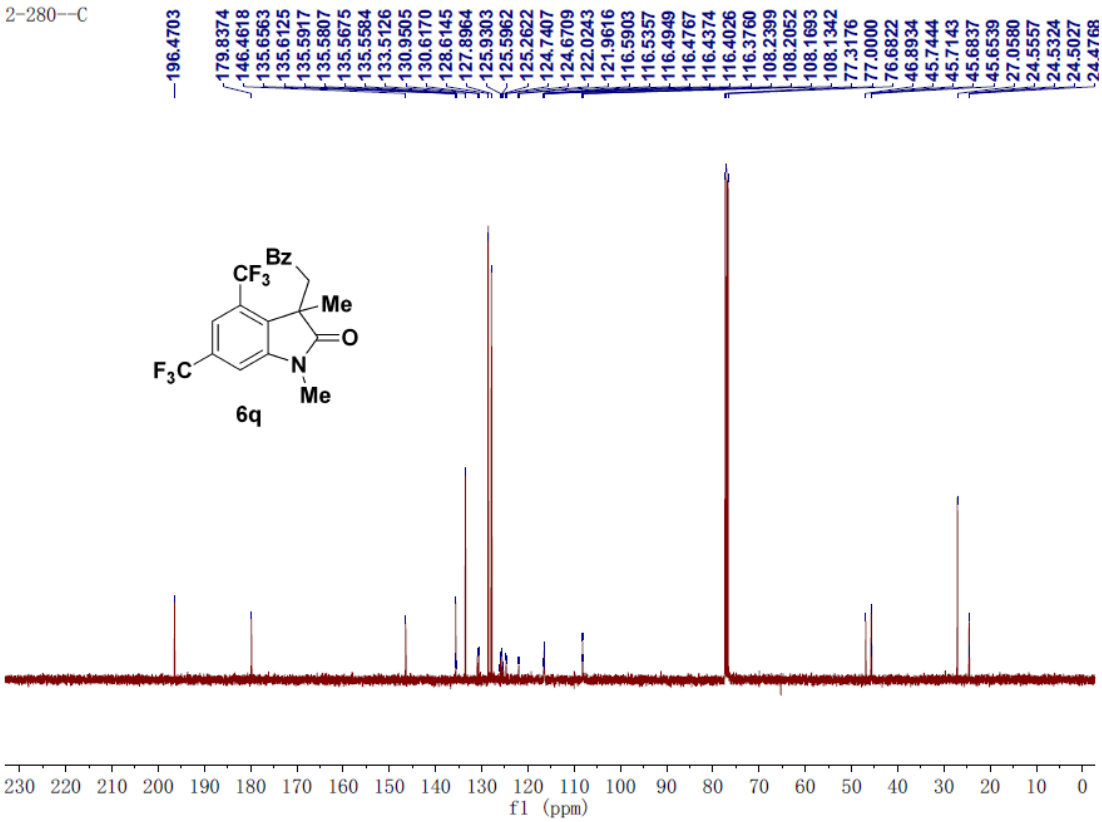
^{19}FNMR of **6p** (376M, $CDCl_3$)



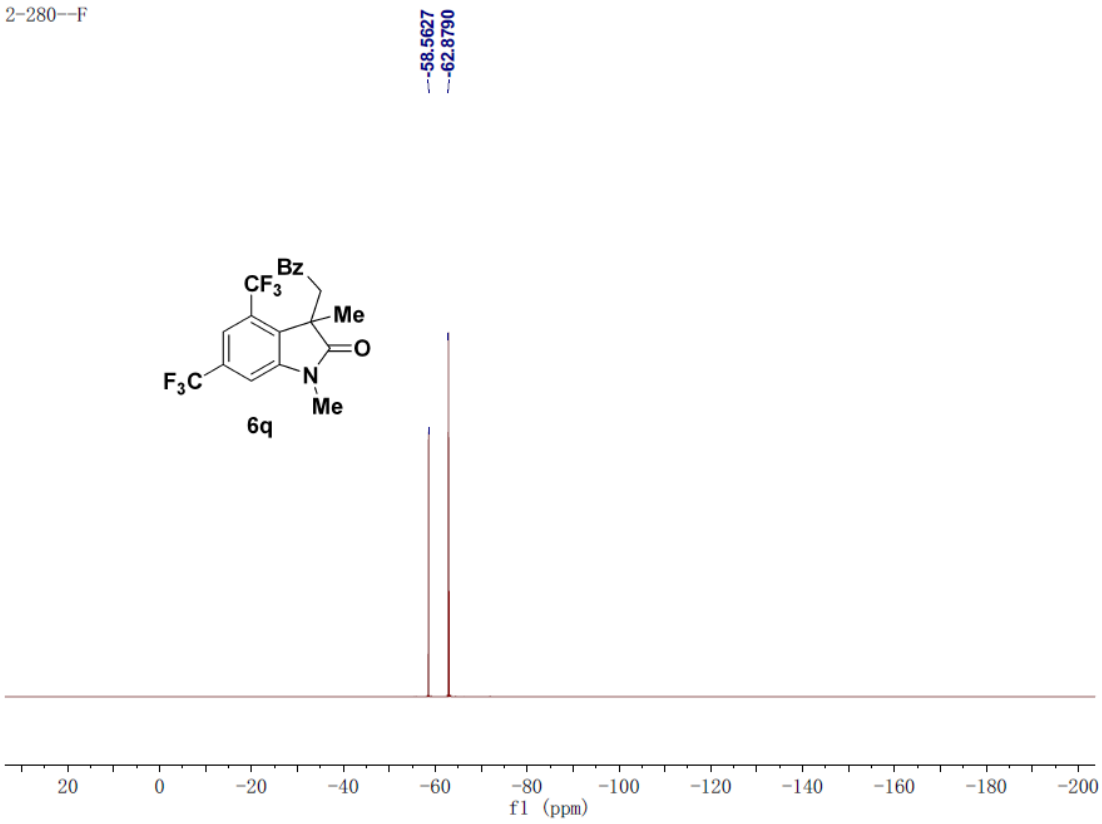
^{1}H NMR of **6q** (400 M, $CDCl_3$)



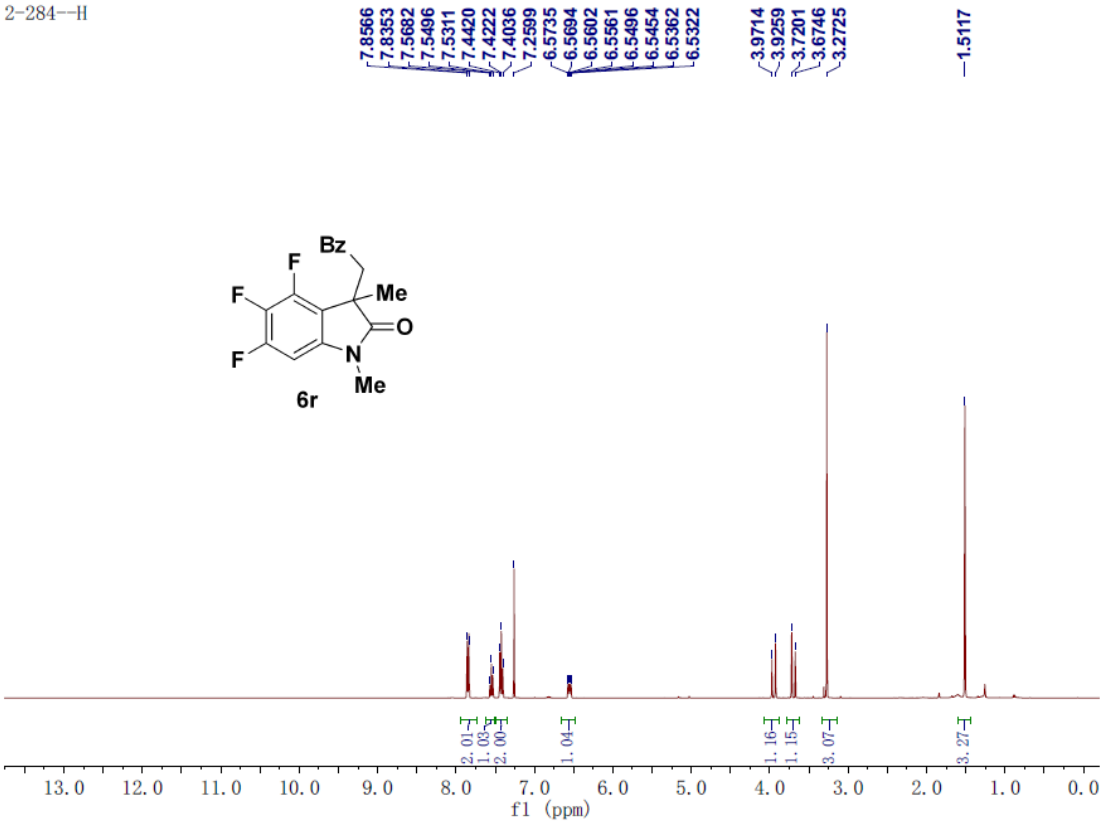
^{13}C NMR of **6q** (100 M, $CDCl_3$)



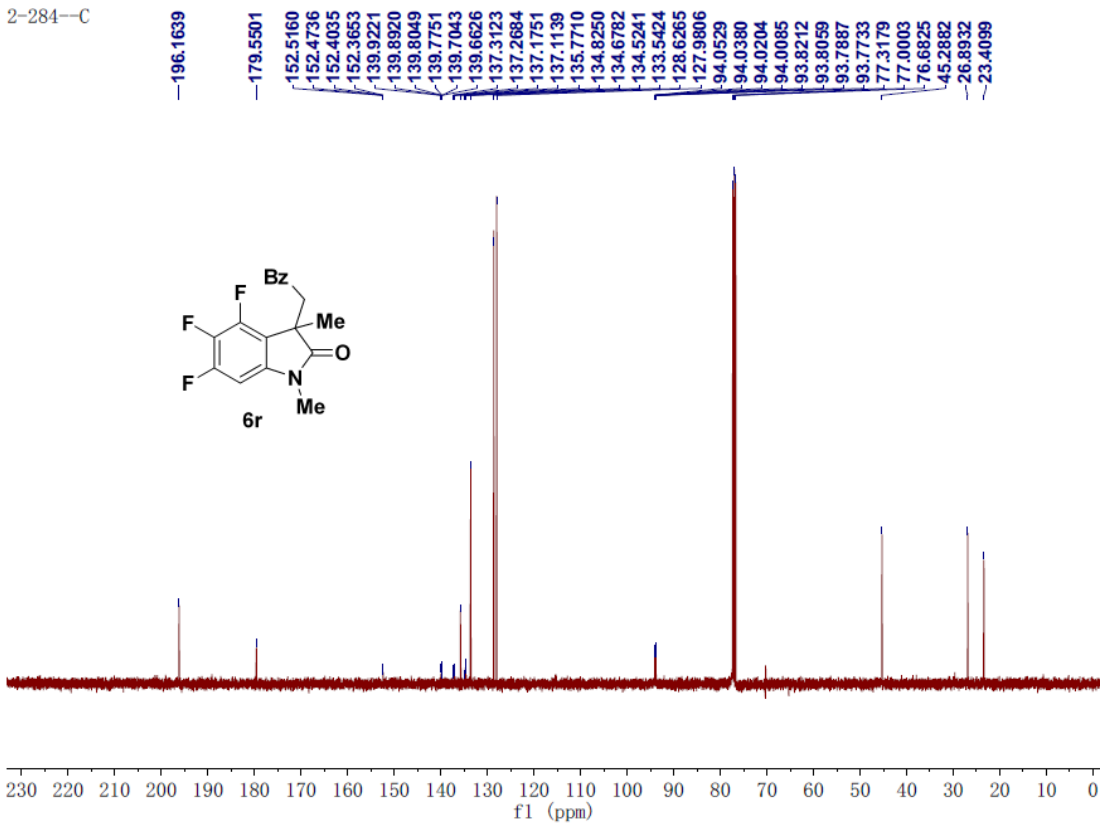
^{19}FNMR of **6q** (376M, $CDCl_3$)



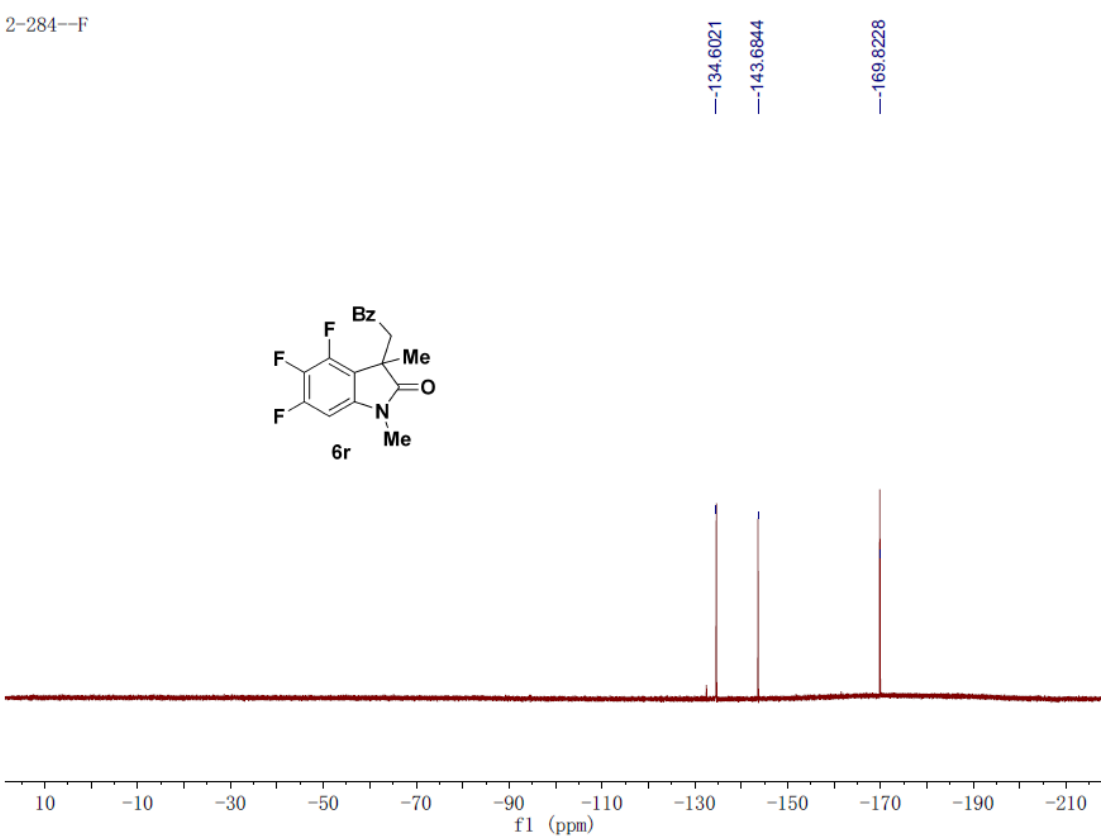
^{1}H NMR of **6r** (400 M, $CDCl_3$)



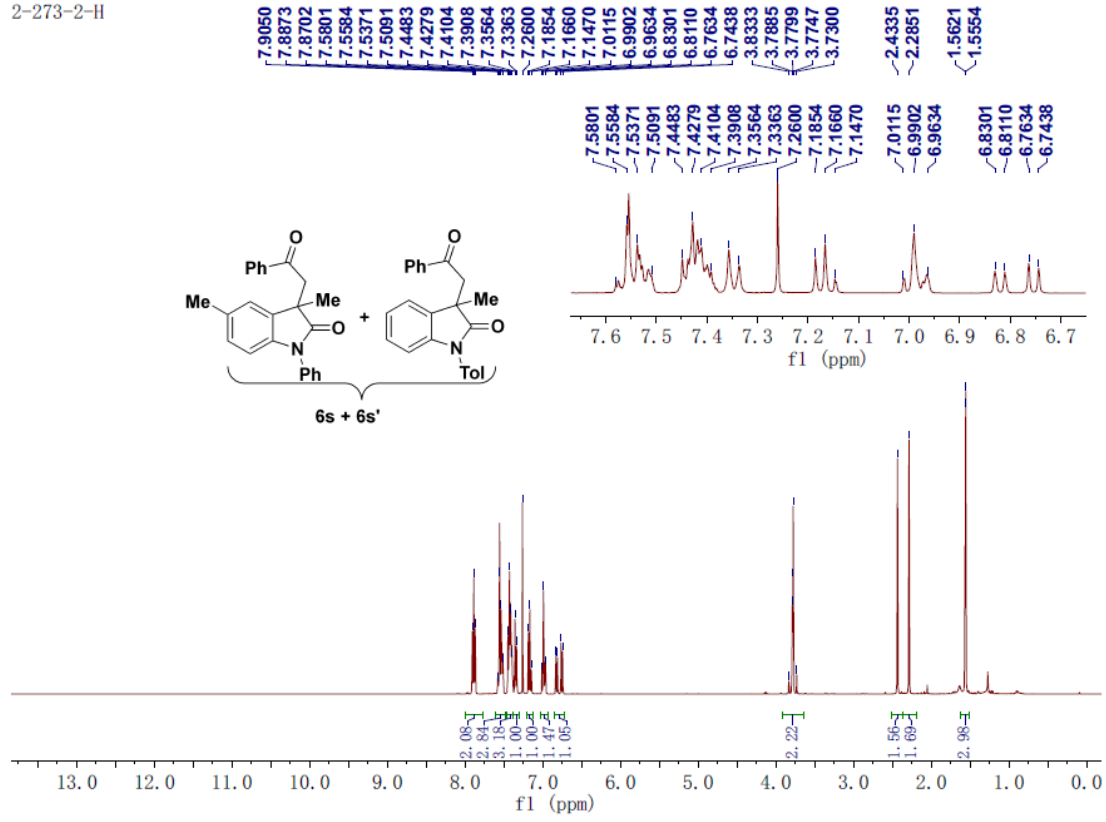
^{13}C NMR of **6r** (100 M, $CDCl_3$)



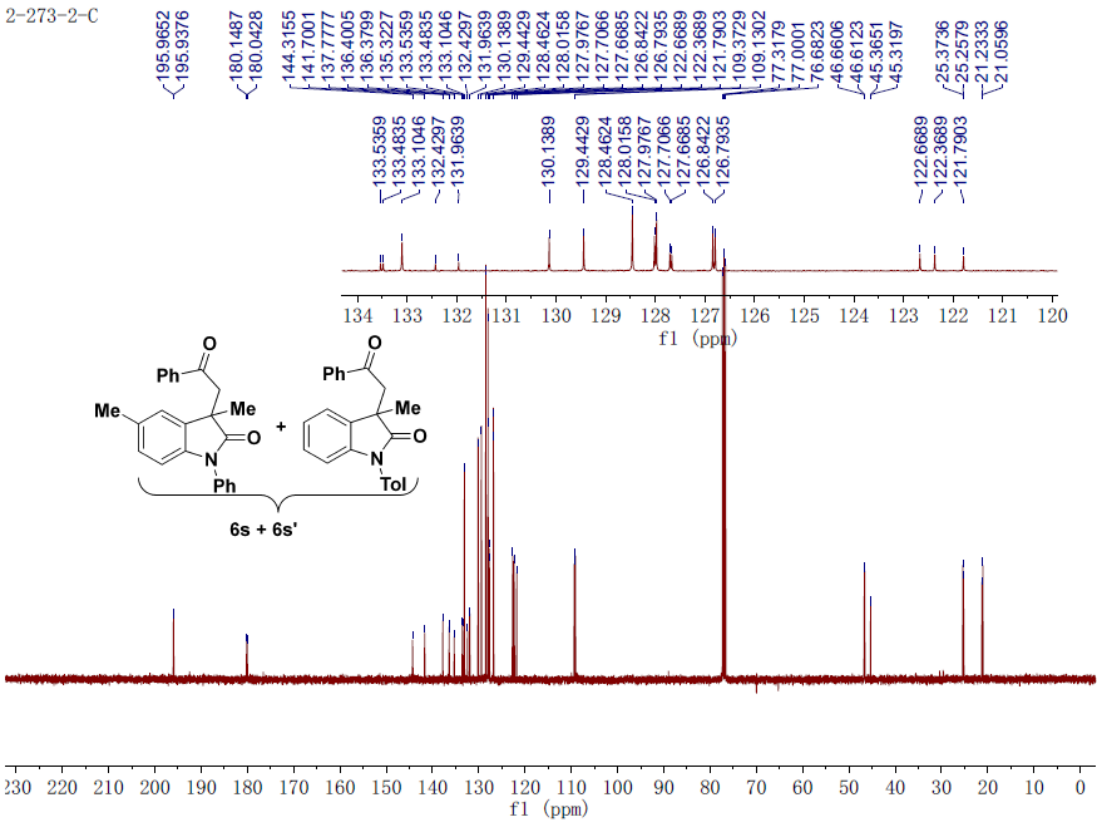
^{19}F NMR of **6r** (376M, $CDCl_3$)



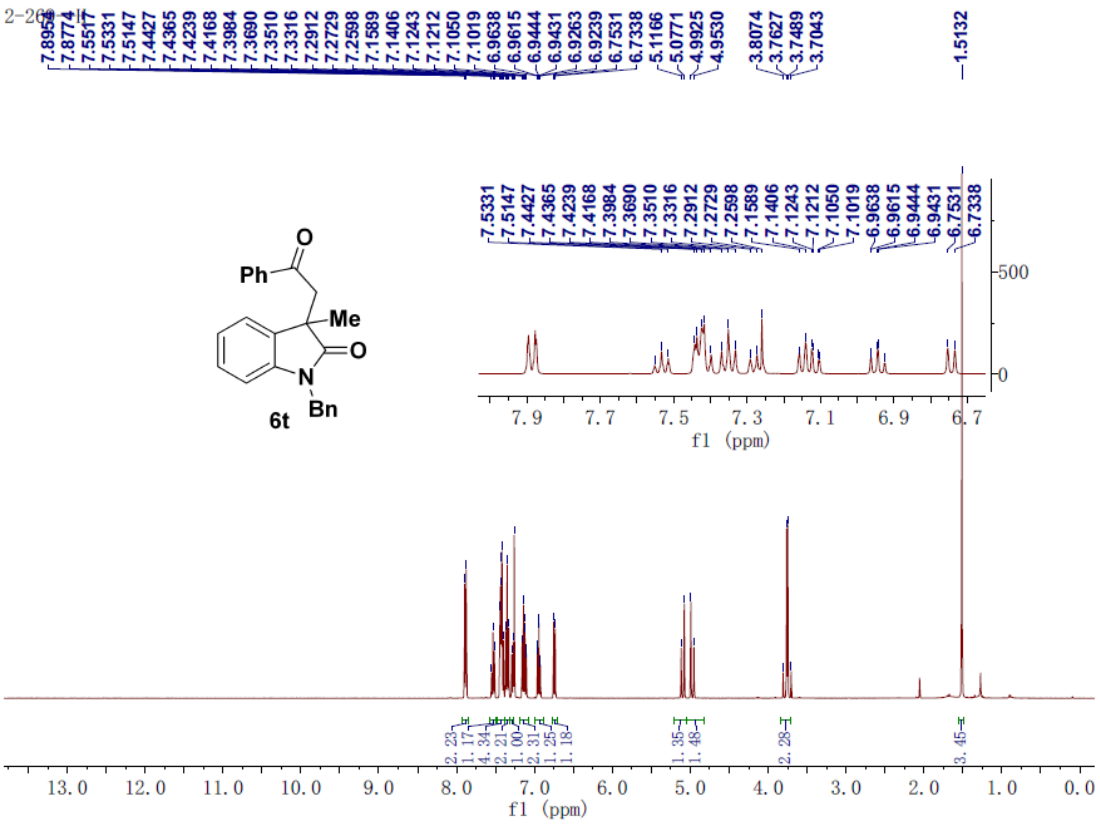
^{1}H NMR of **6s** (400 M, $CDCl_3$)



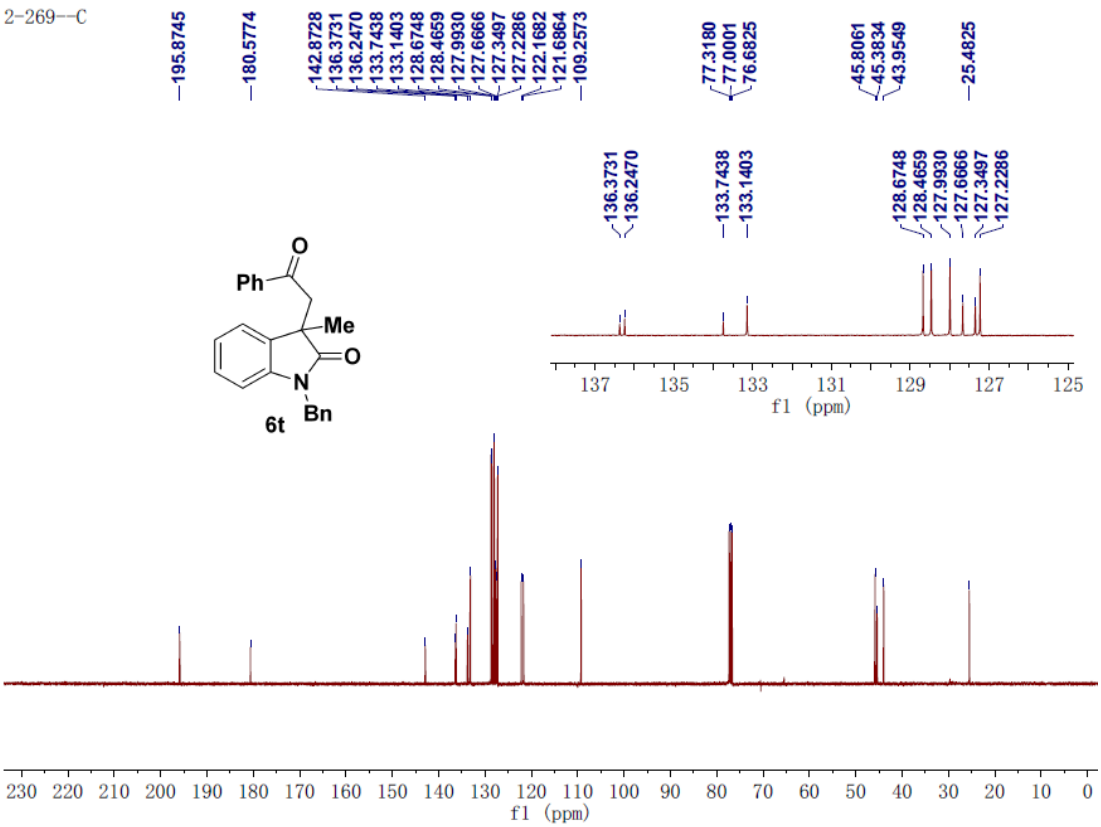
^{13}C NMR of **6s** (100 M, $CDCl_3$)



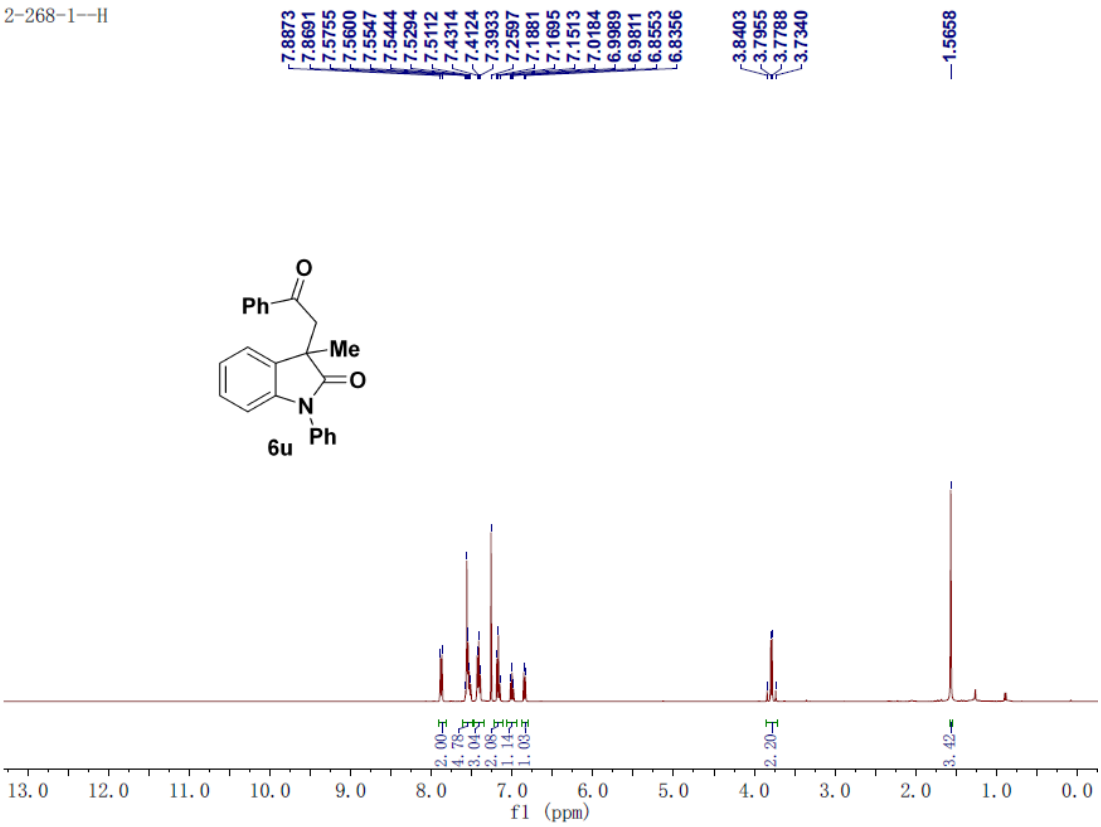
^{1}H NMR of **6t** (400 M, $CDCl_3$)



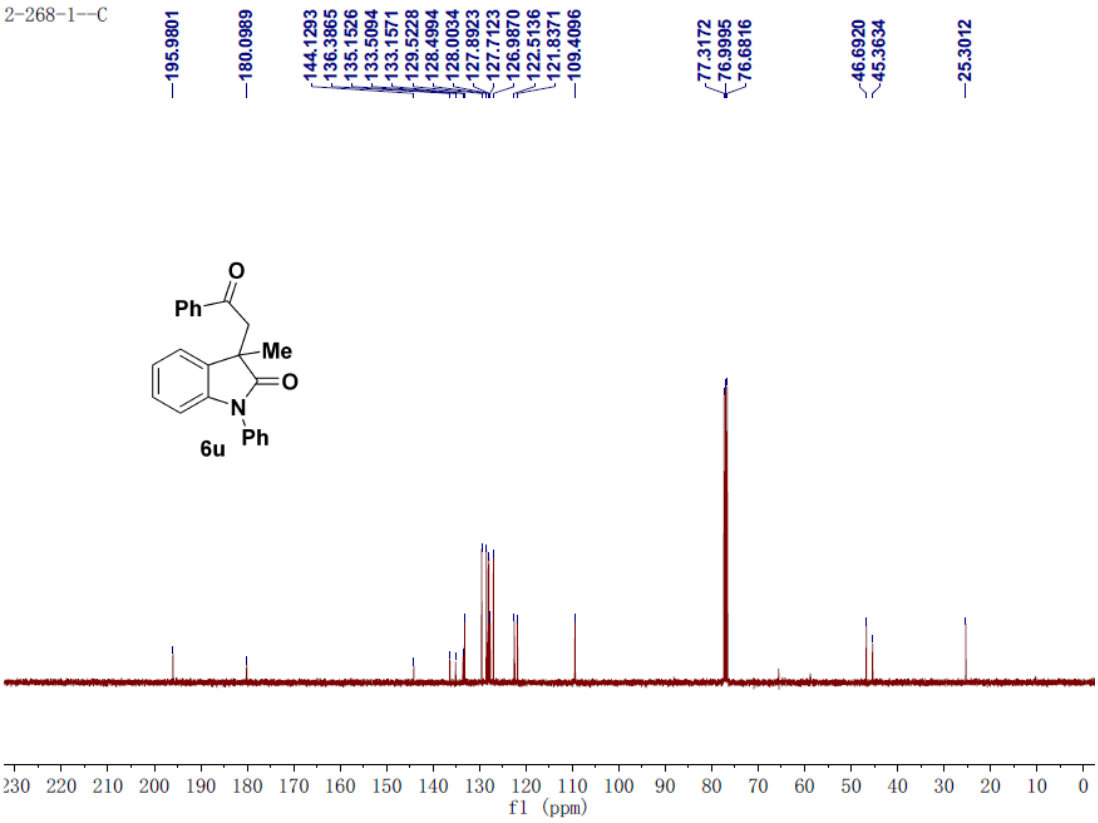
^{13}C NMR of **6t** (100 M, $CDCl_3$)



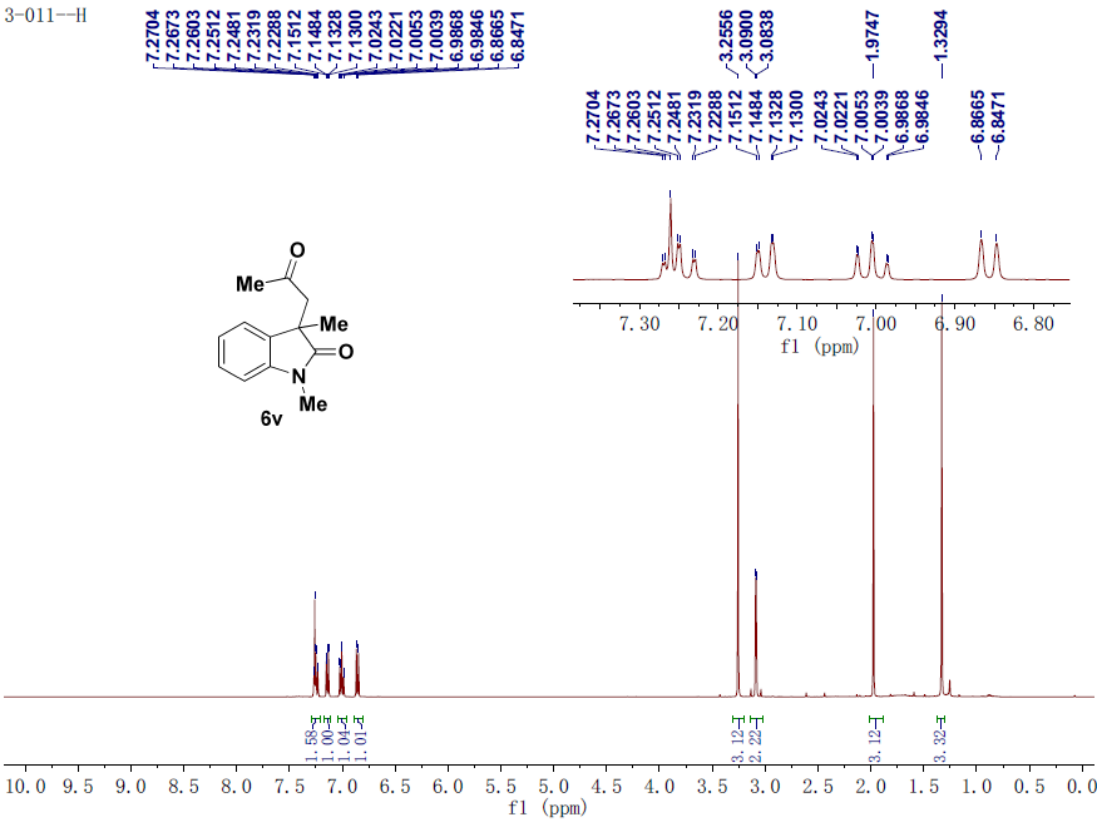
^{1}H NMR of **6u** (400 M, $CDCl_3$)



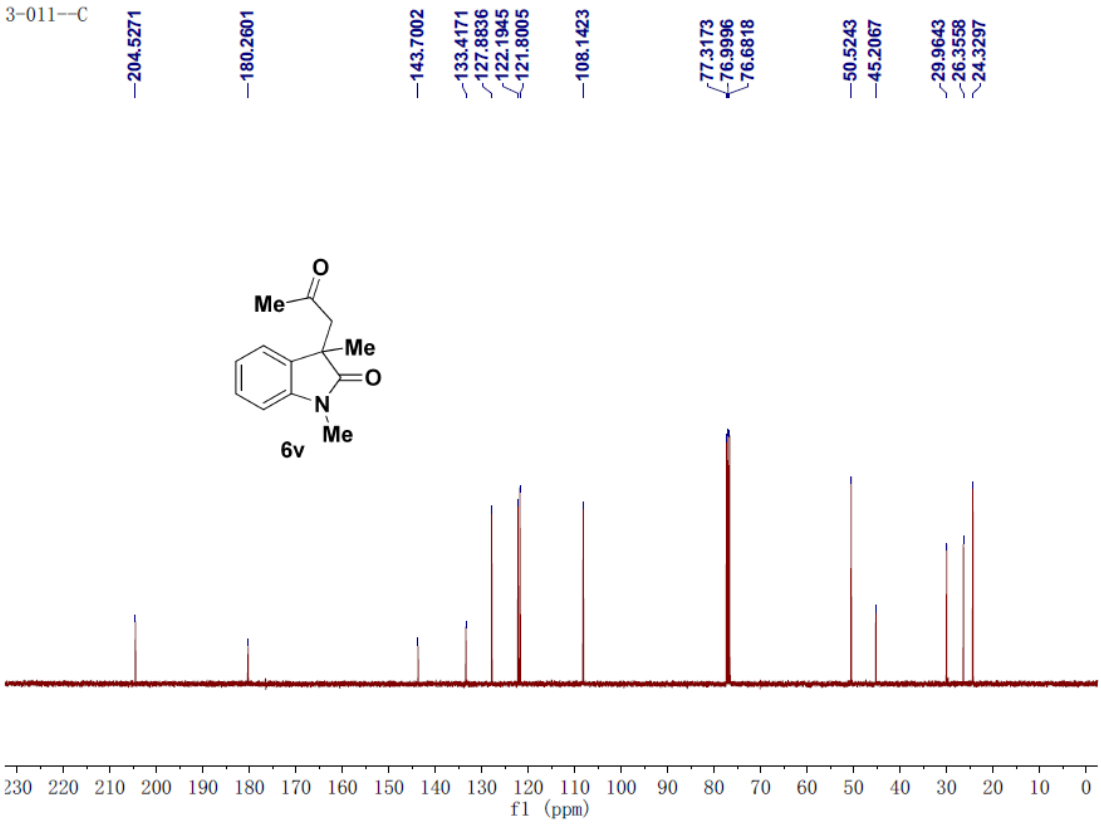
^{13}C NMR of **6u** (100 M, $CDCl_3$)



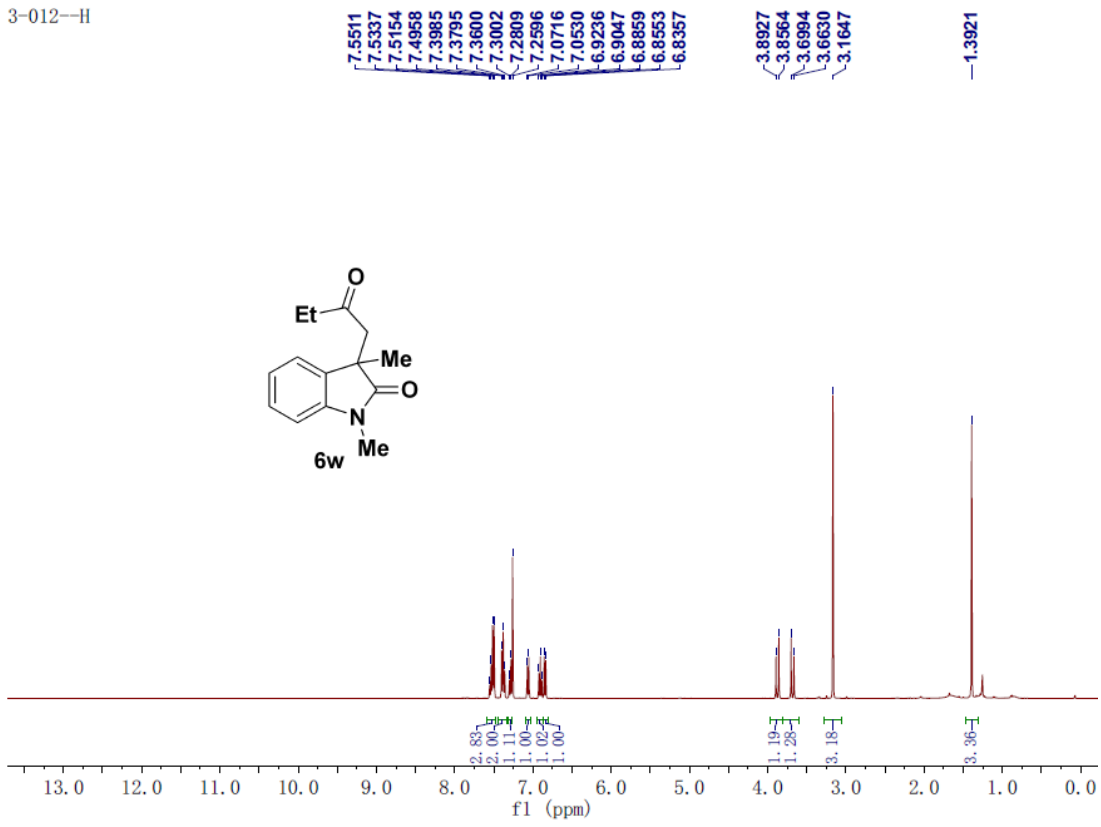
^{1}H NMR of **6v** (400 M, $CDCl_3$)



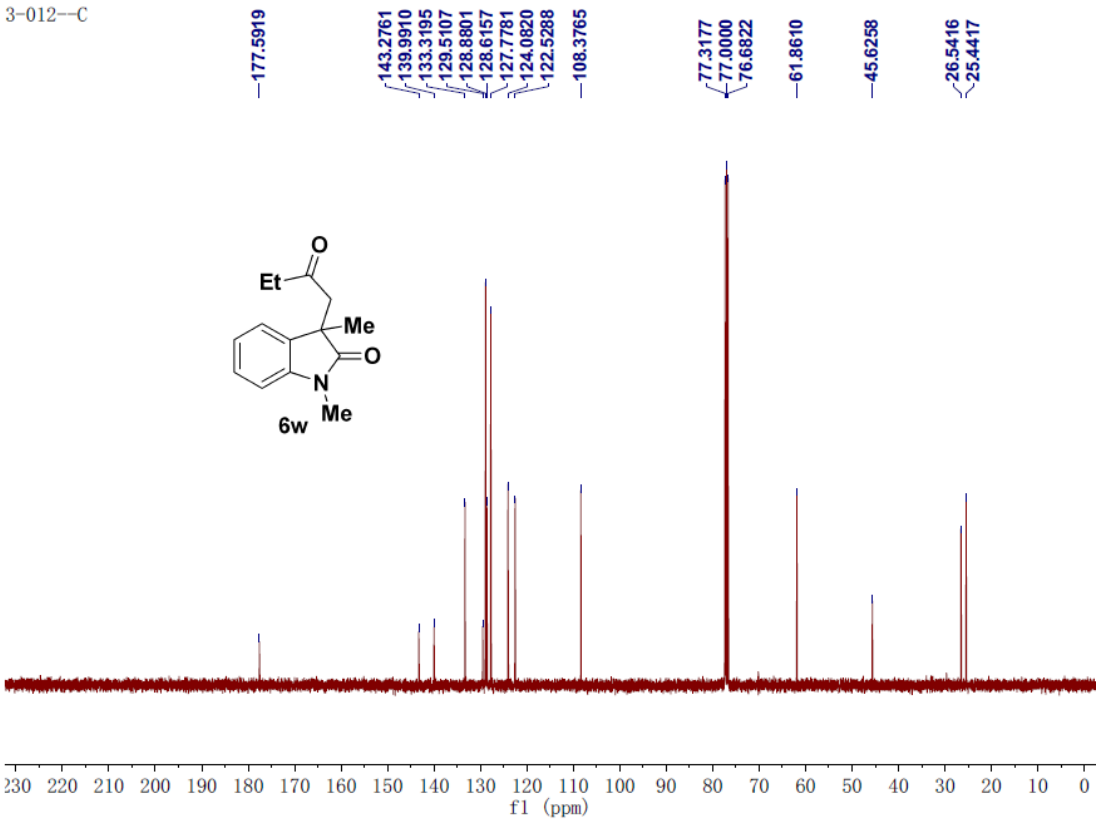
^{13}C NMR of **6v** (100 M, $CDCl_3$)



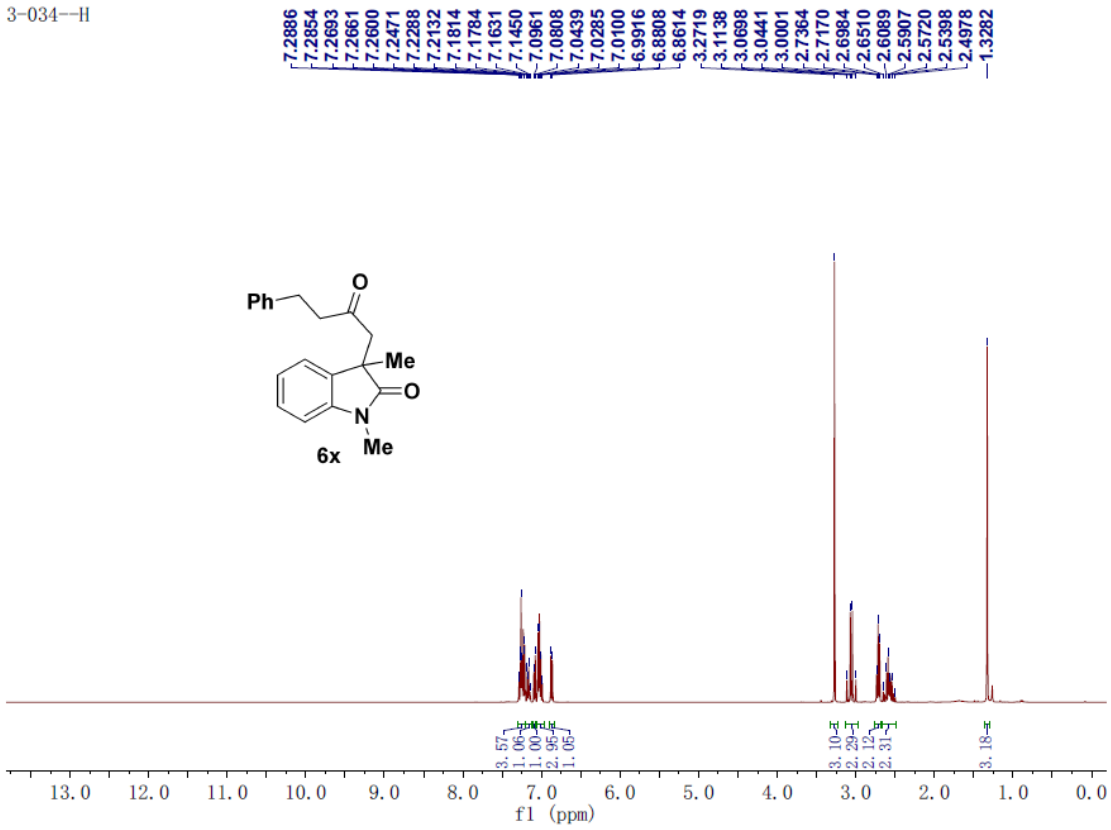
^{1}H NMR of **6w** (400 M, $CDCl_3$)



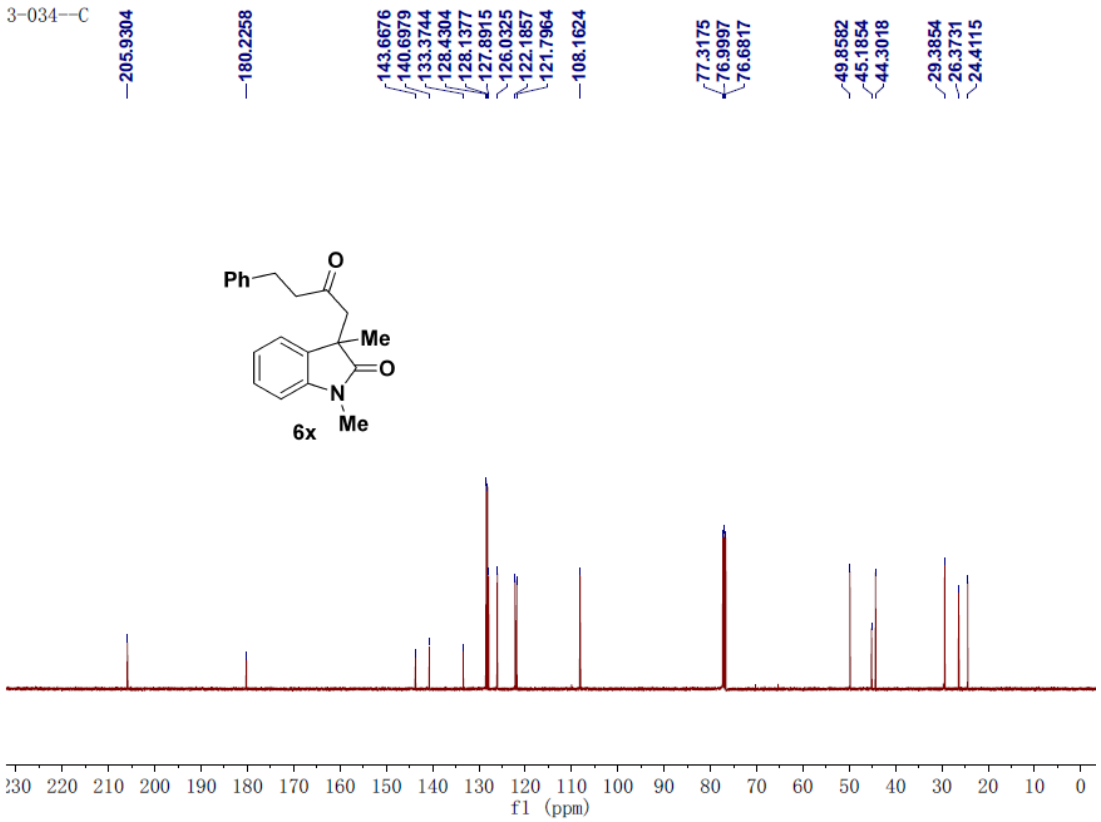
^{13}C NMR of **6w** (100 M, $CDCl_3$)



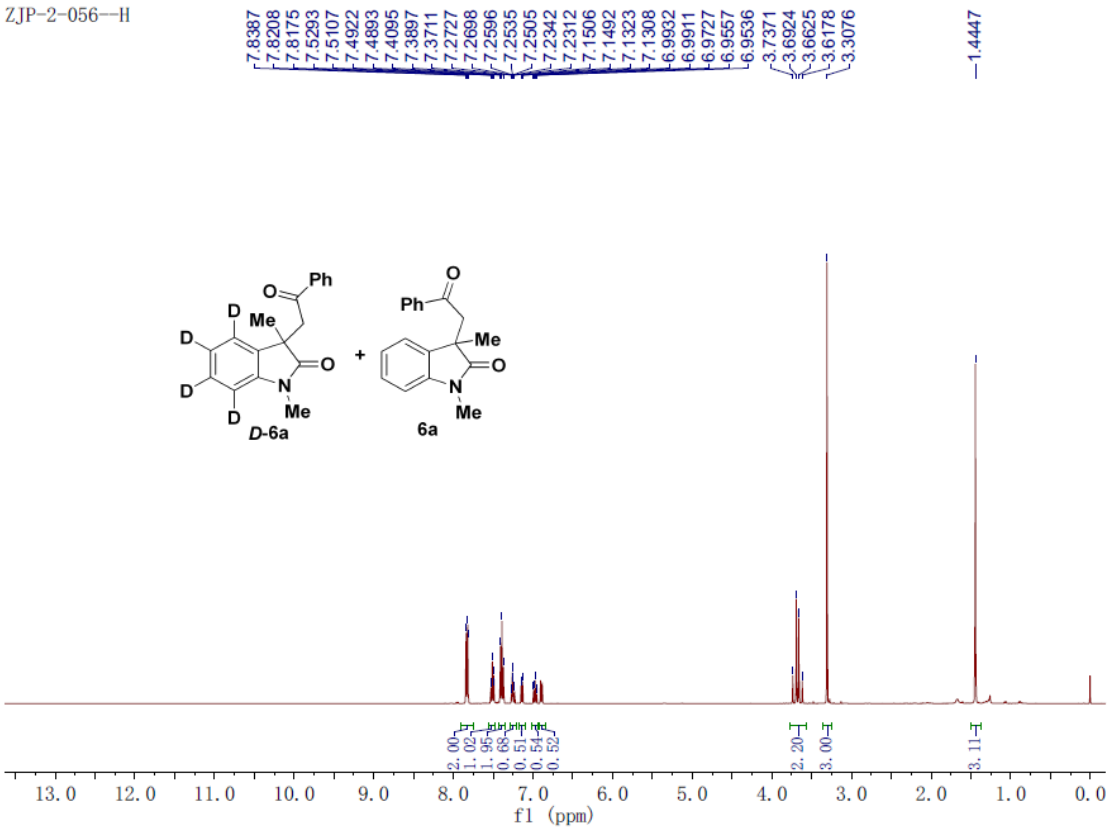
^{1}H NMR of **6x** (400 M, $CDCl_3$)



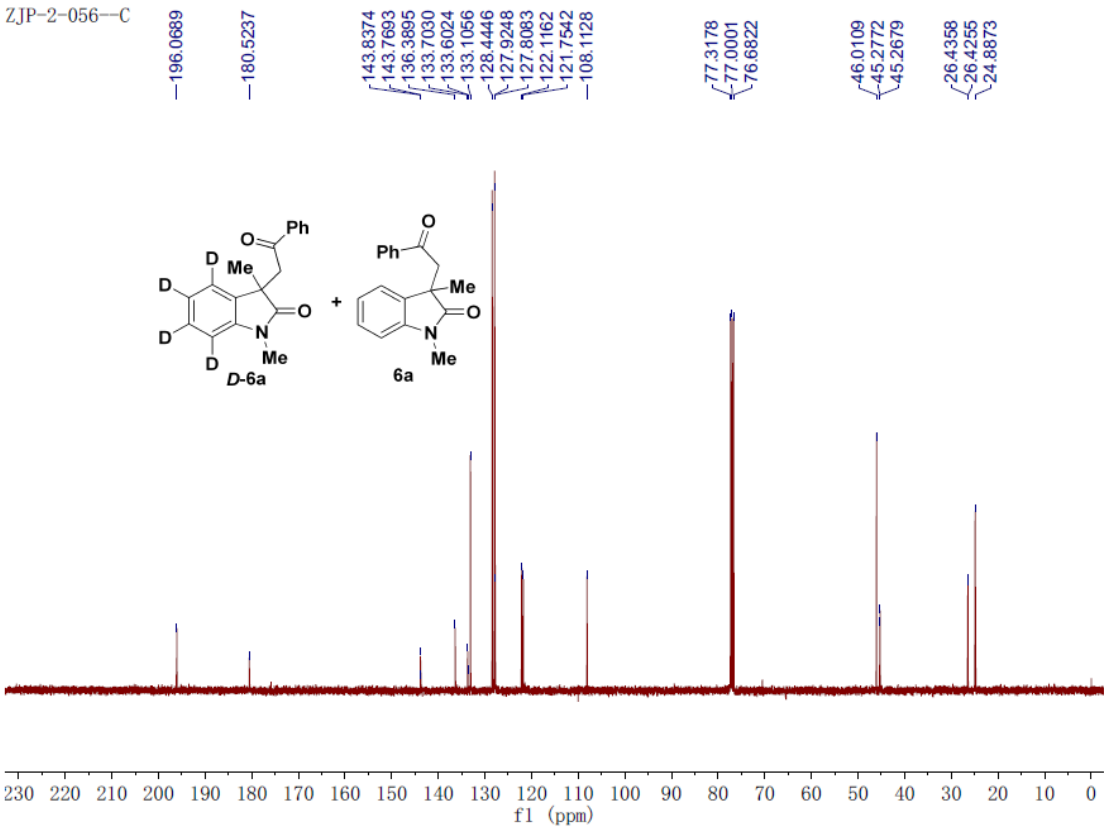
^{13}C NMR of **6x** (100 M, $CDCl_3$)



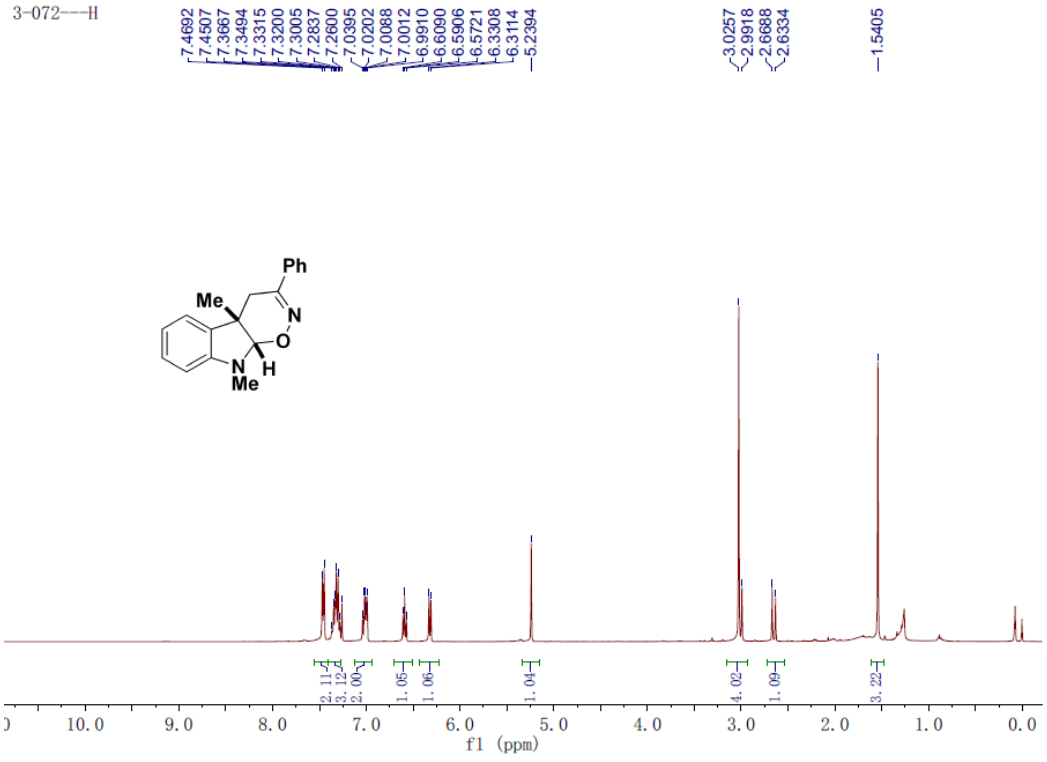
^{1}H NMR of ***D*-6a**+**6a** (400 M, $CDCl_3$)



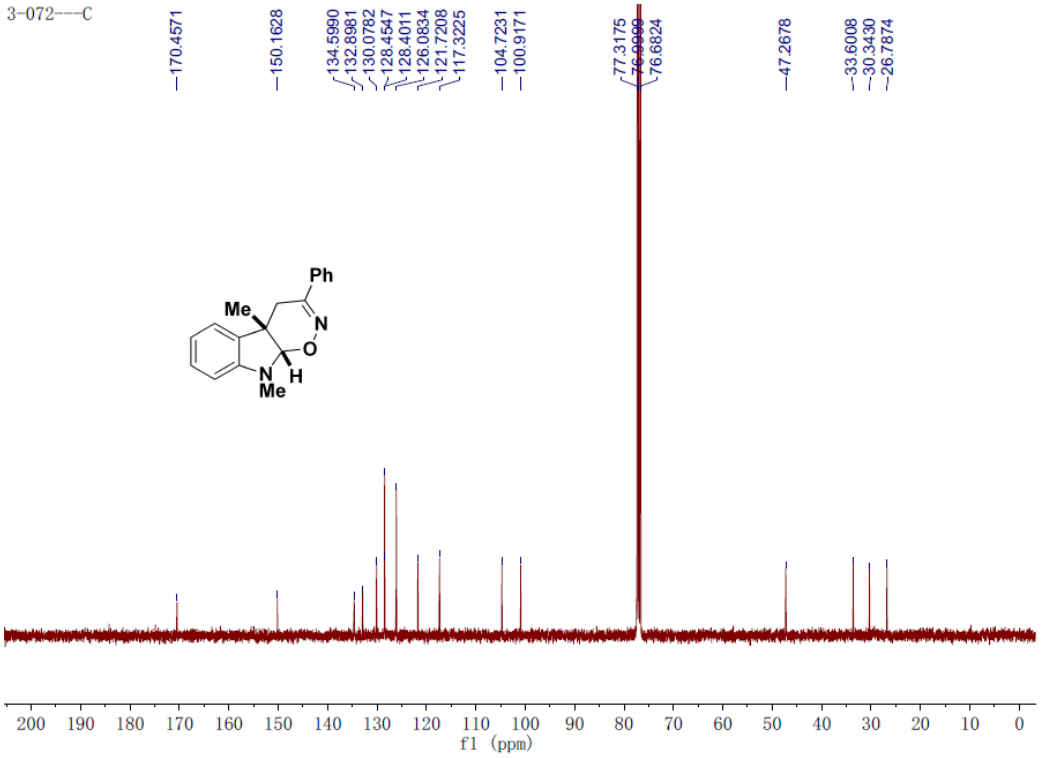
^{13}C NMR of ***D*-6a**+**6a** (100 M, $CDCl_3$)



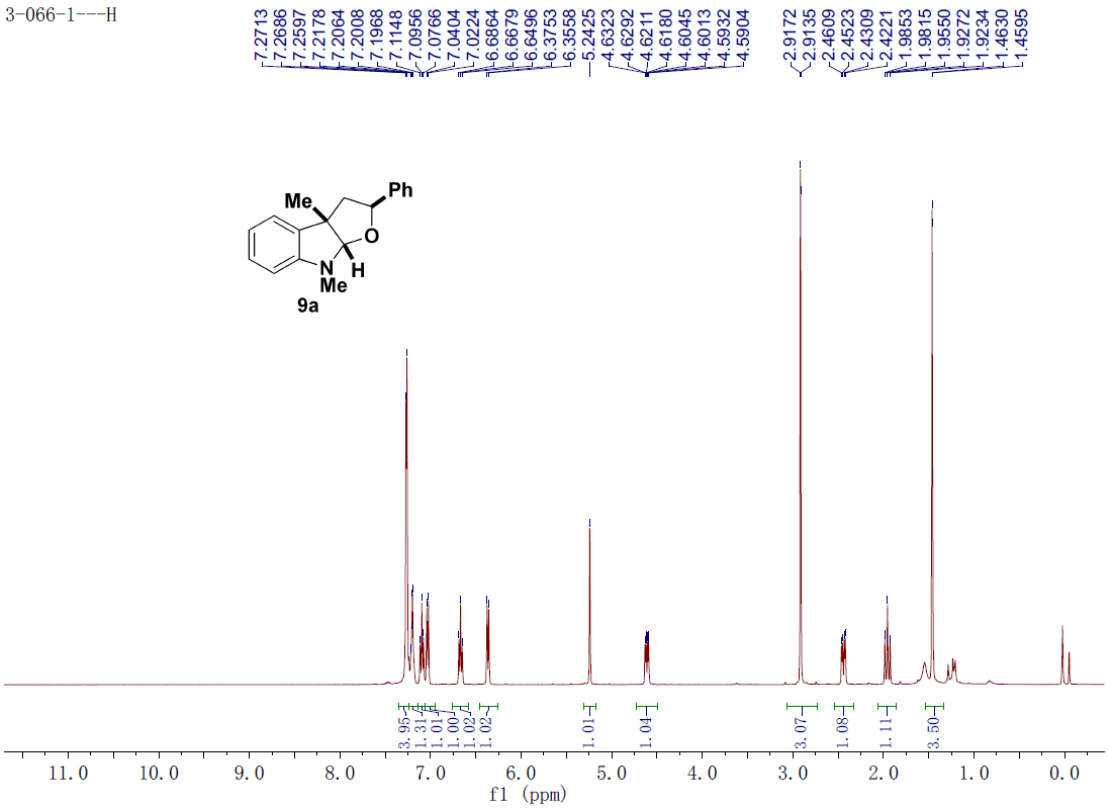
^{1}H NMR of **8** (400 M, $CDCl_3$)



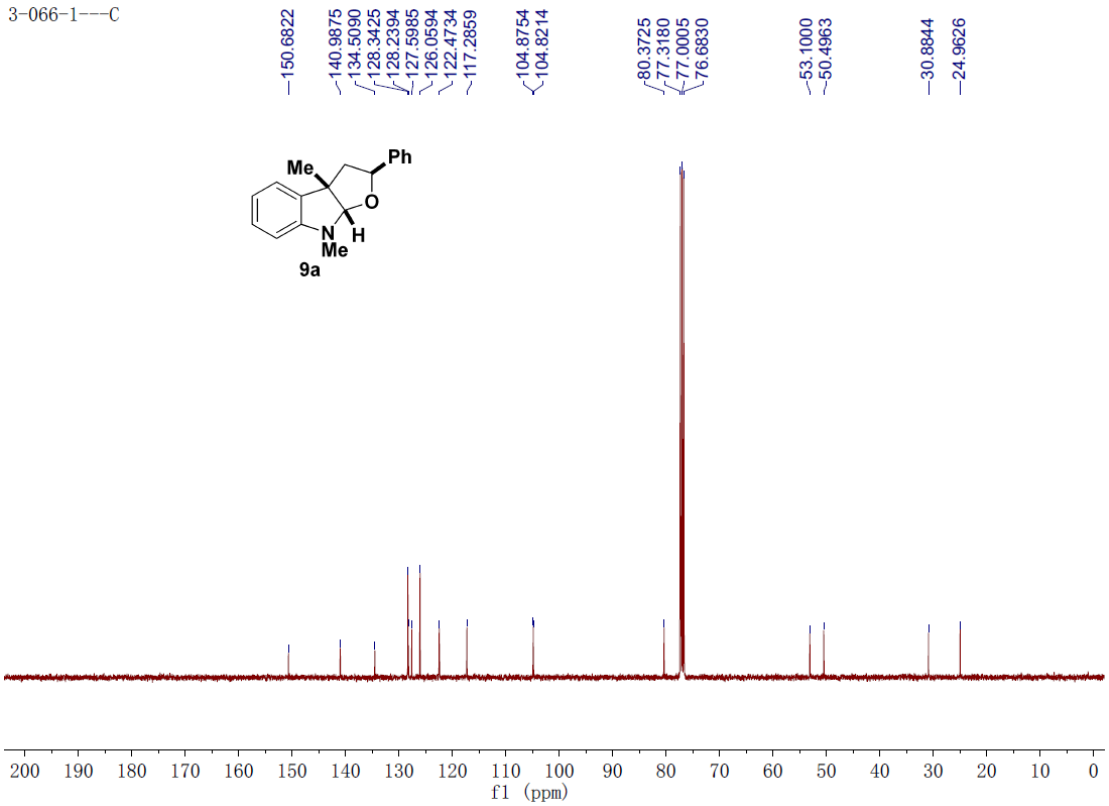
^{13}C NMR of **8** (100 M, $CDCl_3$)



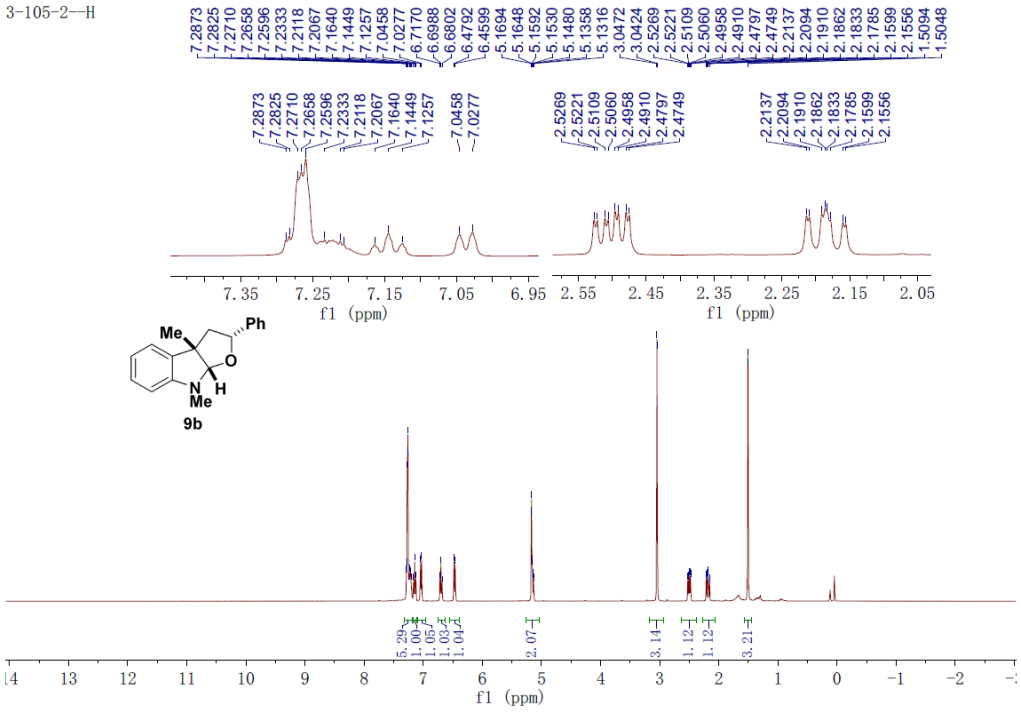
^{1}H NMR of **9a** (400 M, $CDCl_3$)



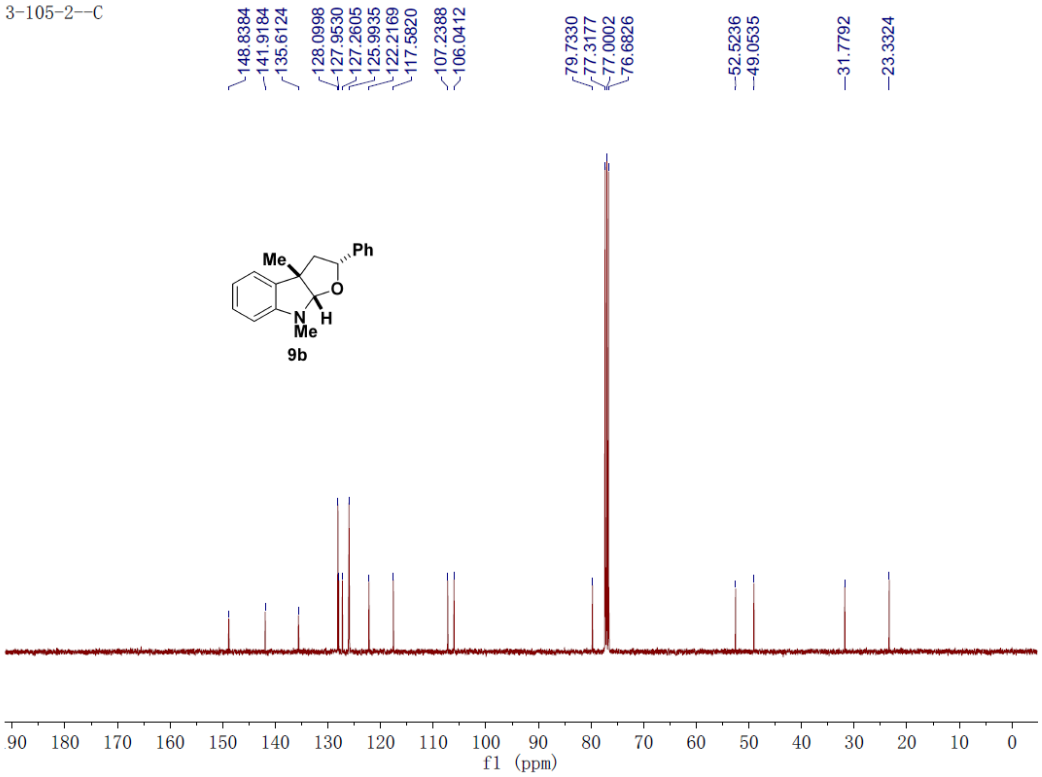
^{13}C NMR of **9a** (100 M, $CDCl_3$)



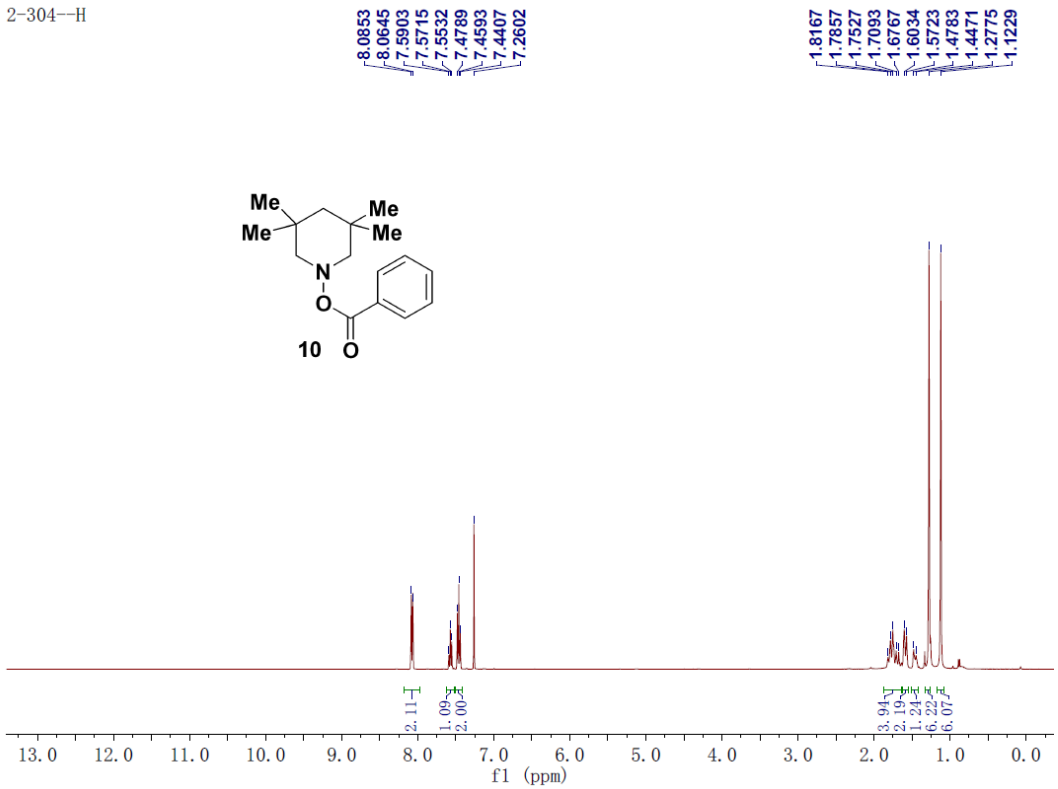
^{1}H NMR of **9b** (400 M, $CDCl_3$)



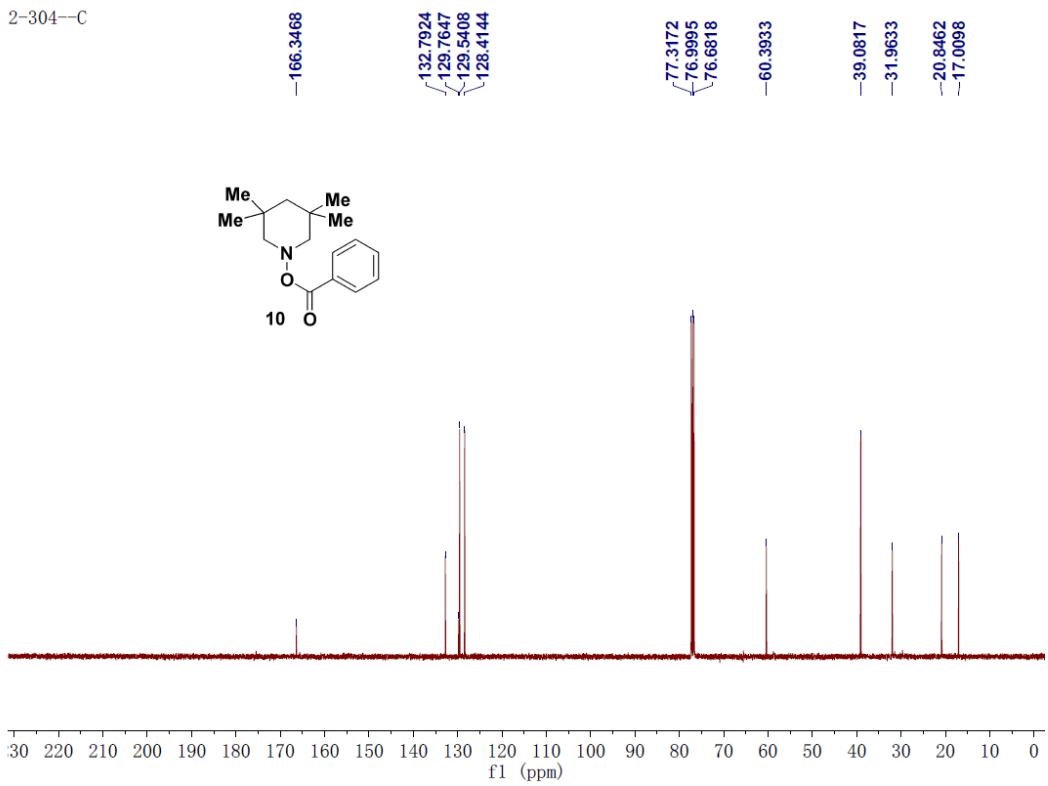
^{13}C NMR of **9b** (100 M, $CDCl_3$)



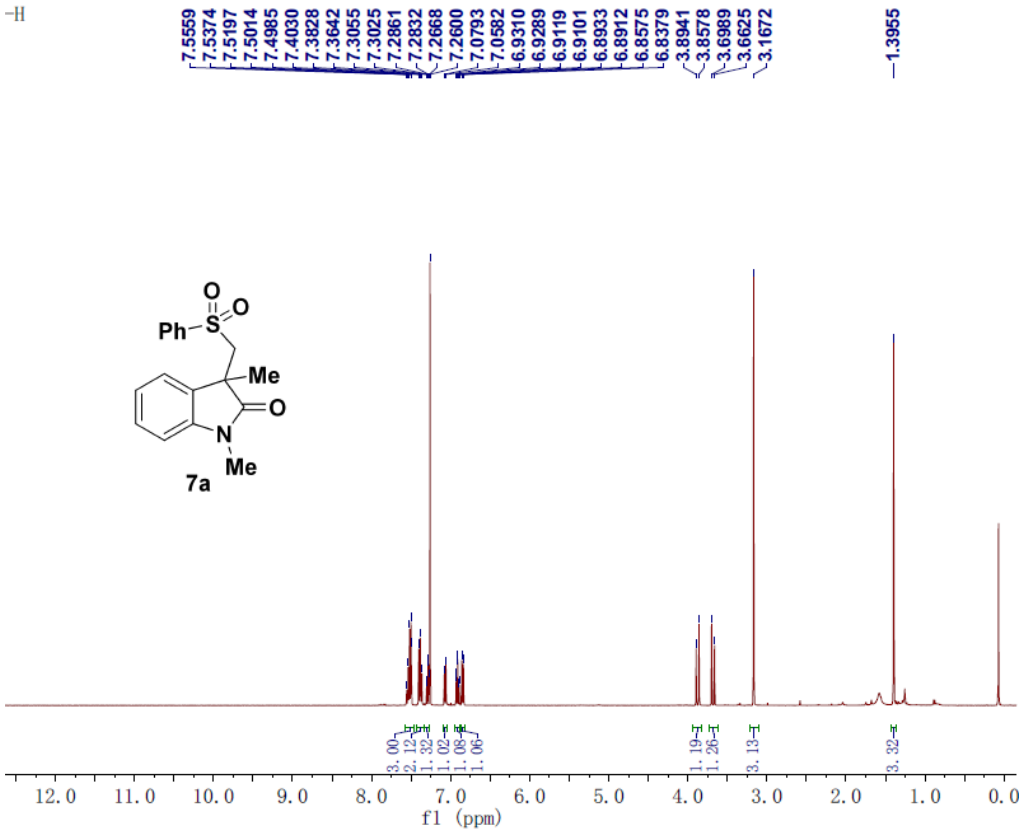
^{1}H NMR of **10** (400 M, $CDCl_3$)



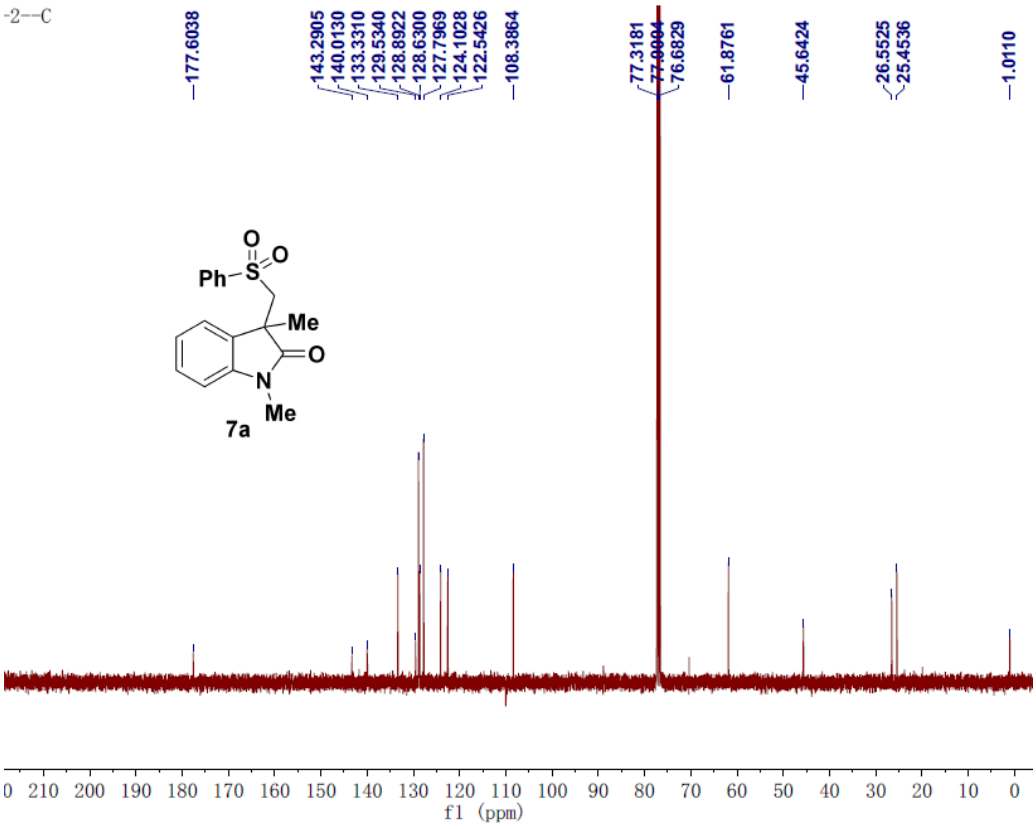
、^{13}C NMR of **10** (100 M, $CDCl_3$)



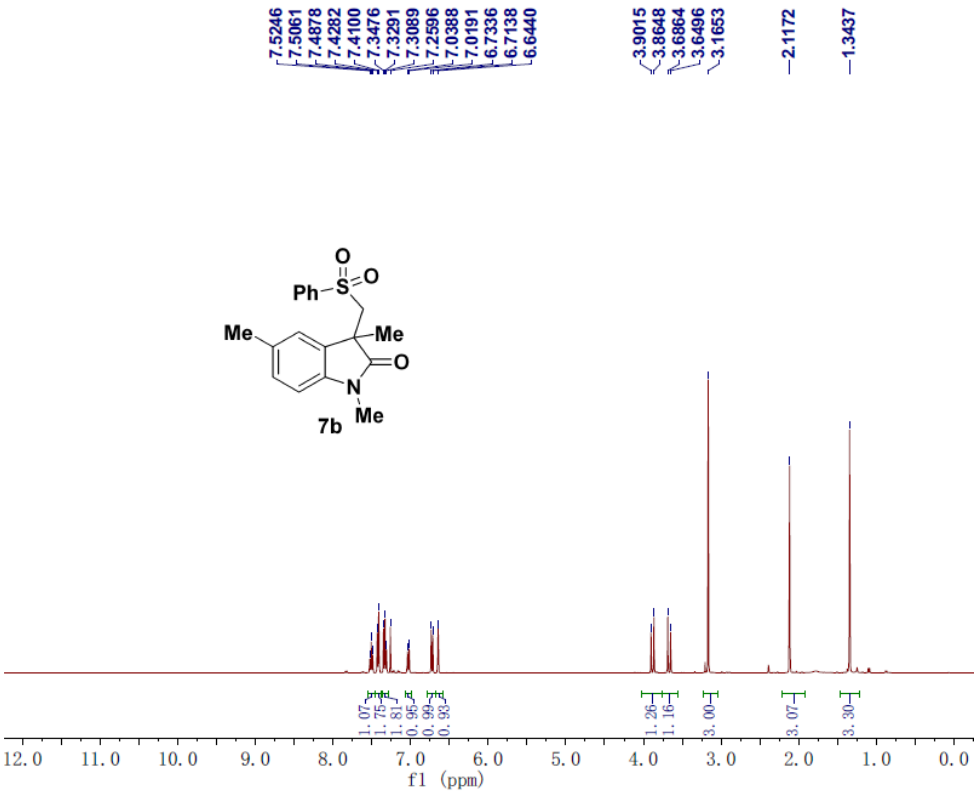
^{1}H NMR of **7a** (400 M, $CDCl_3$)



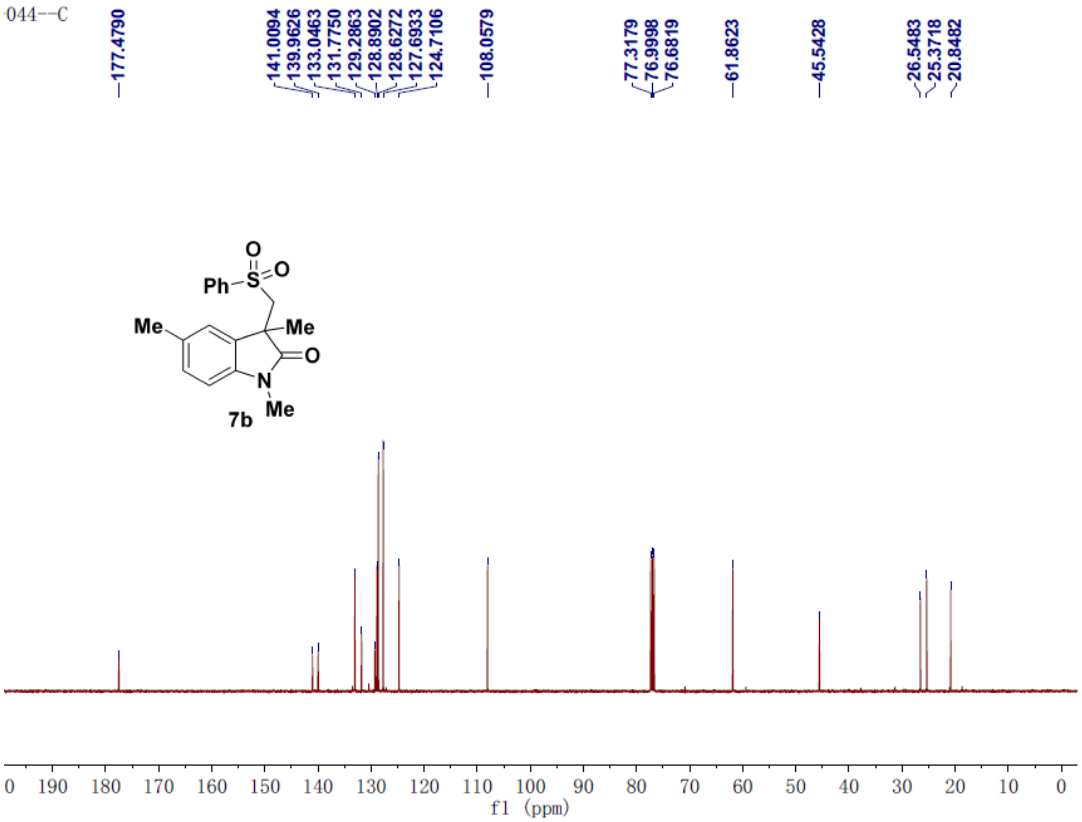
^{13}C NMR of **7a** (100 M, $CDCl_3$)



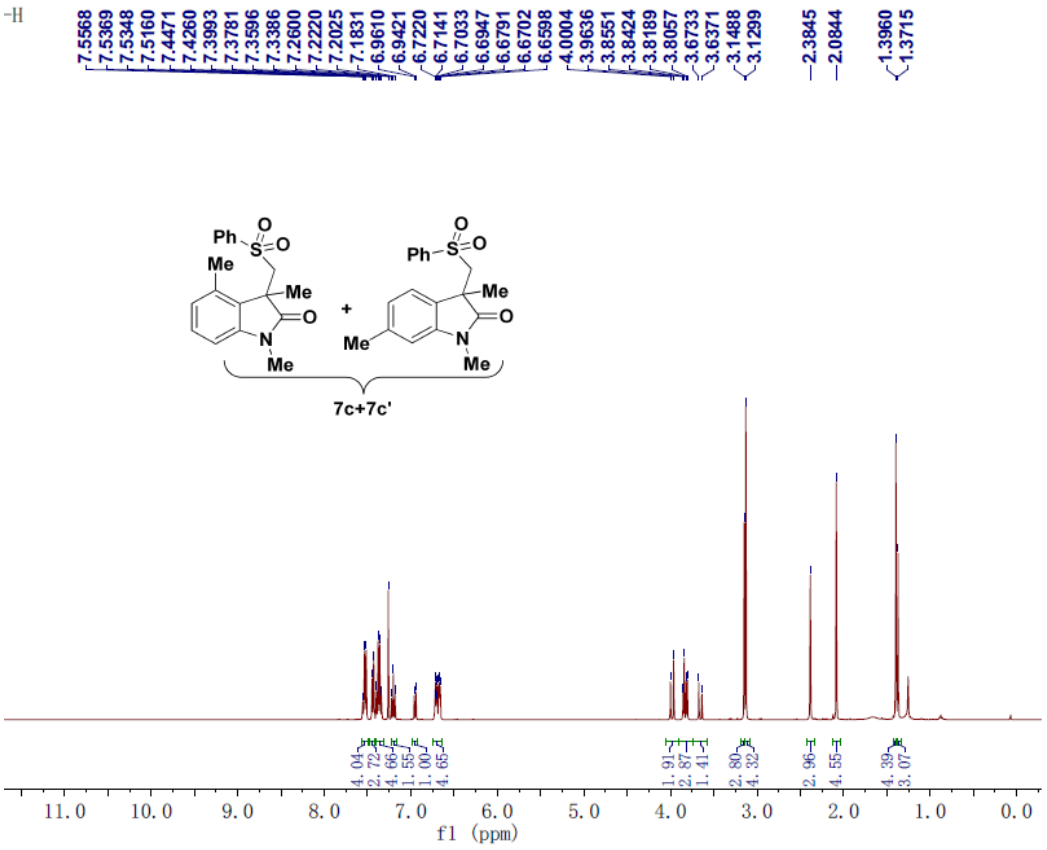
^{1}H NMR of **7b** (400 M, $CDCl_3$)



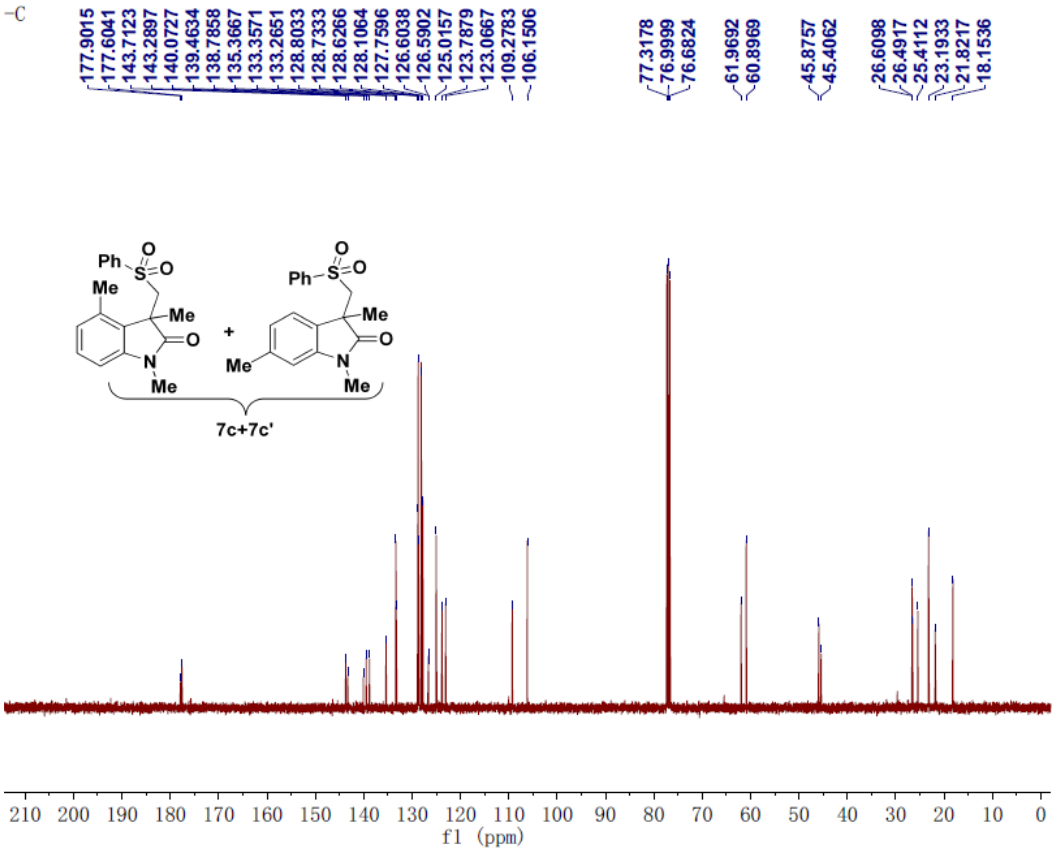
^{13}C NMR of **7b** (100 M, $CDCl_3$)



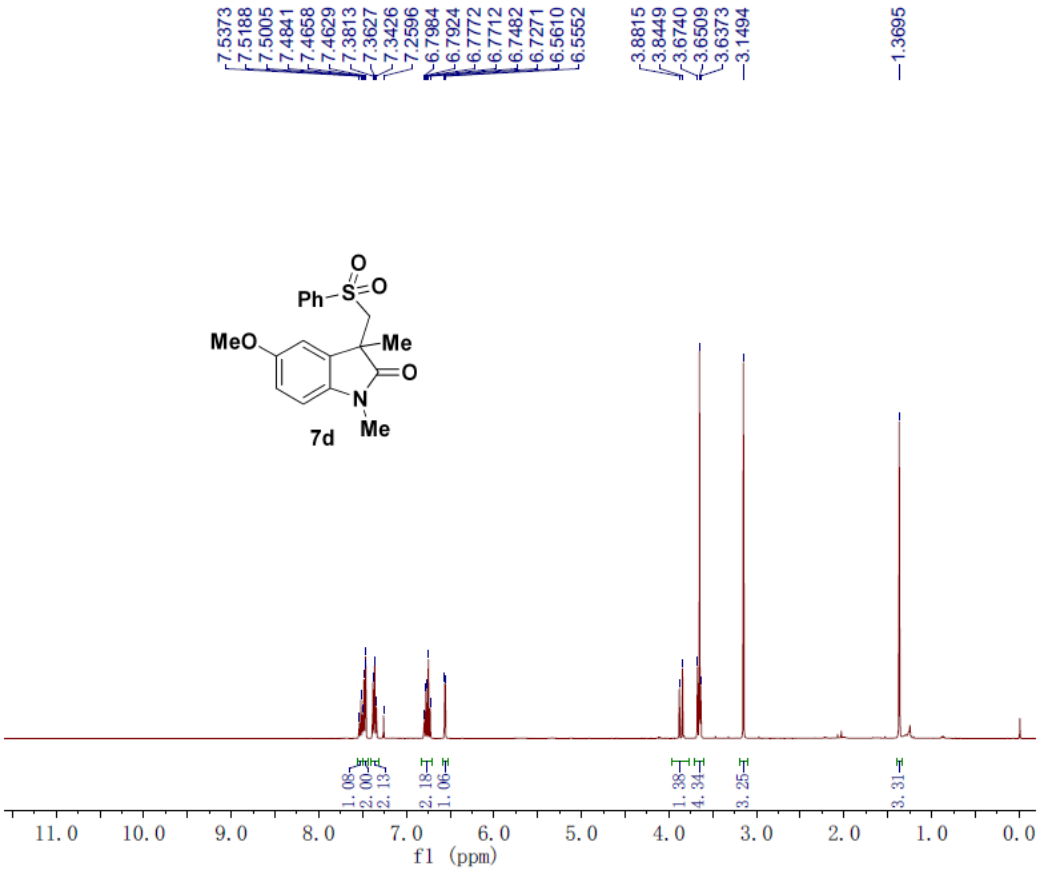
^{1}H NMR of **7c** (400 M, $CDCl_3$)



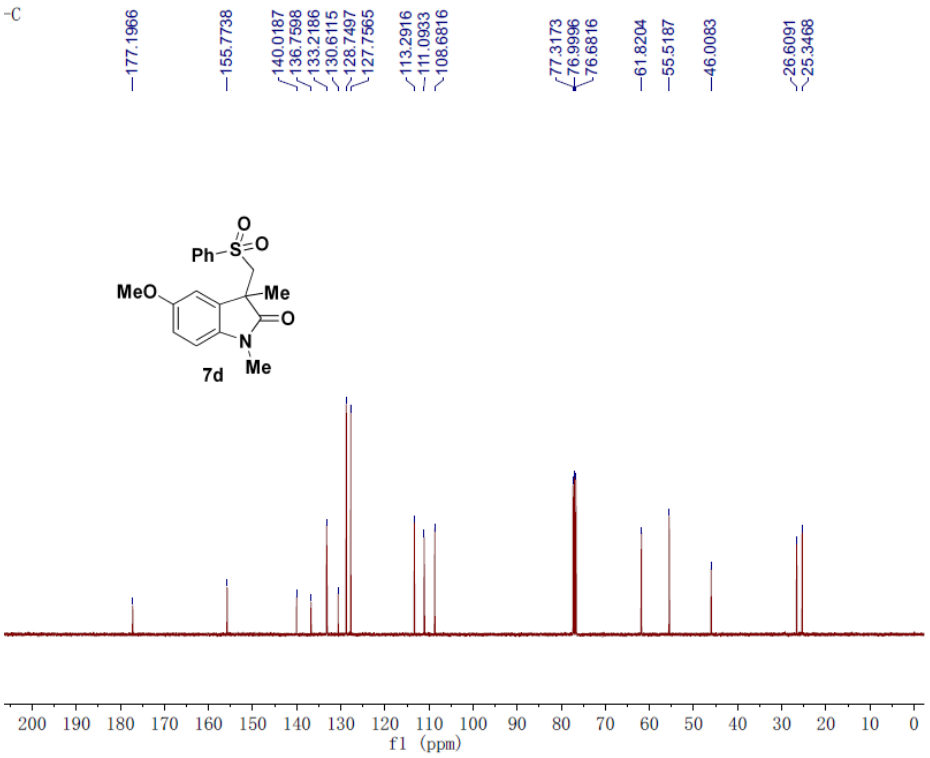
^{13}C NMR of **7c** (100 M, $CDCl_3$)



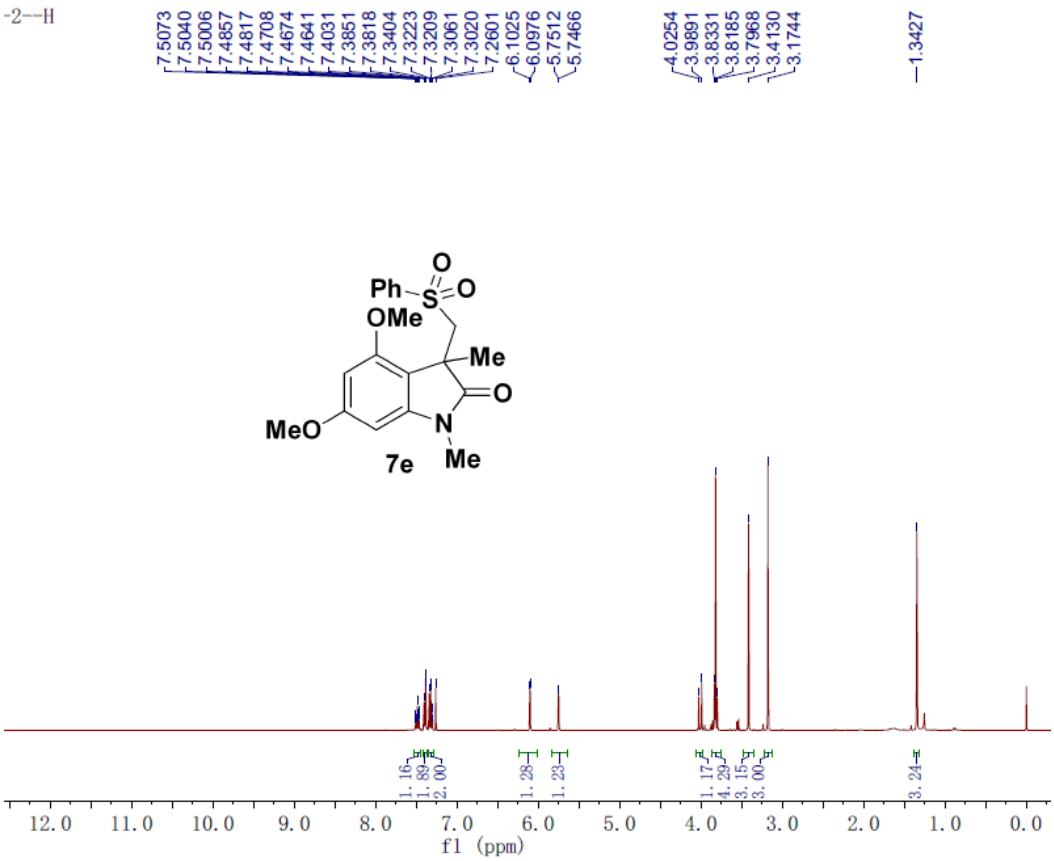
^{1}H NMR of **7d** (400 M, $CDCl_3$)



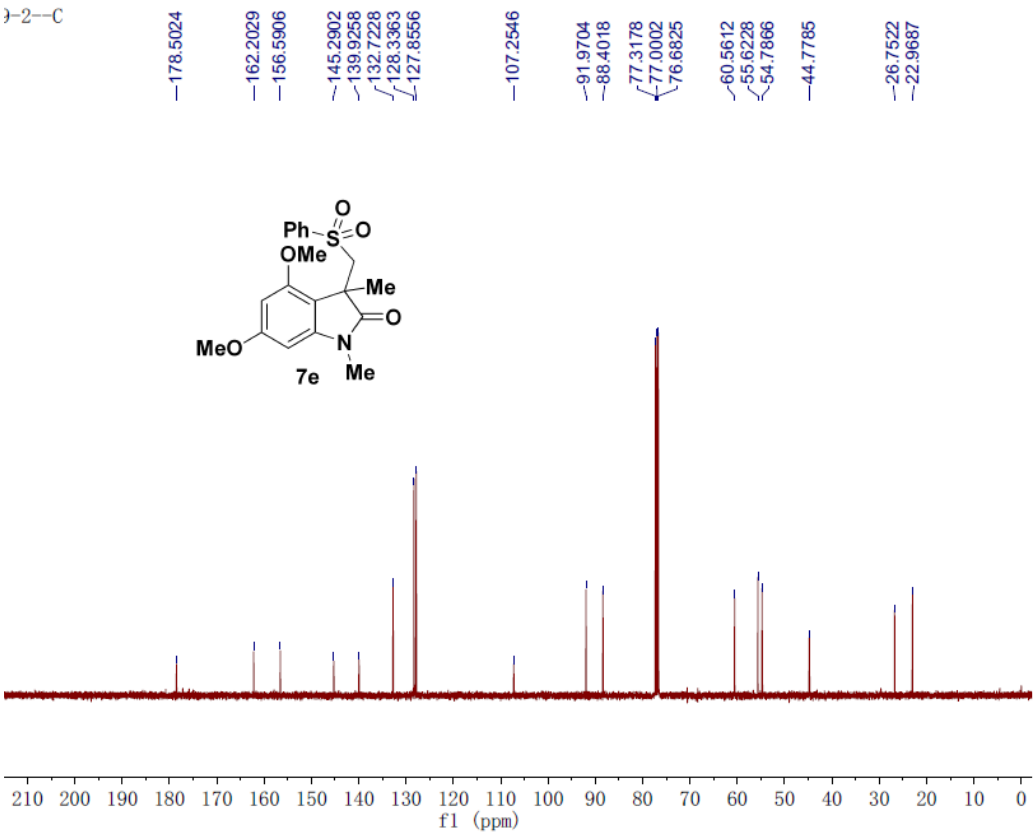
^{13}C NMR of **7d** (100 M, $CDCl_3$)



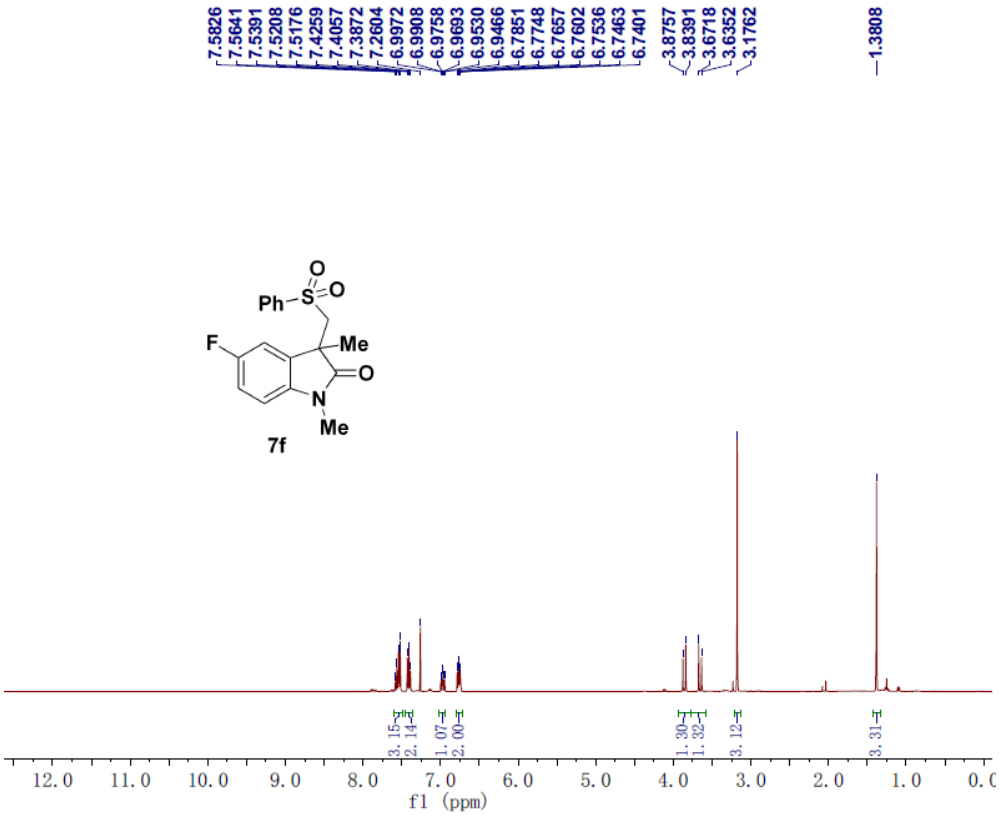
^{1}H NMR of **7e** (400 M, $CDCl_3$)



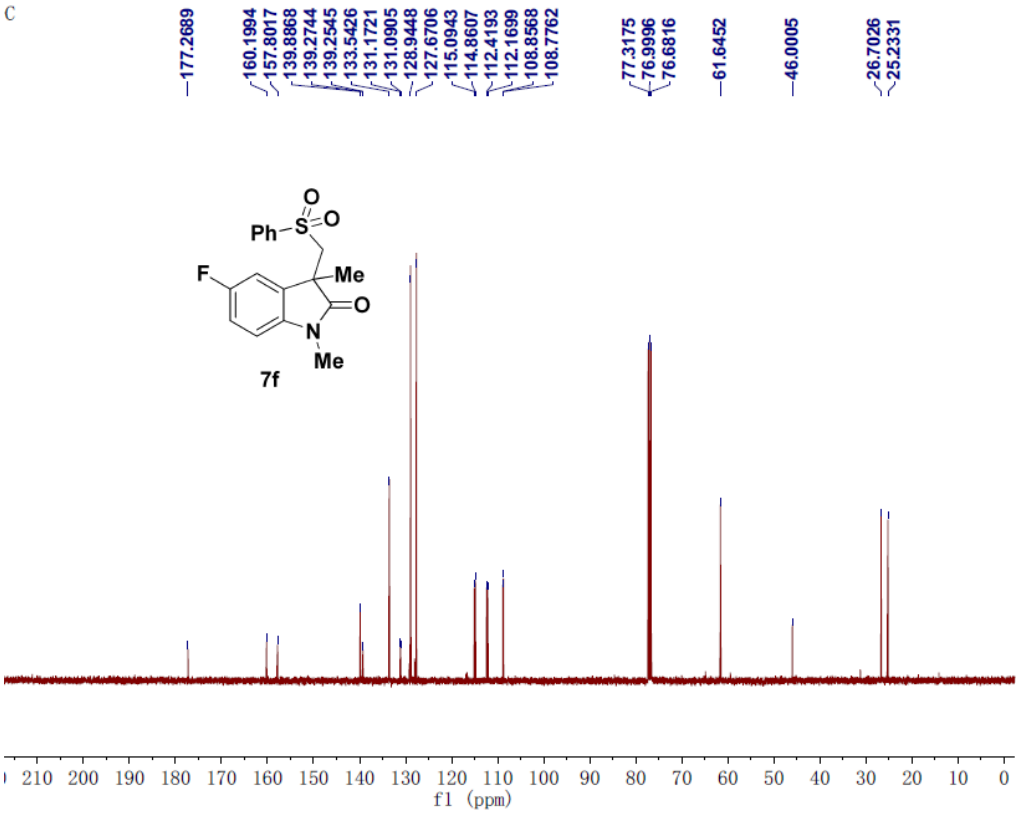
^{13}C NMR of **7e** (100 M, $CDCl_3$)



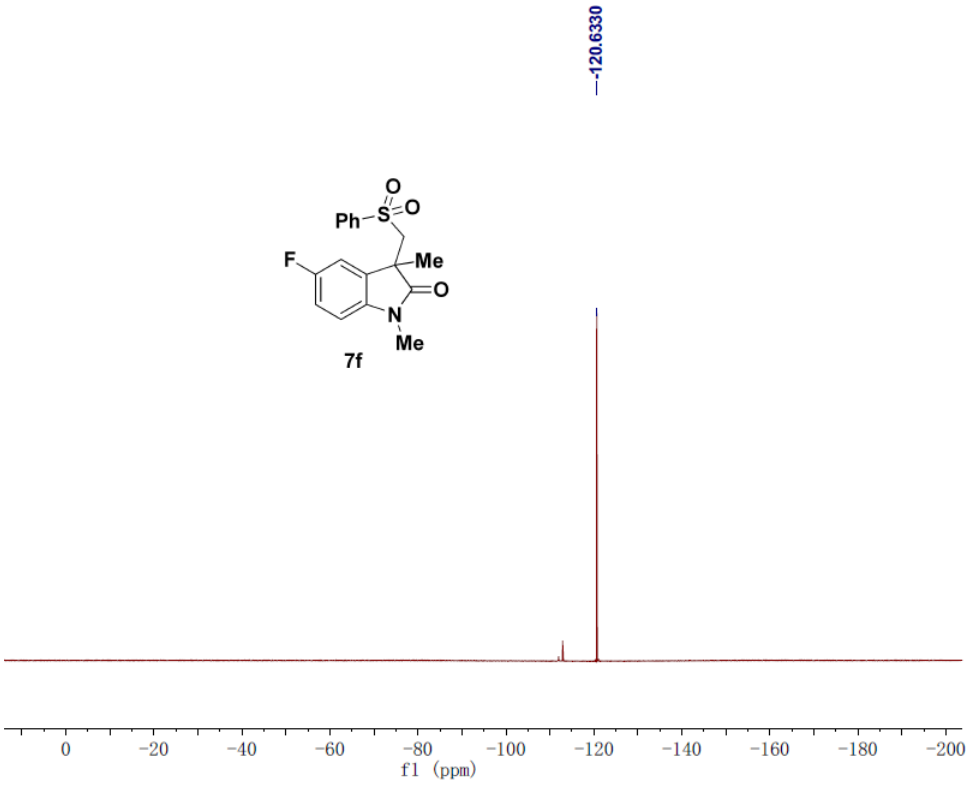
^{1}H NMR of **7f** (400 M, $CDCl_3$)



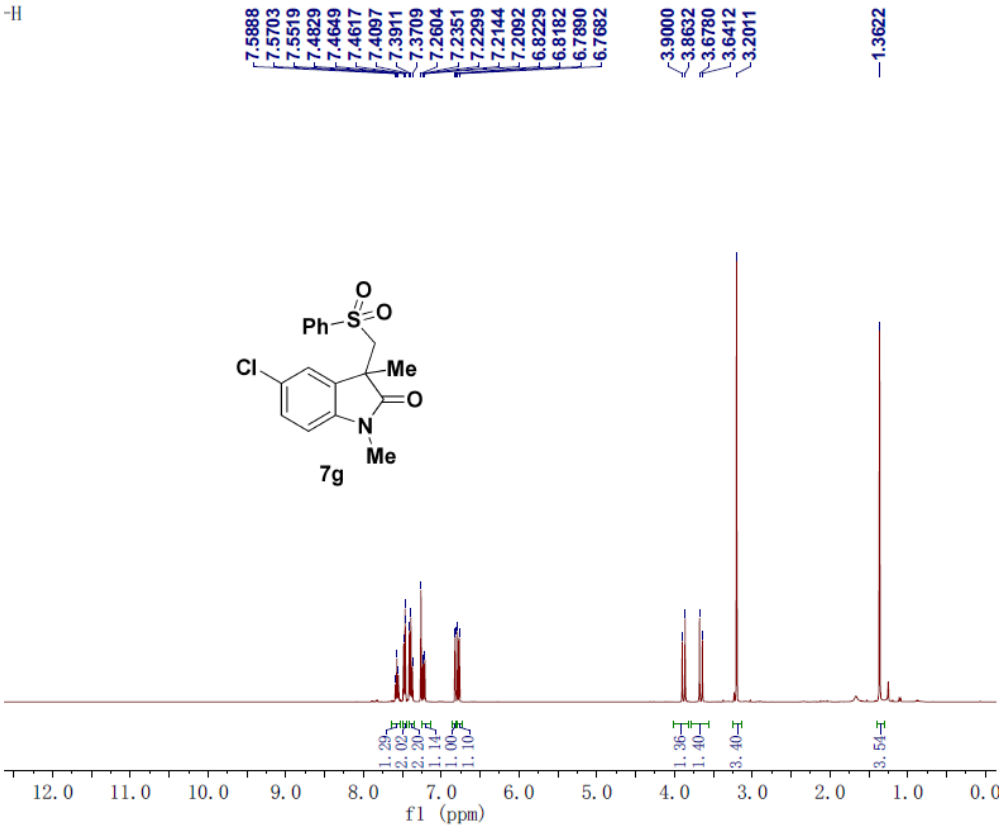
^{13}C NMR of **7f** (100 M, $CDCl_3$)



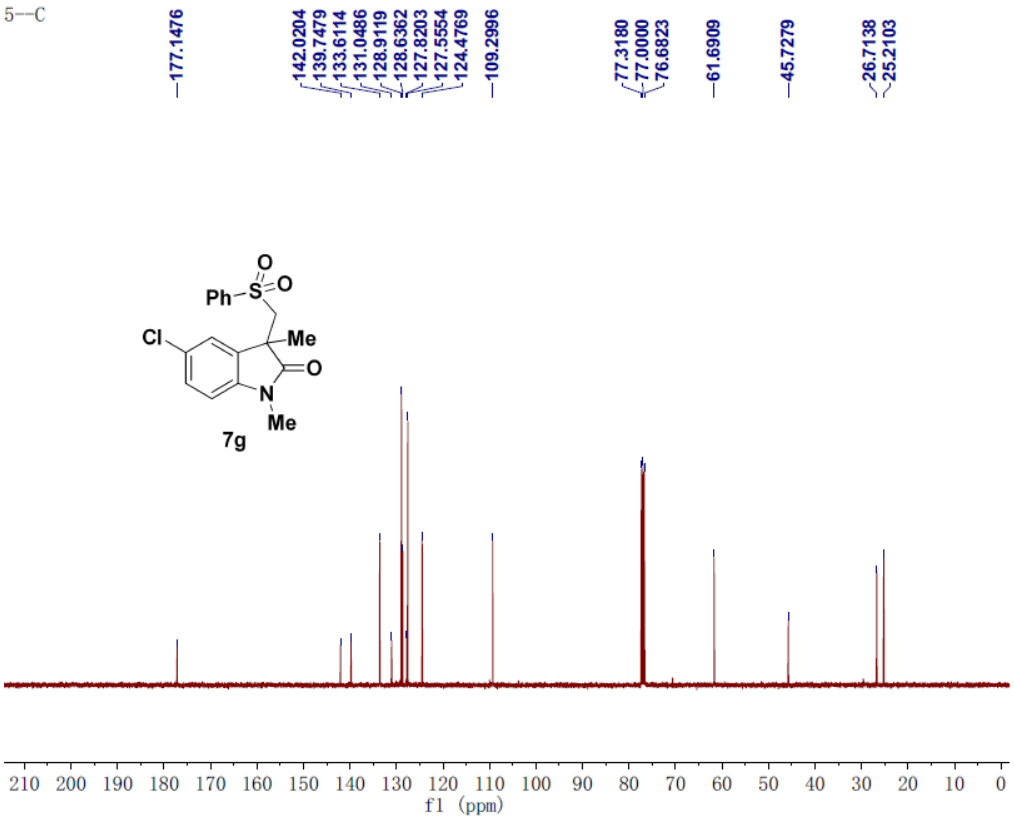
^{19}F NMR of **7f** (376 M, $CDCl_3$)



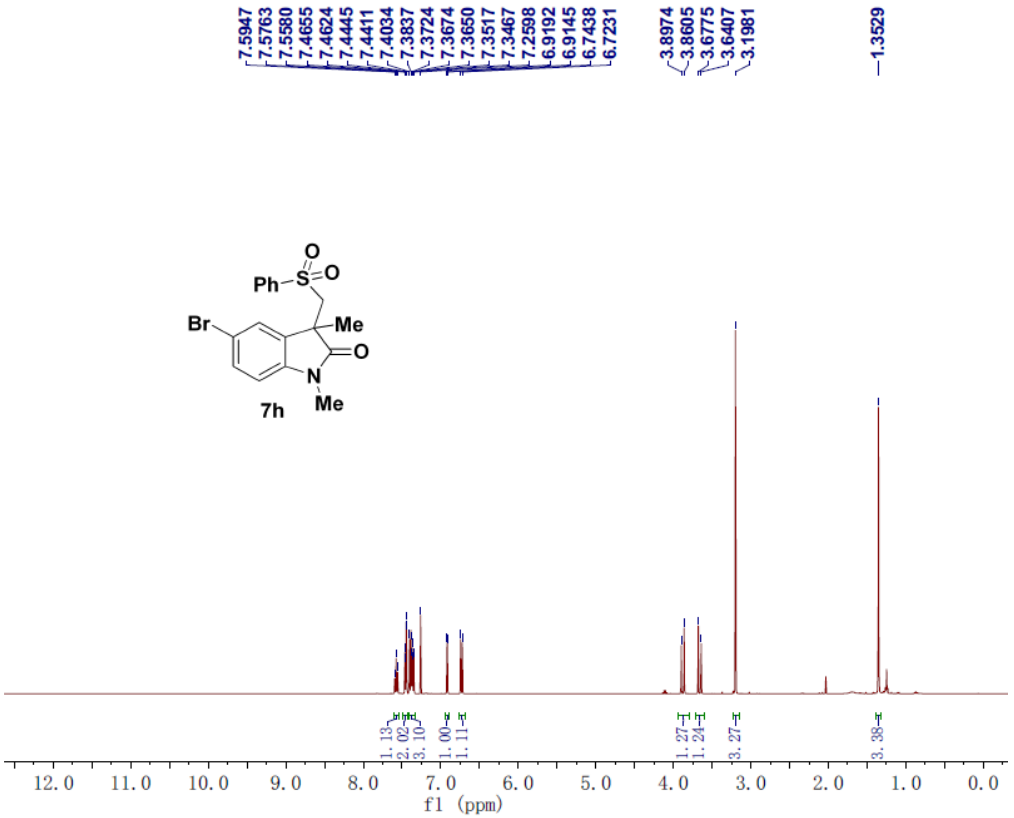
^{1}H NMR of **7g** (400 M, $CDCl_3$)



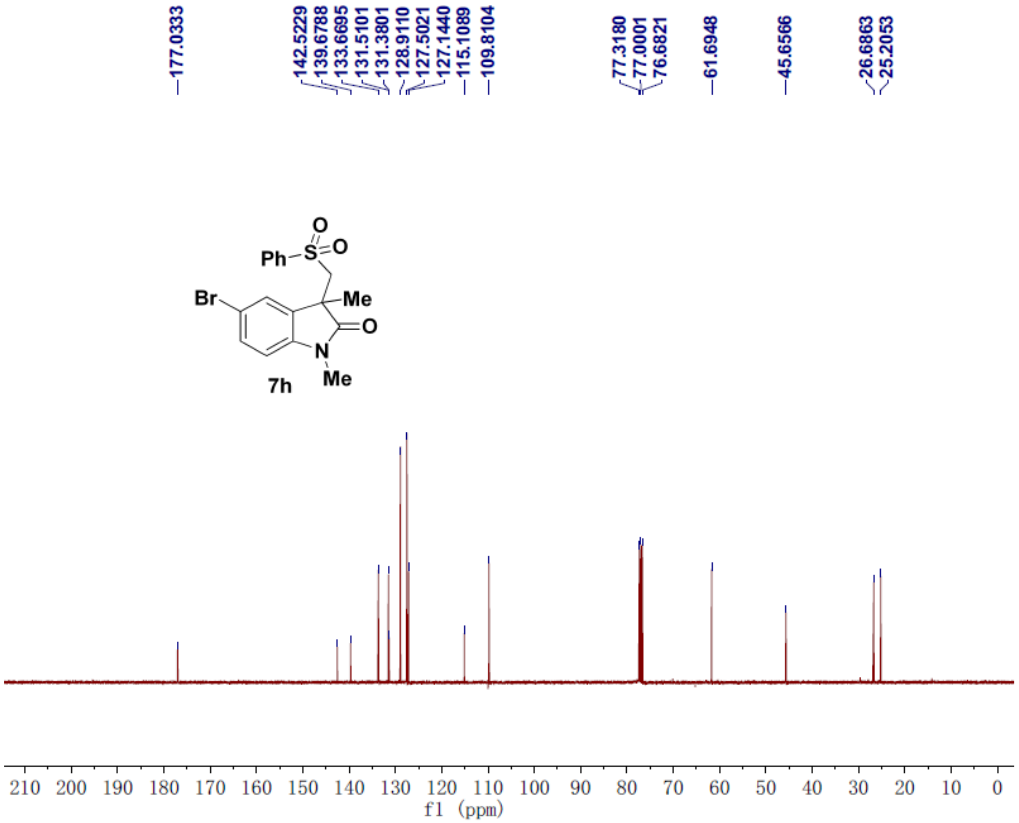
^{13}C NMR of **7g** (100 M, $CDCl_3$)



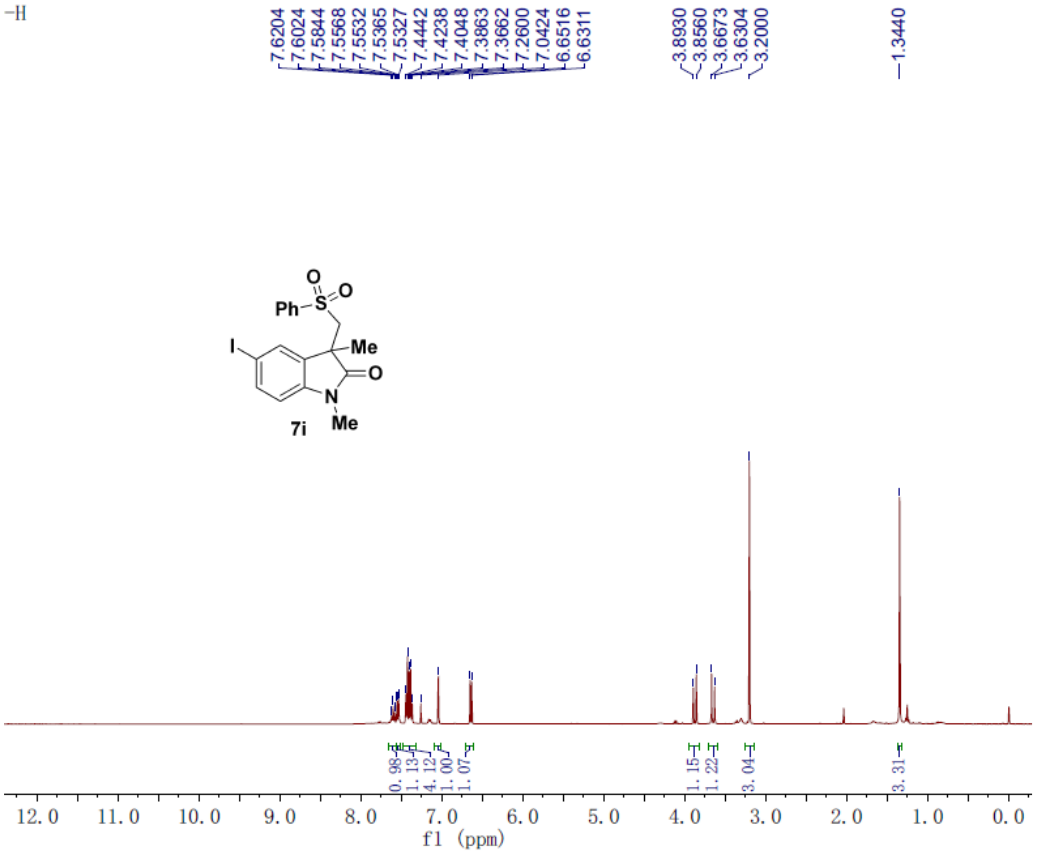
^{1}H NMR of **7h** (400 M, $CDCl_3$)



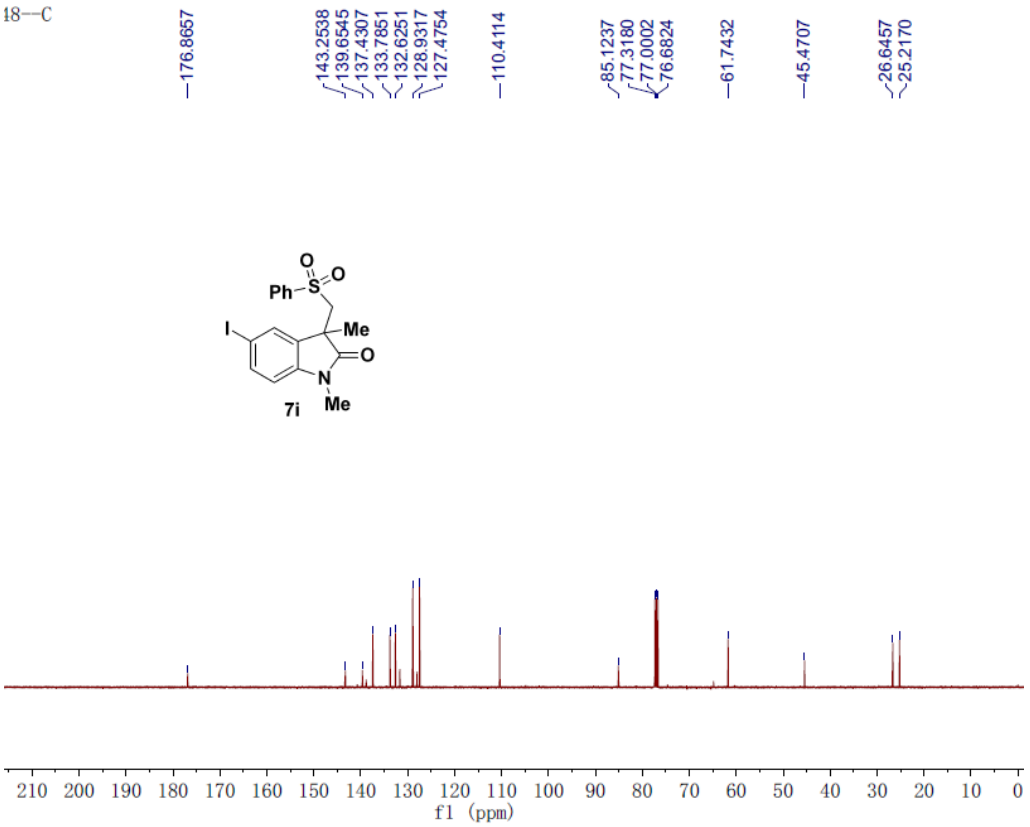
^{13}C NMR of **7h** (100 M, $CDCl_3$)



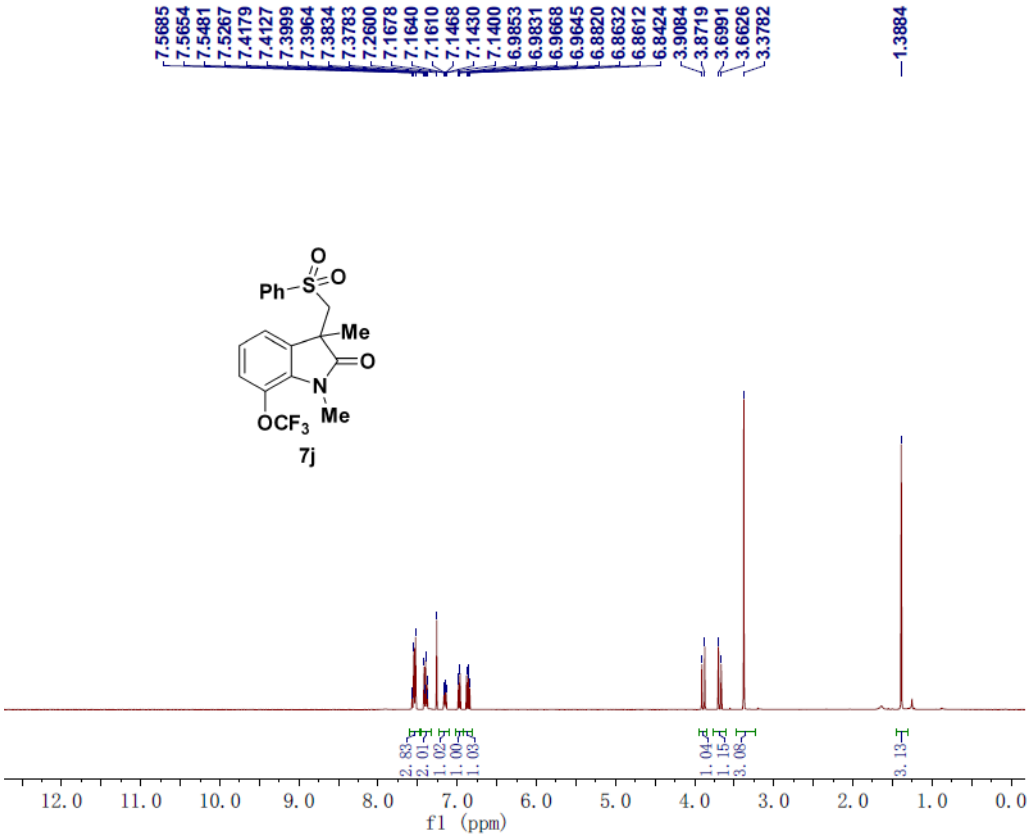
^{1}H NMR of **7i** (400 M, $CDCl_3$)



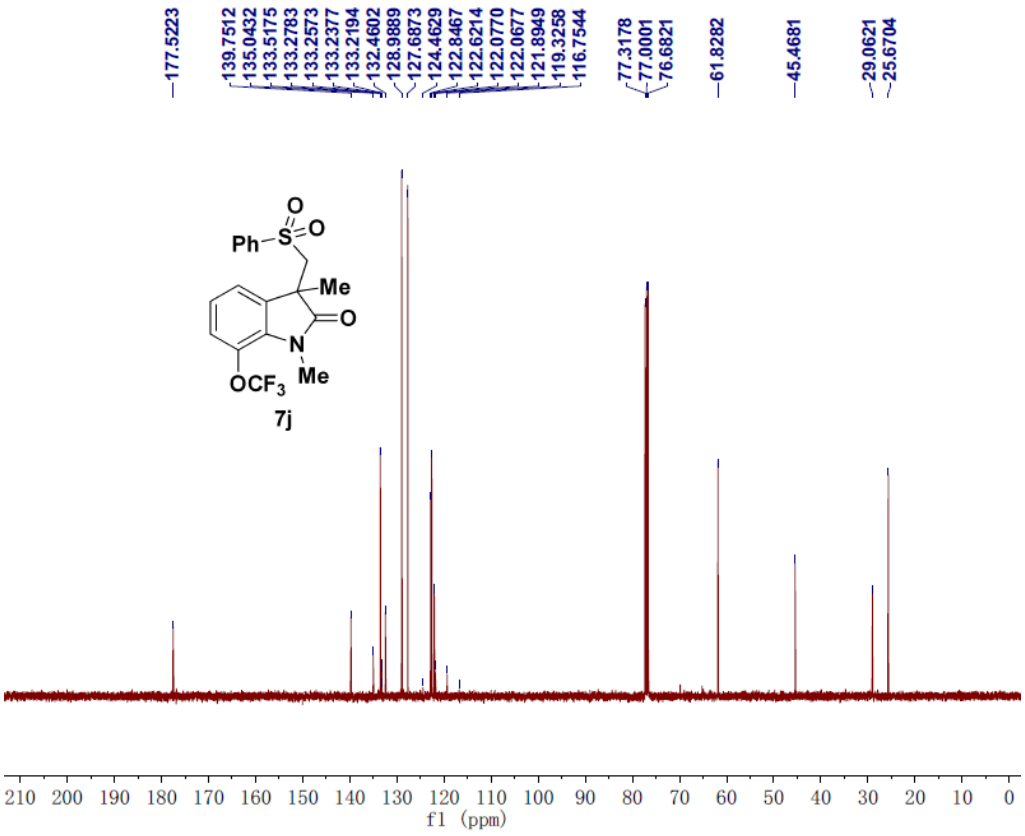
^{13}C NMR of **7i** (100 M, $CDCl_3$)



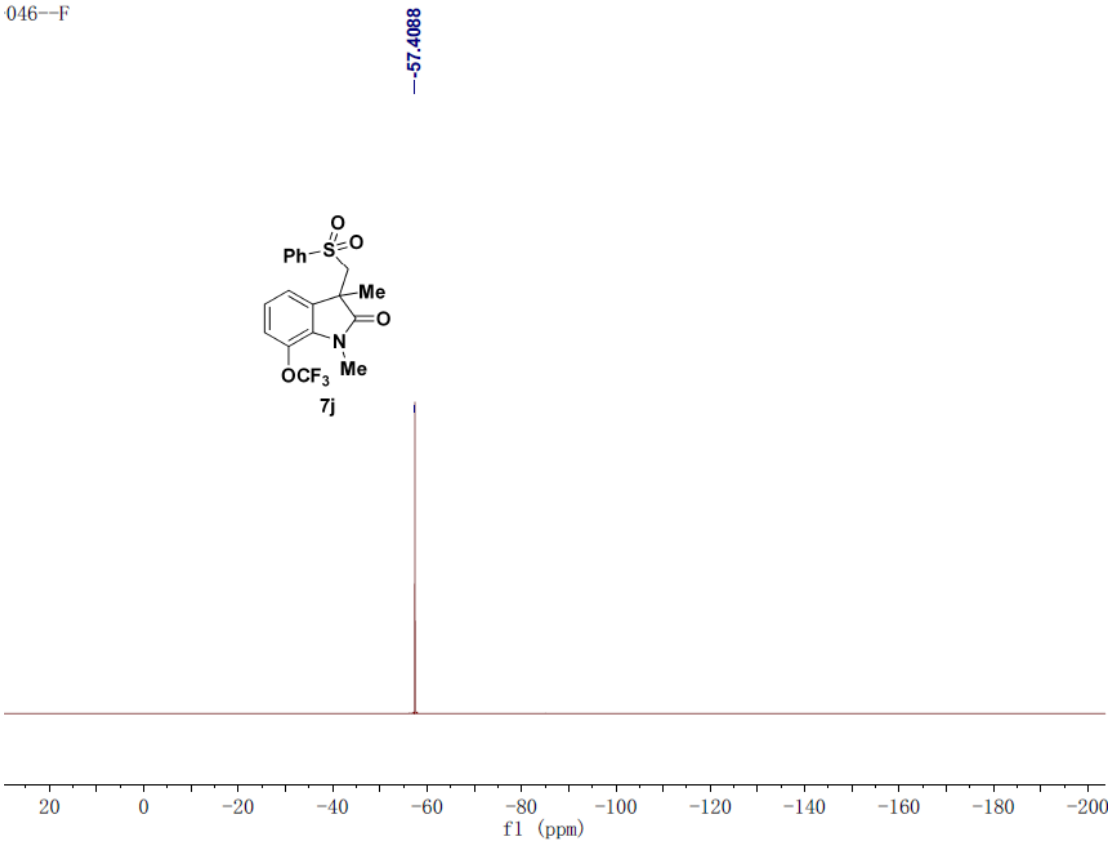
^{1}H NMR of **7j** (400 M, $CDCl_3$)



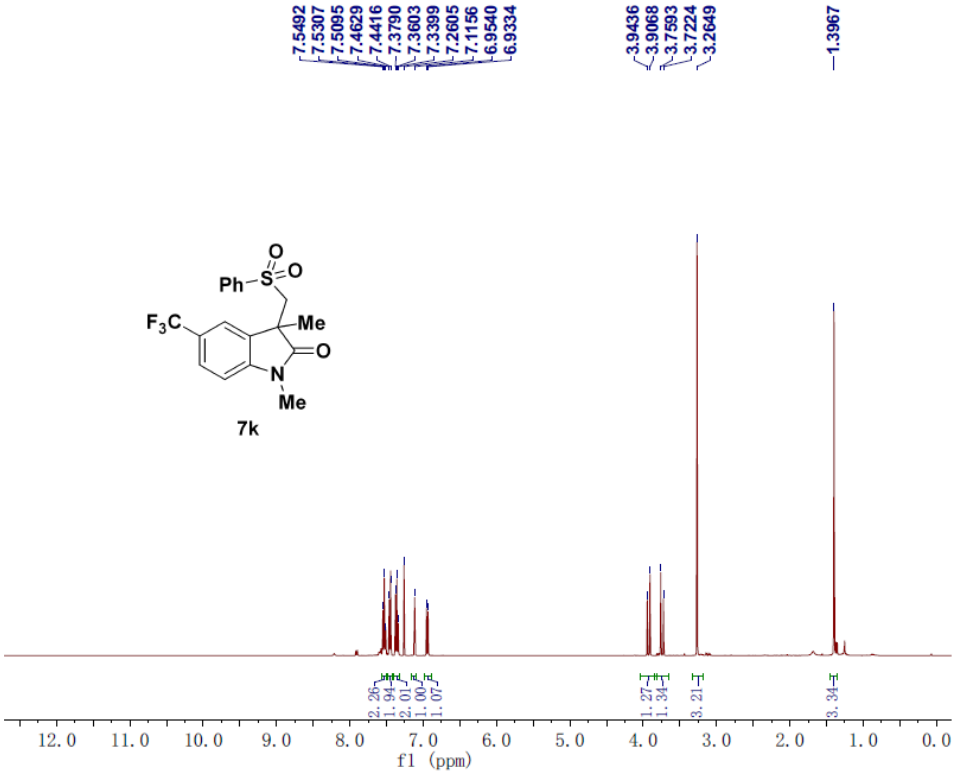
^{13}C NMR of **7j** (100 M, $CDCl_3$)



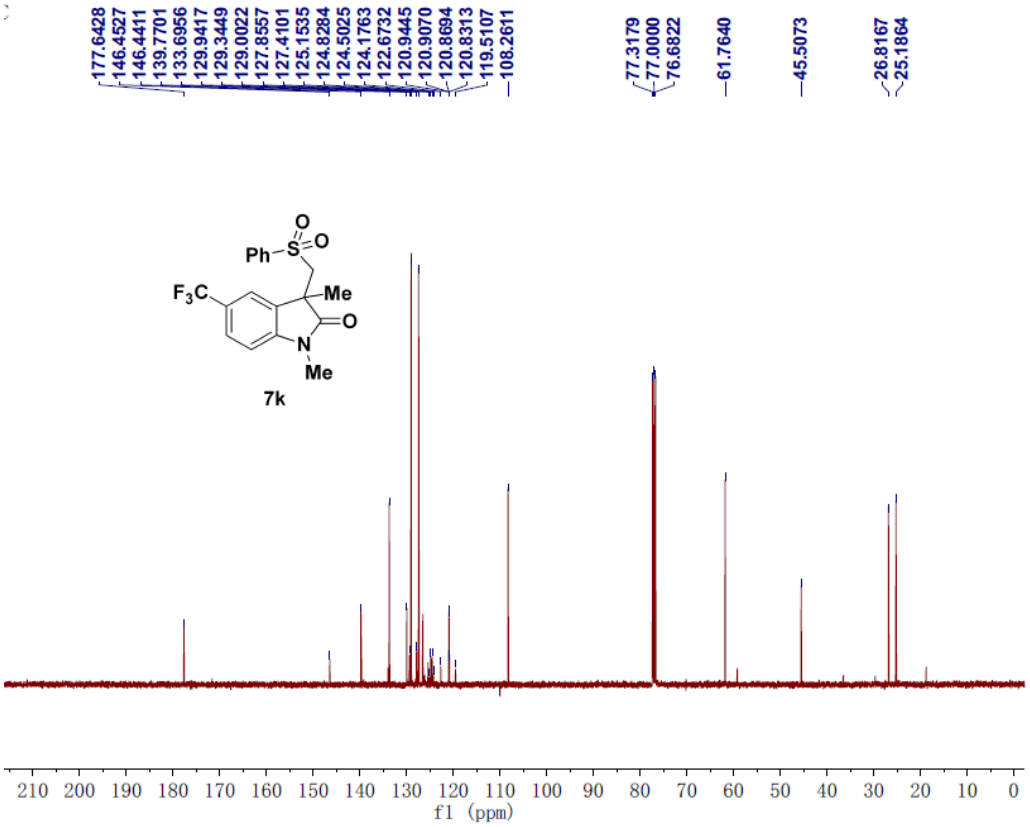
^{19}F NMR of **7j** (376 M, $CDCl_3$)



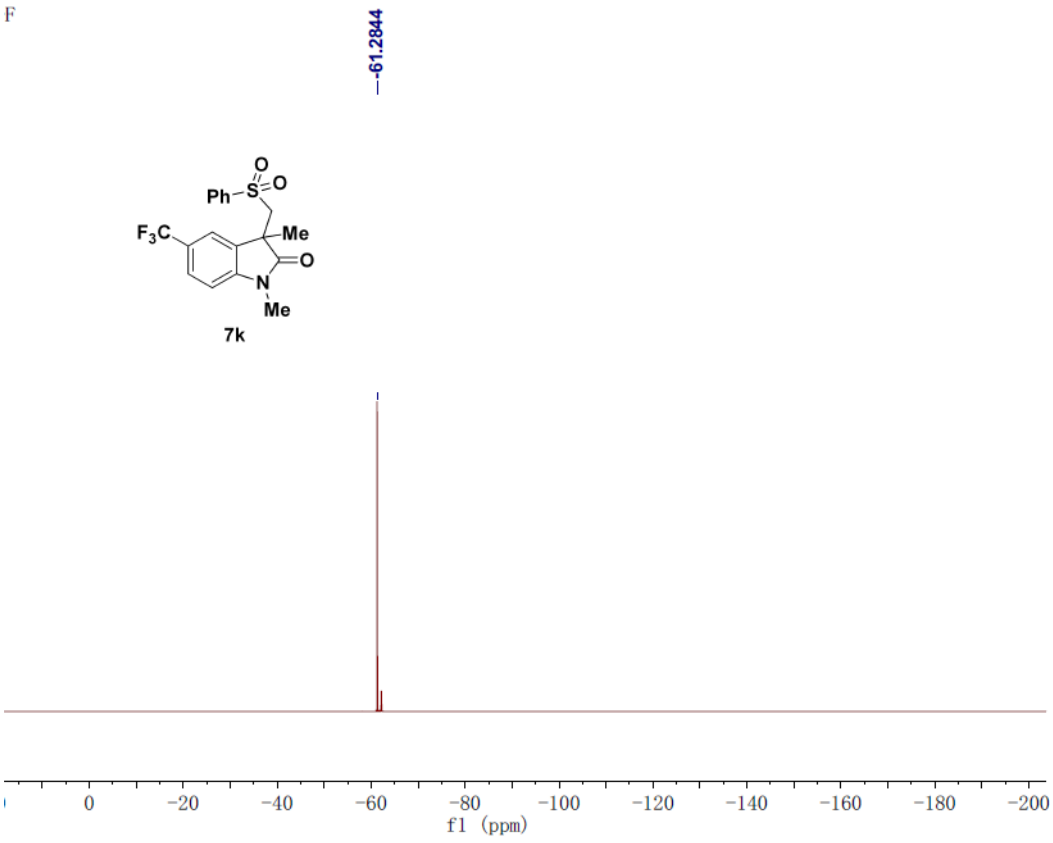
^{1}H NMR of **7k** (400 M, $CDCl_3$)



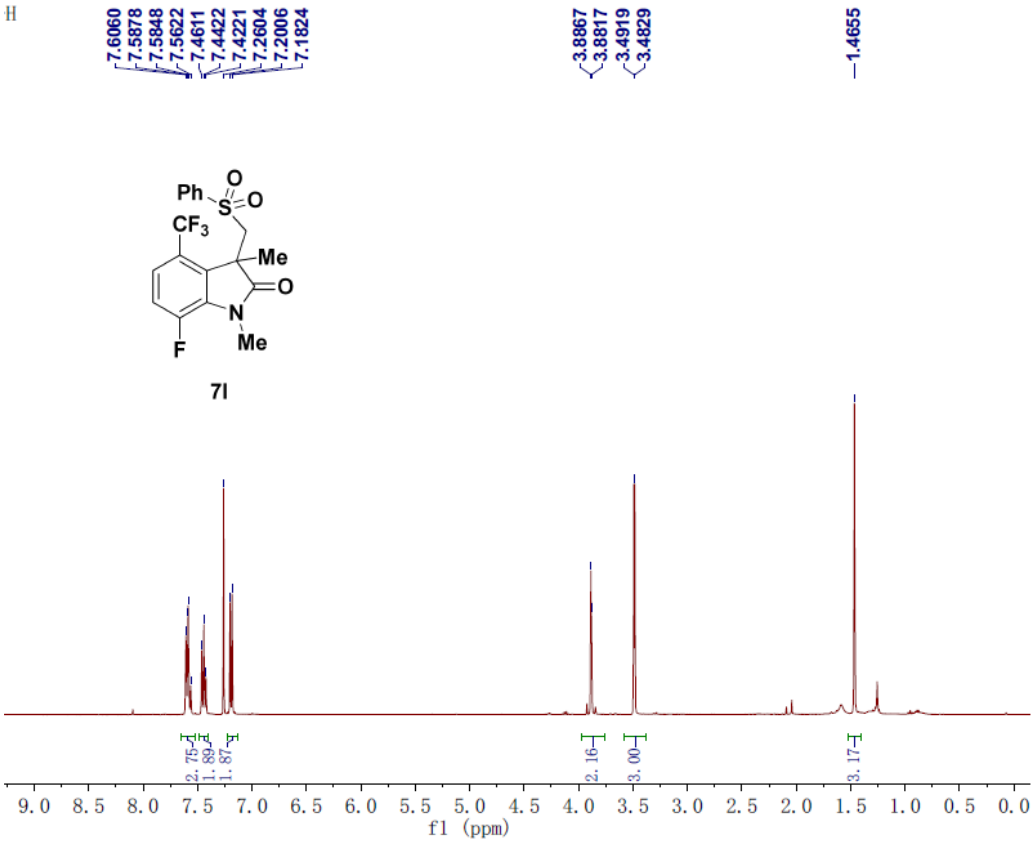
^{13}C NMR of **7k** (100 M, $CDCl_3$)



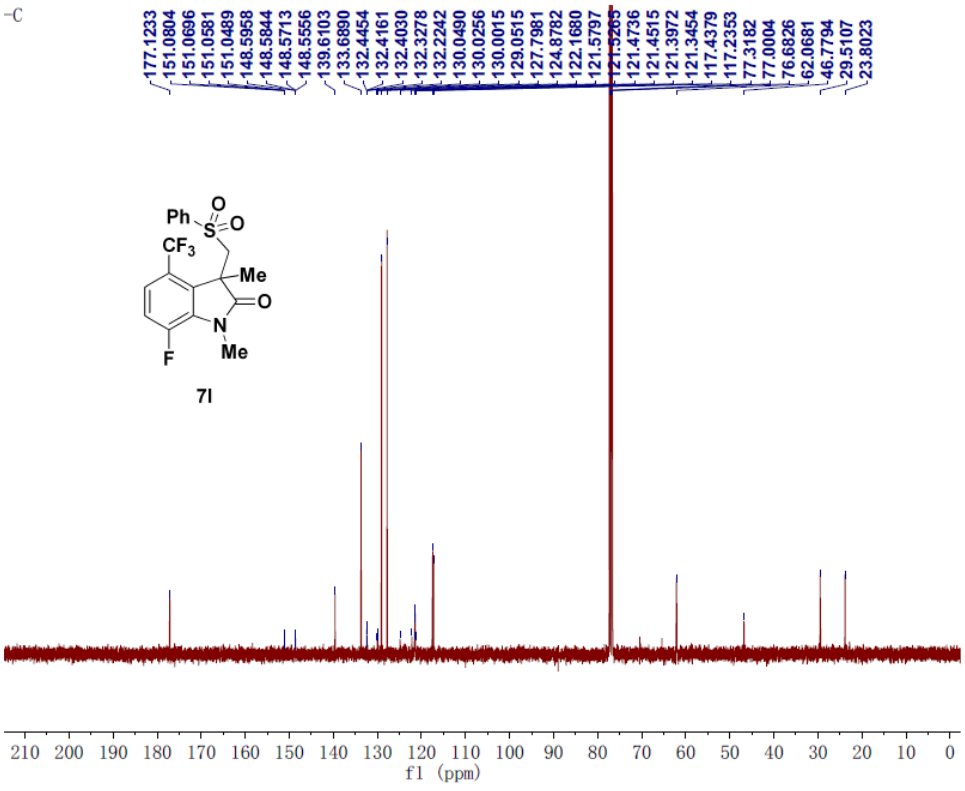
^{19}F NMR of **7k** (376 M, $CDCl_3$)



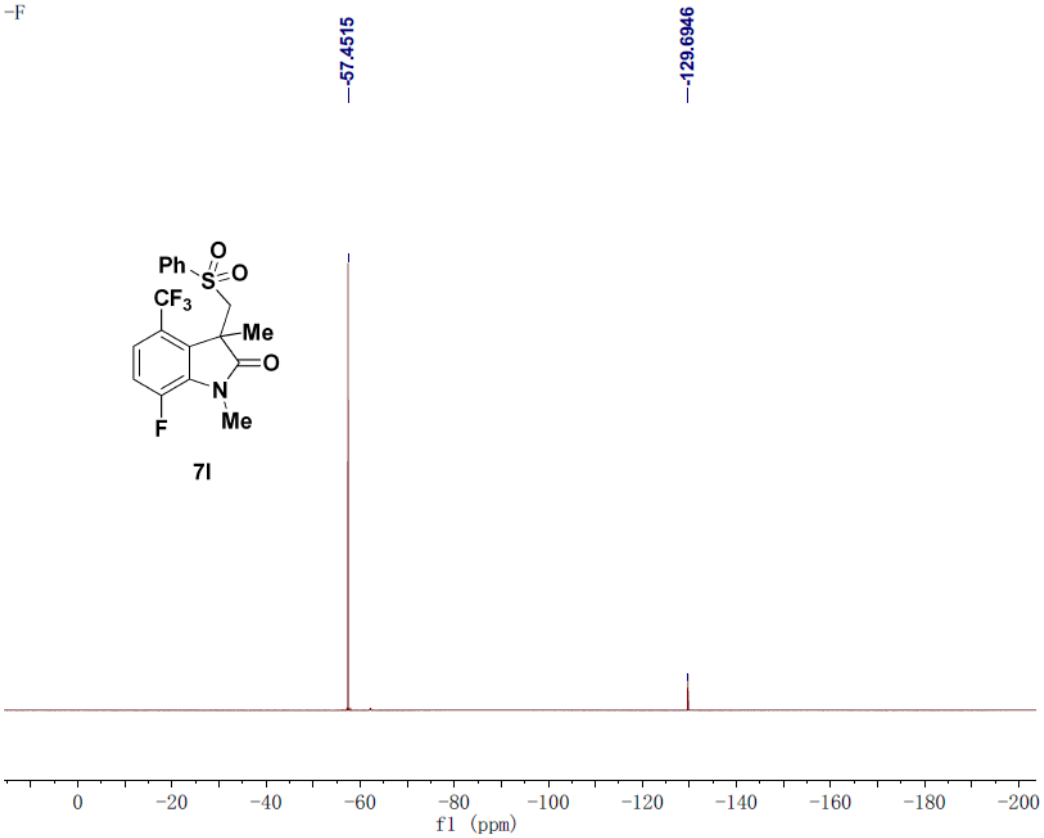
^{1}H NMR of **7l** (400 M, $CDCl_3$)



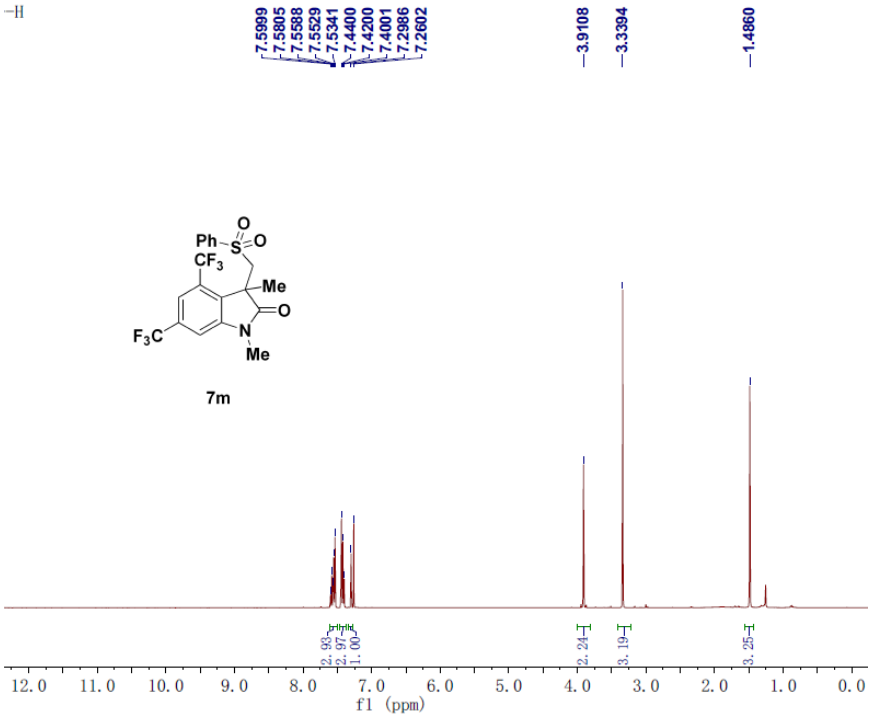
^{13}C NMR of **7l** (100 M, $CDCl_3$)



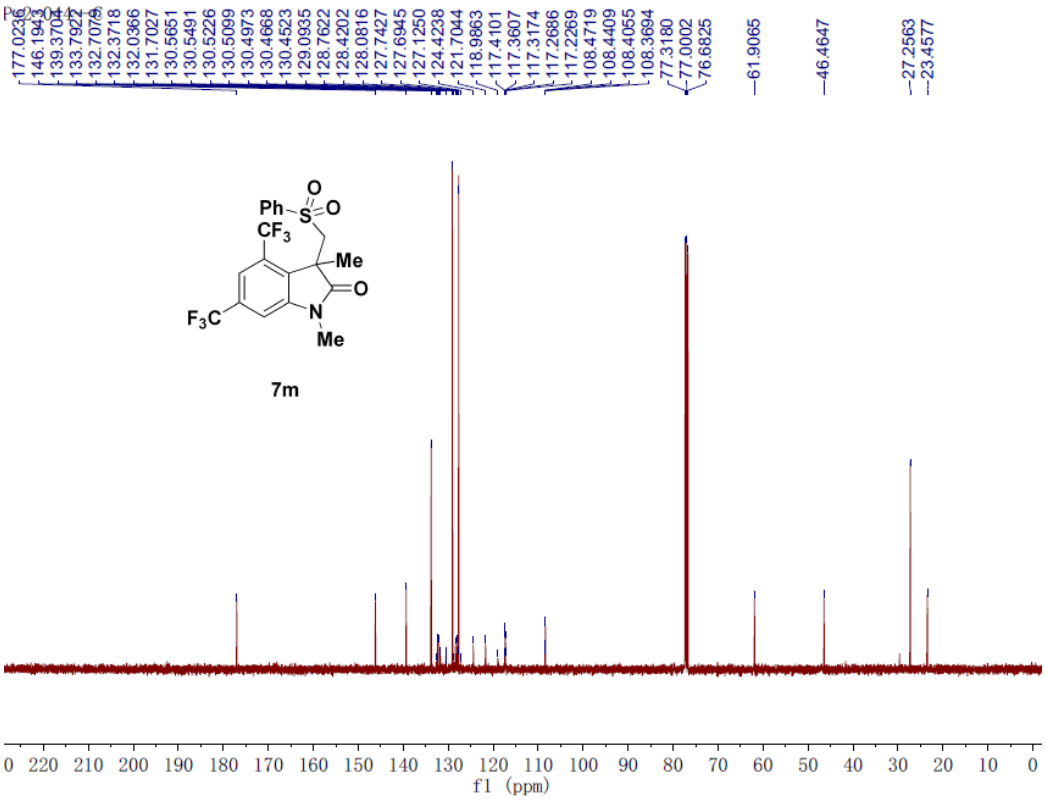
^{19}F NMR of **7l** (376 M, $CDCl_3$)



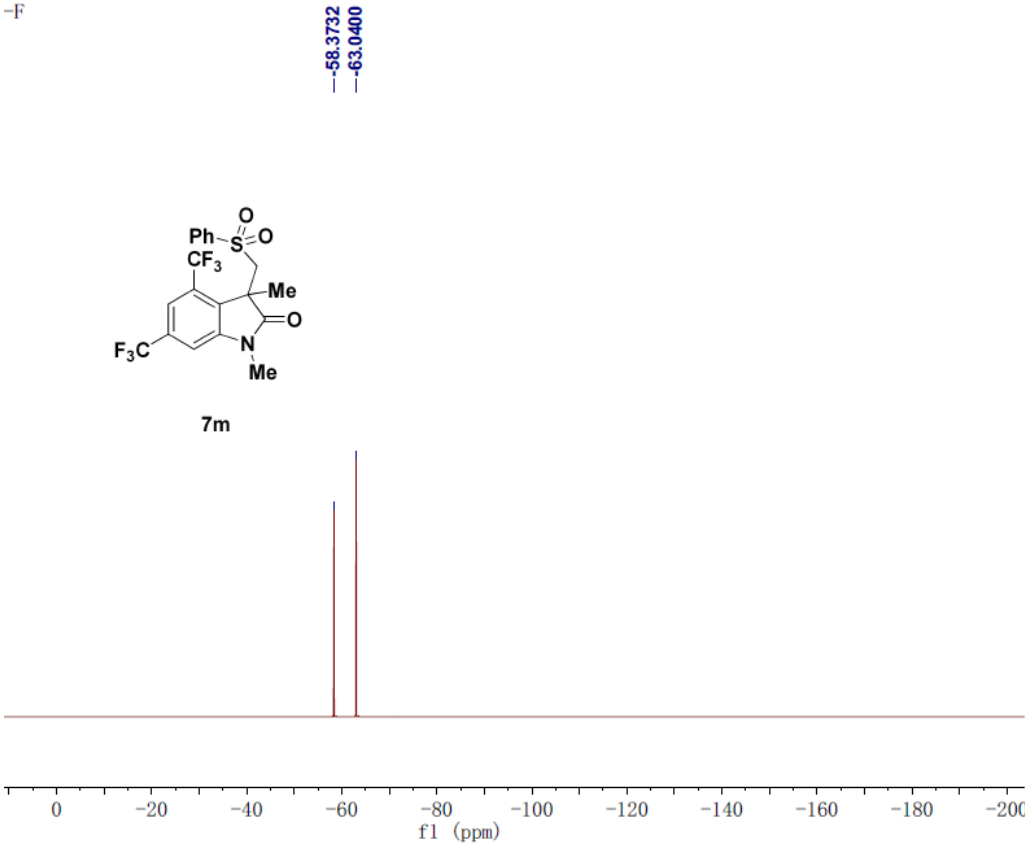
^{1}H NMR of **7m** (400 M, $CDCl_3$)



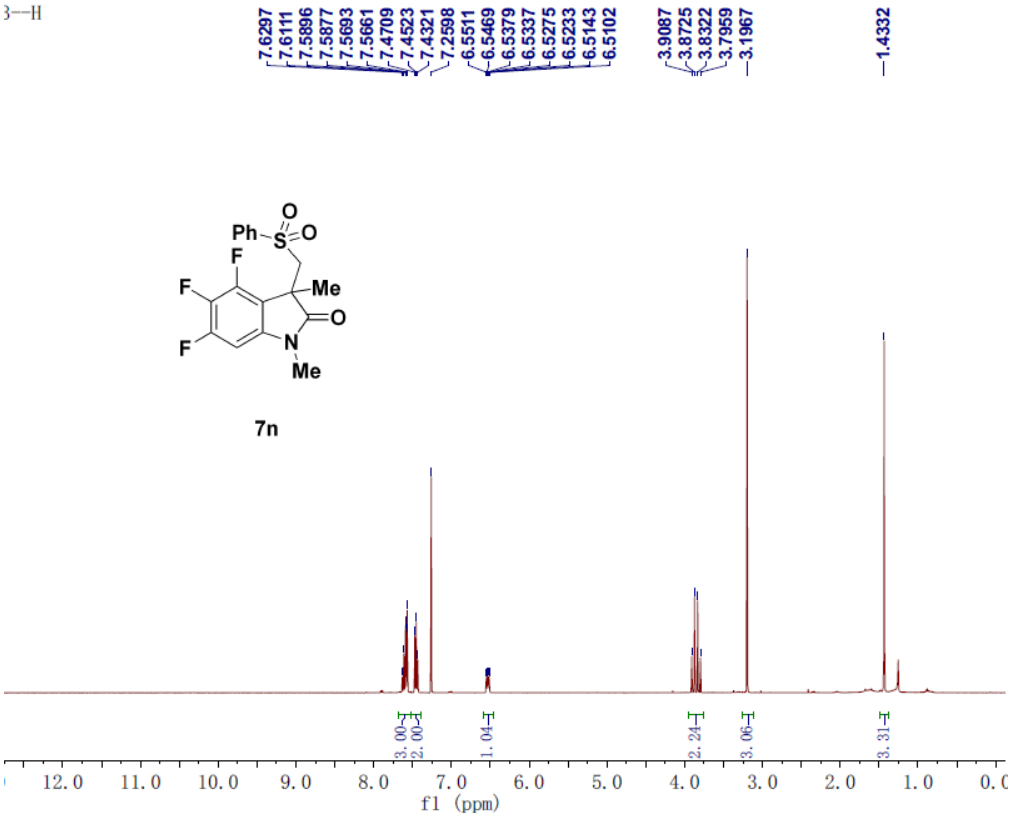
^{13}C NMR of **7m** (100 M, $CDCl_3$)



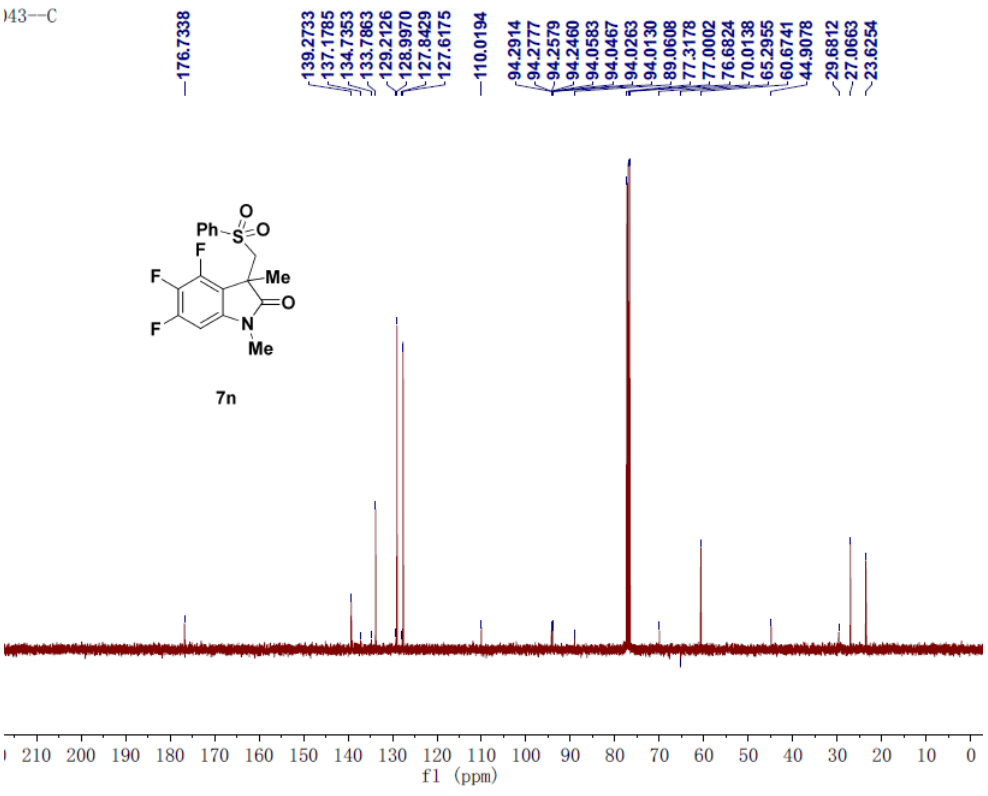
^{19}F NMR of **7m** (376 M, $CDCl_3$)



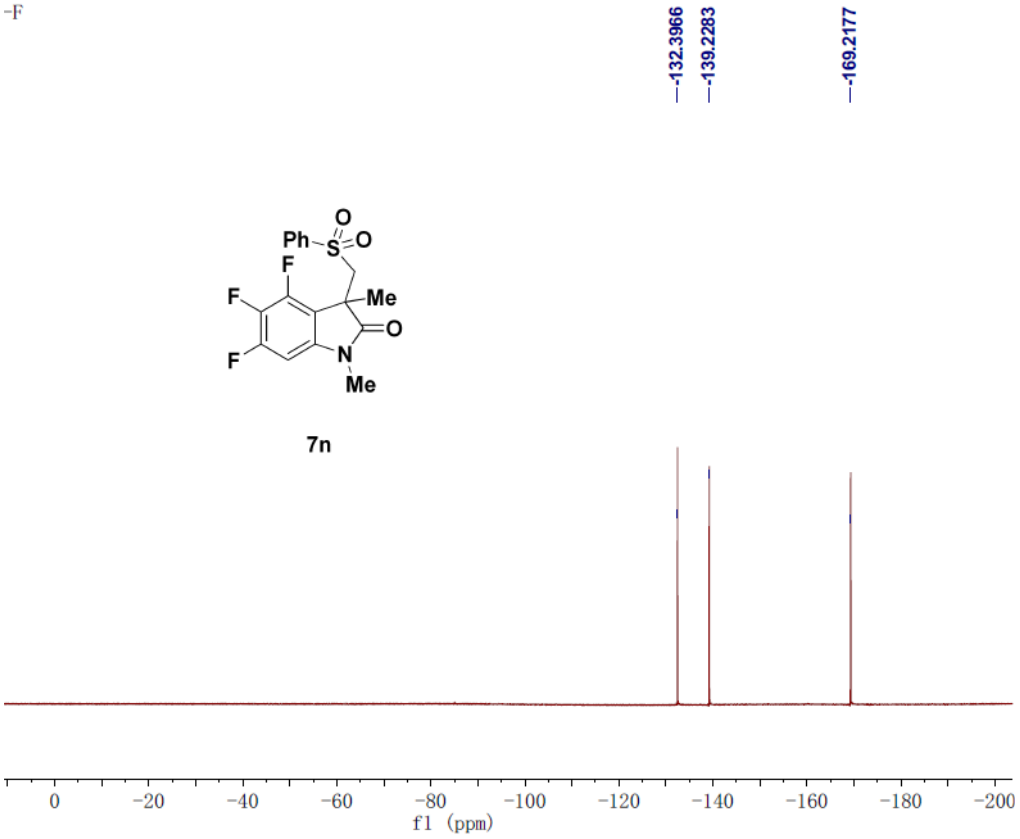
^{1}H NMR of **7n** (400 M, $CDCl_3$)



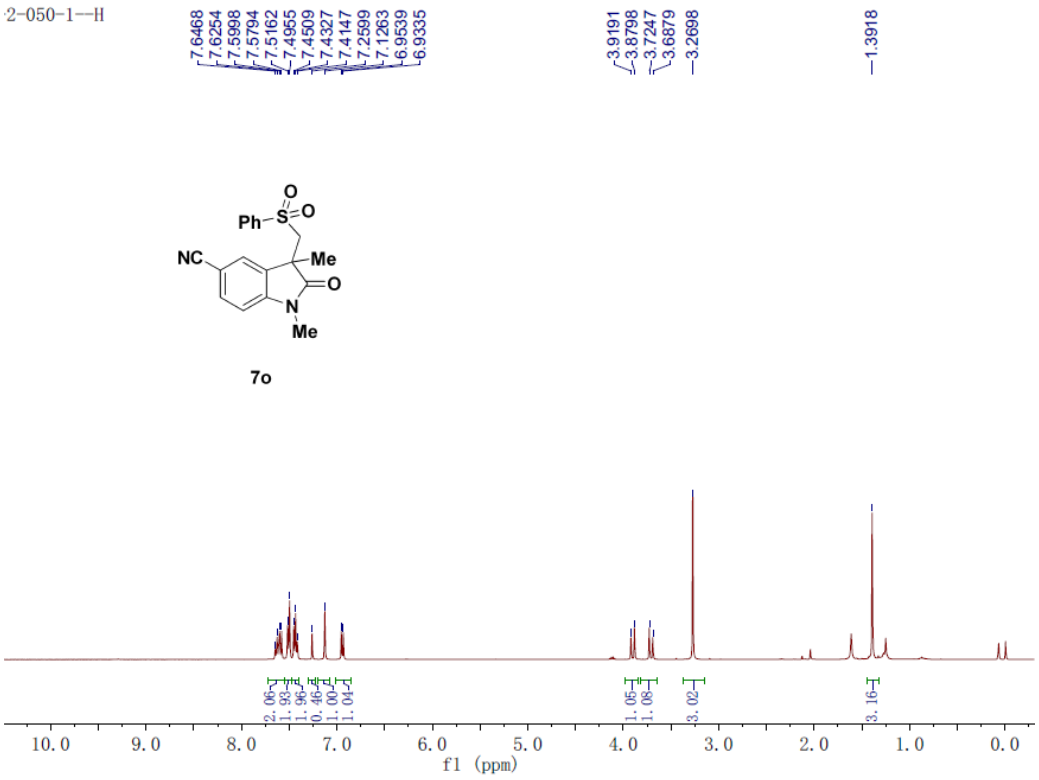
^{13}C NMR of **7n** (100 M, $CDCl_3$)



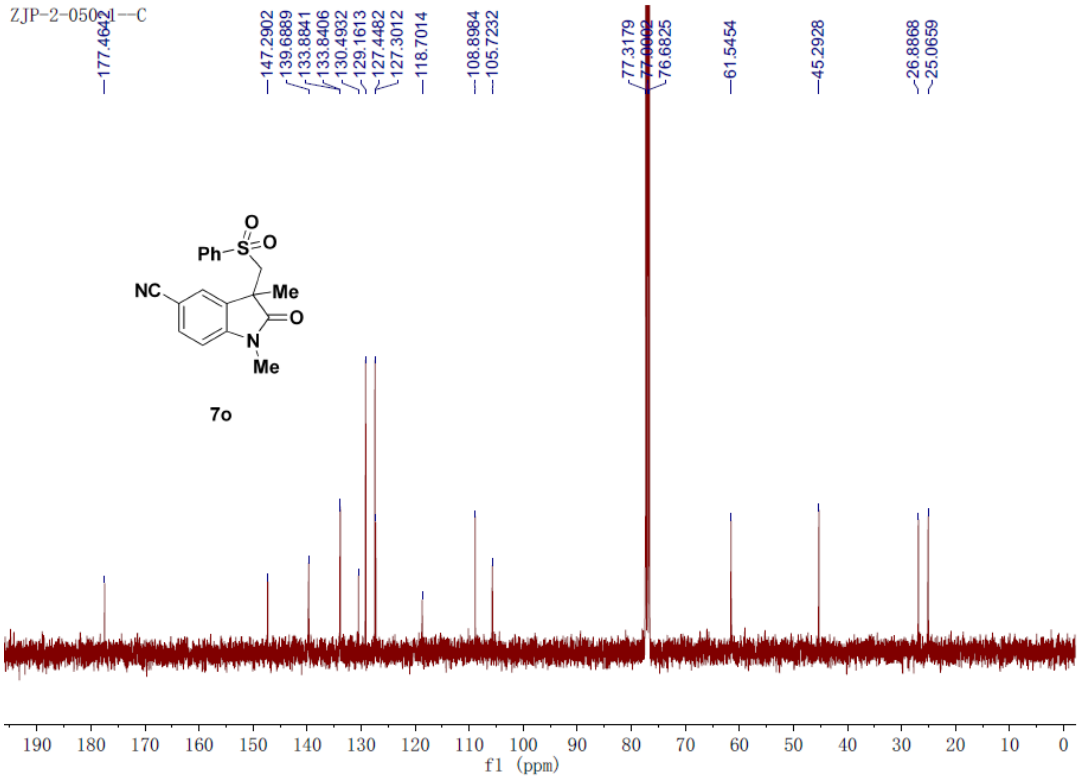
^{19}F NMR of **7n** (376 M, $CDCl_3$)



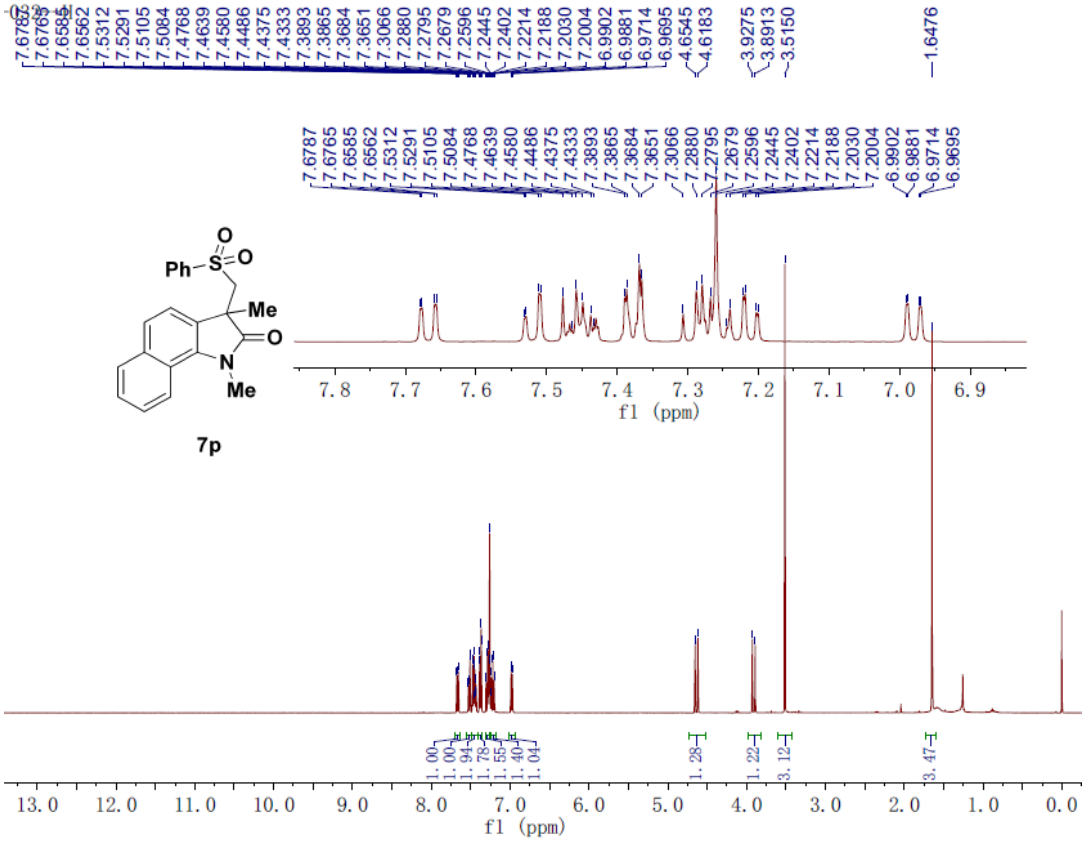
^{1}H NMR of **7o** (400 M, $CDCl_3$)



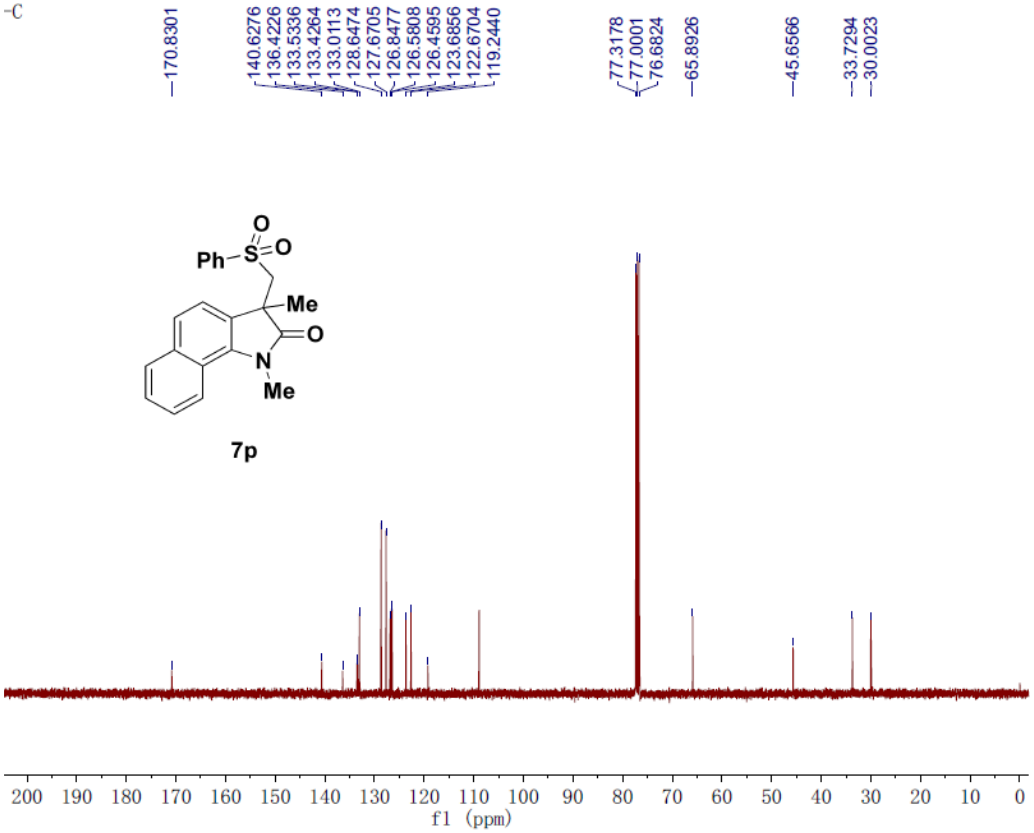
^{13}C NMR of **7o** (100 M, $CDCl_3$)



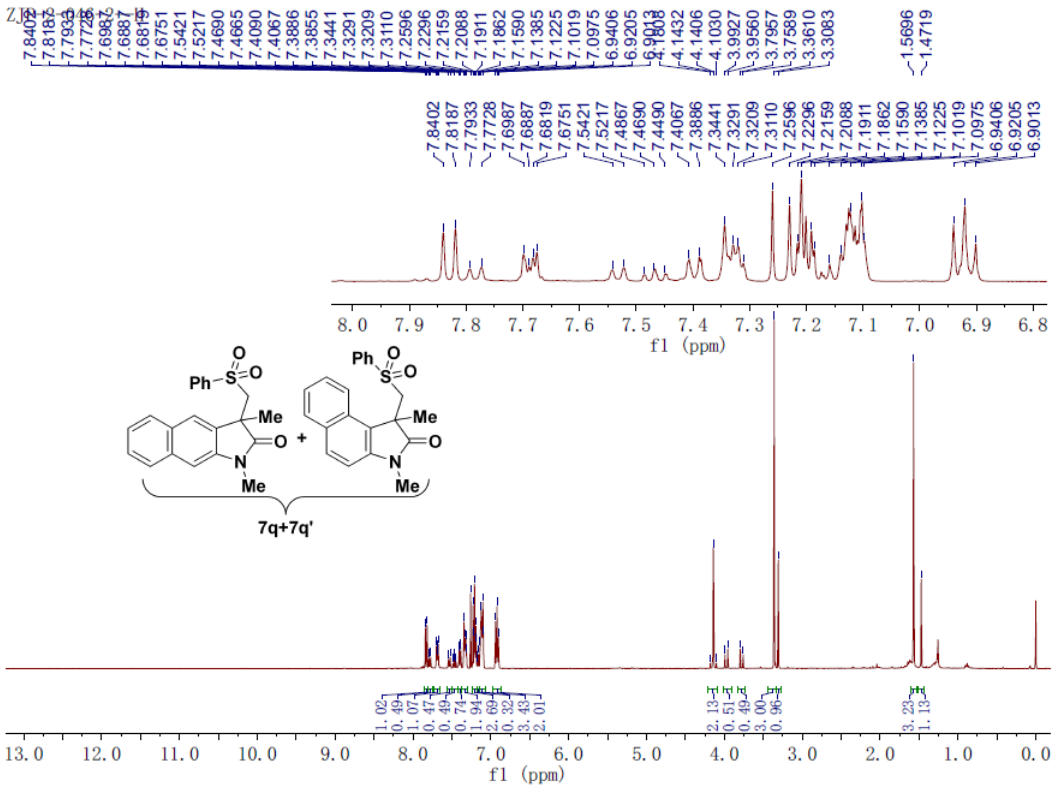
^{1}H NMR of **7p** (400 M, $CDCl_3$)



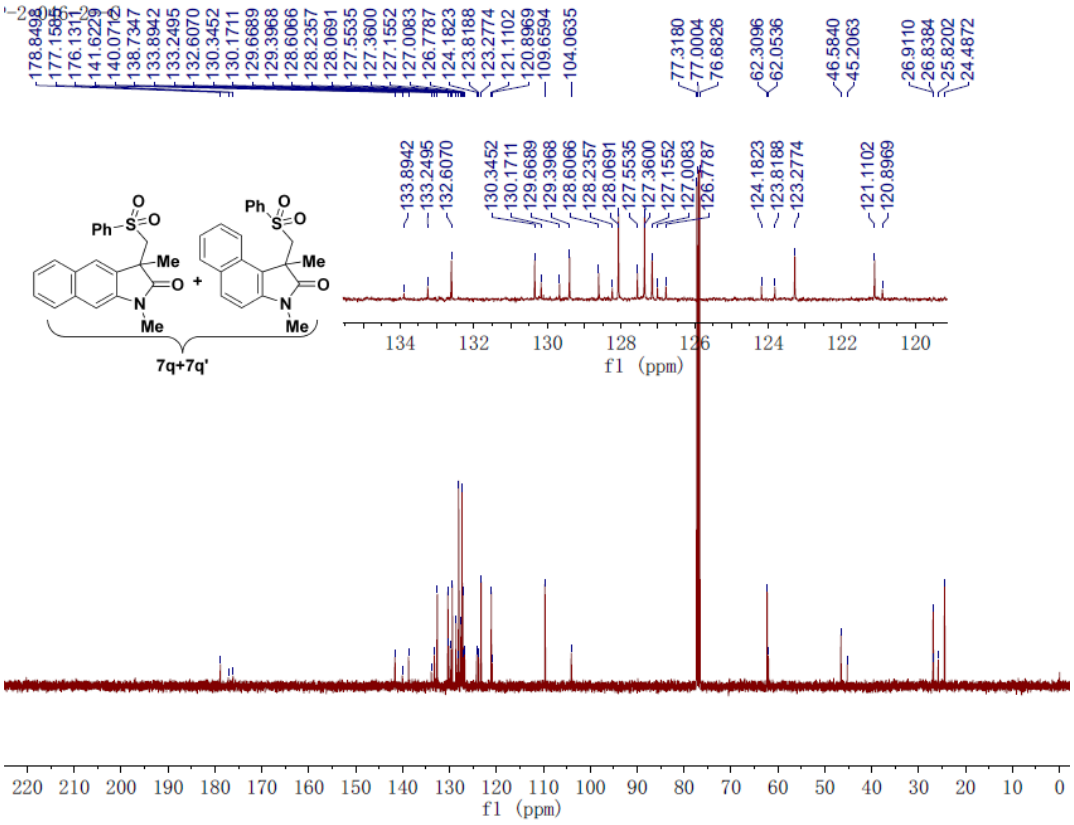
^{13}C NMR of **7p** (100 M, $CDCl_3$)



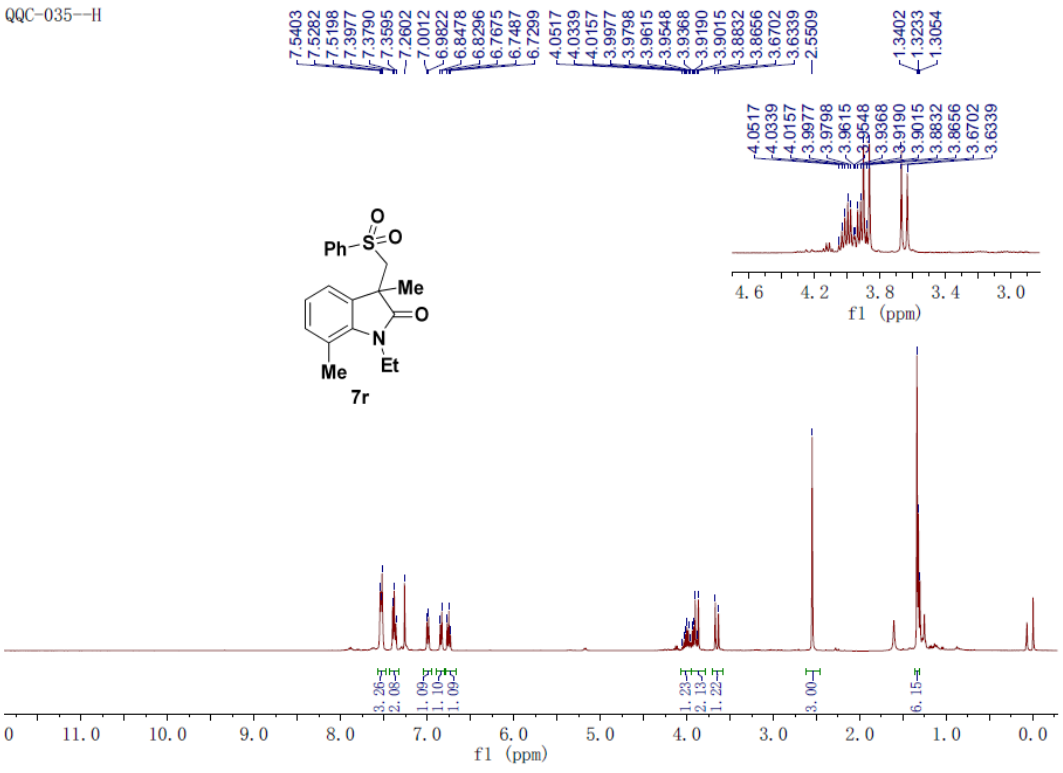
^{1}H NMR of **7q** (400 M, $CDCl_3$)



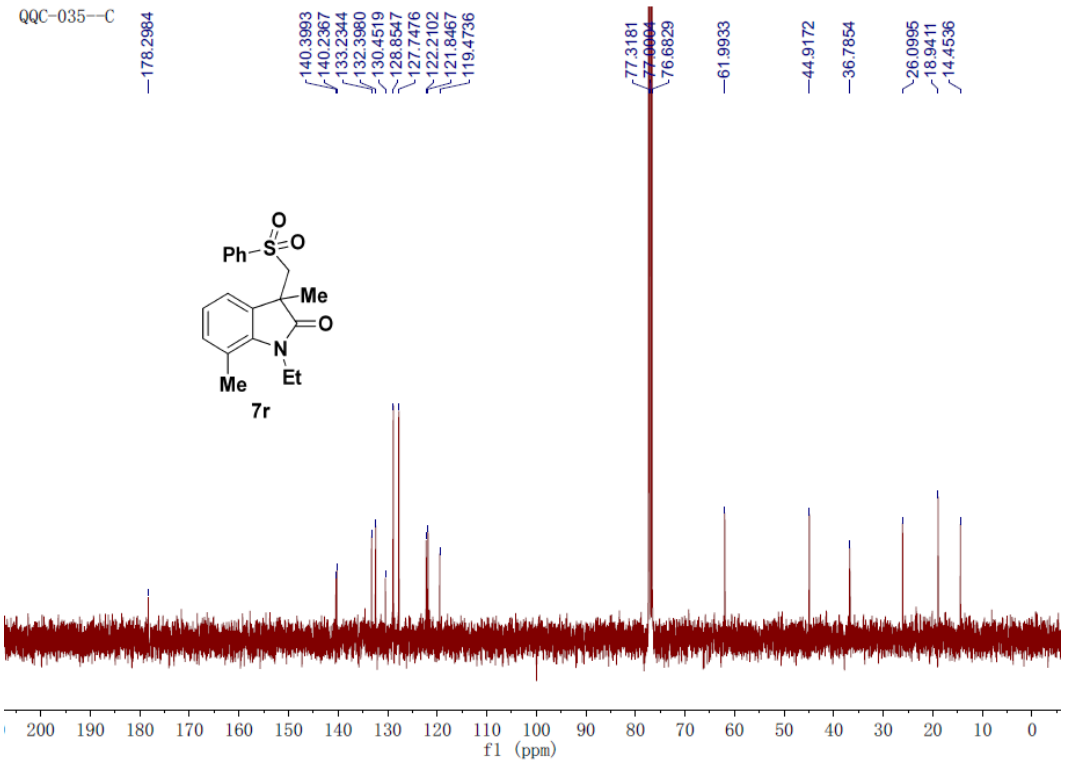
^{13}C NMR of **7q** (100 M, $CDCl_3$)



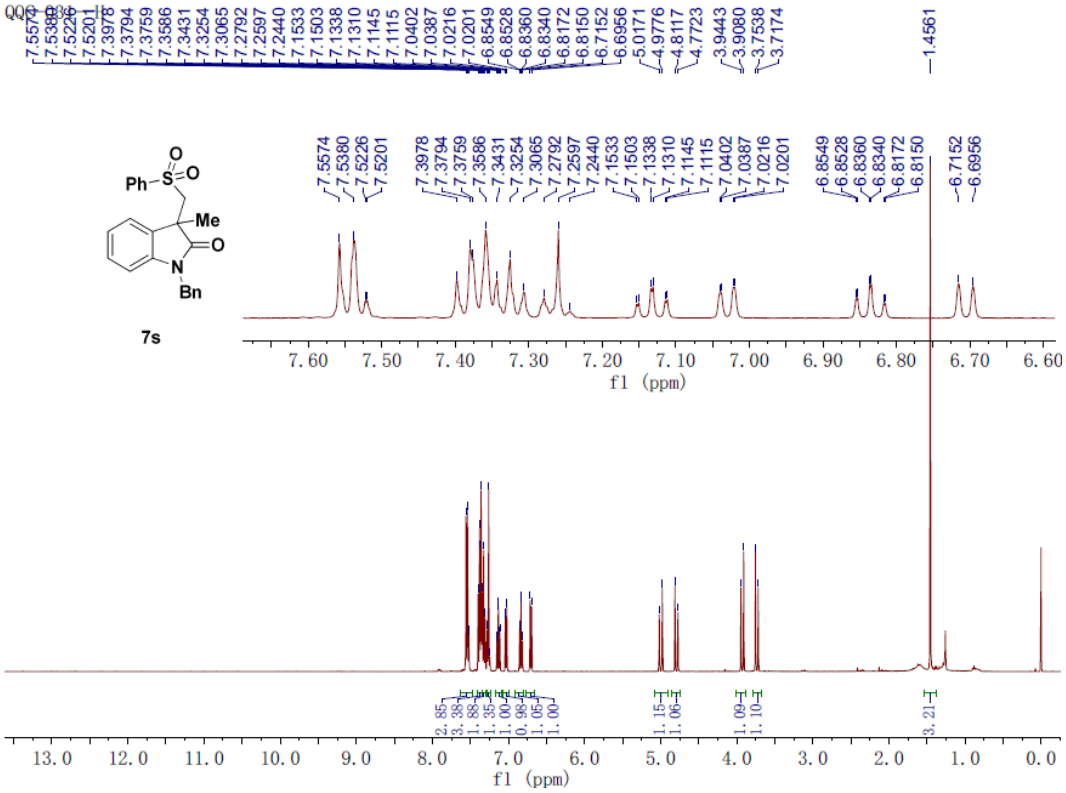
^{1}H NMR of **7r** (400 M, $CDCl_3$)



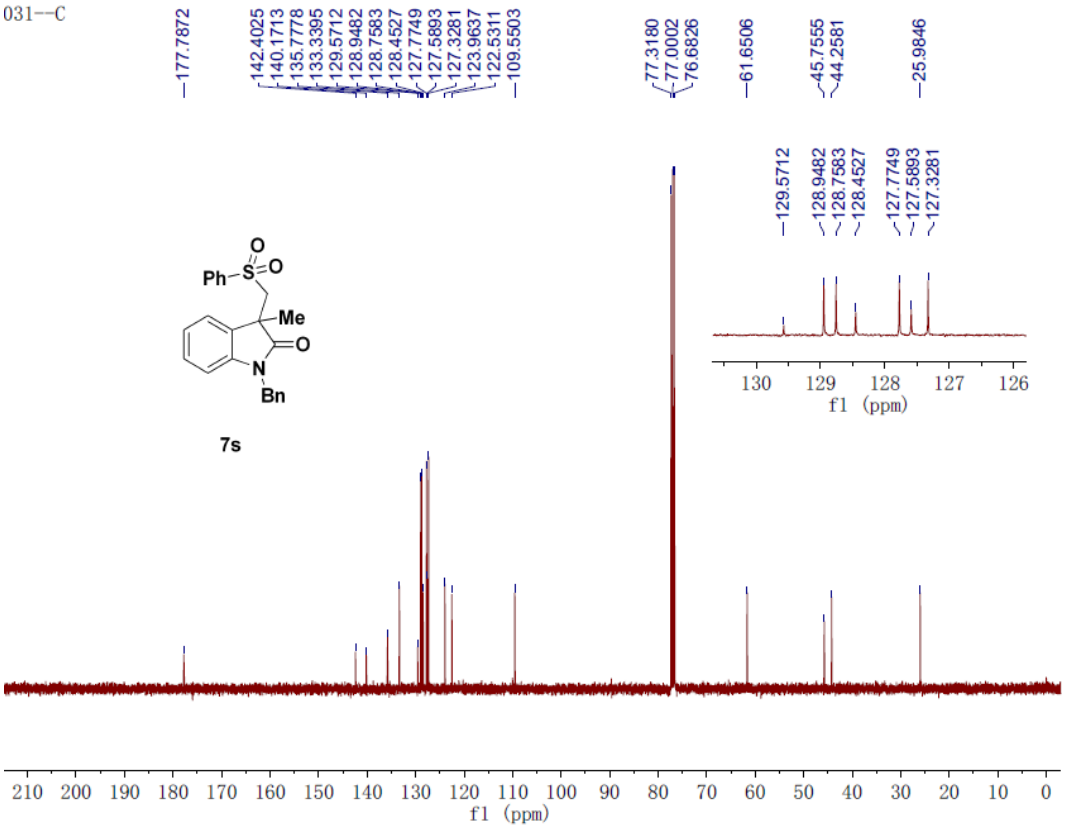
^{13}C NMR of **7r** (100 M, $CDCl_3$)



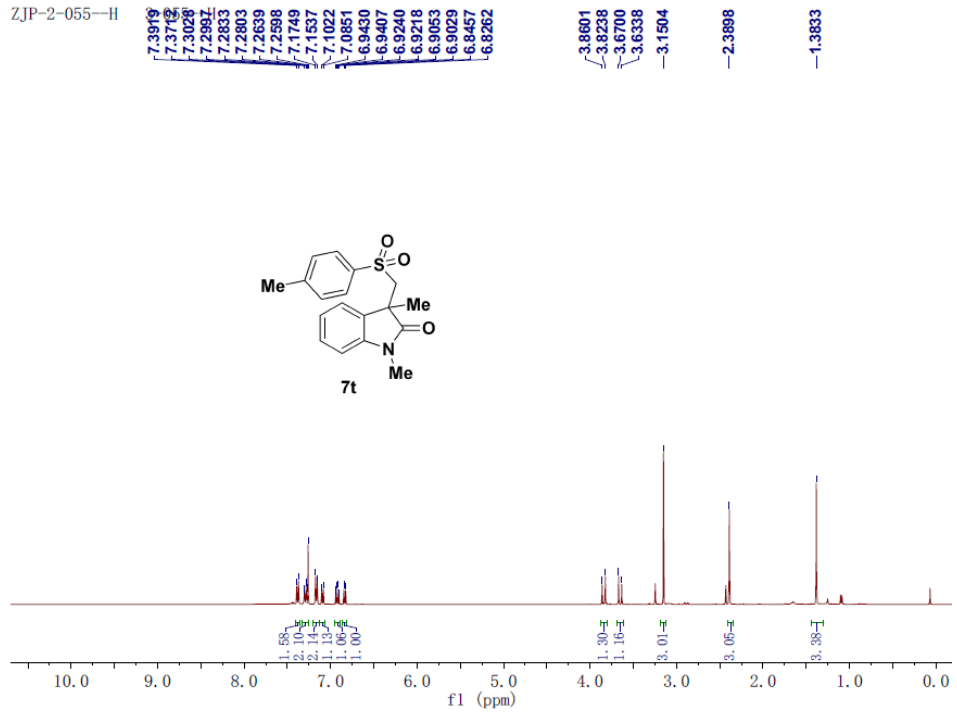
^{1}H NMR of **7s** (400 M, $CDCl_3$)



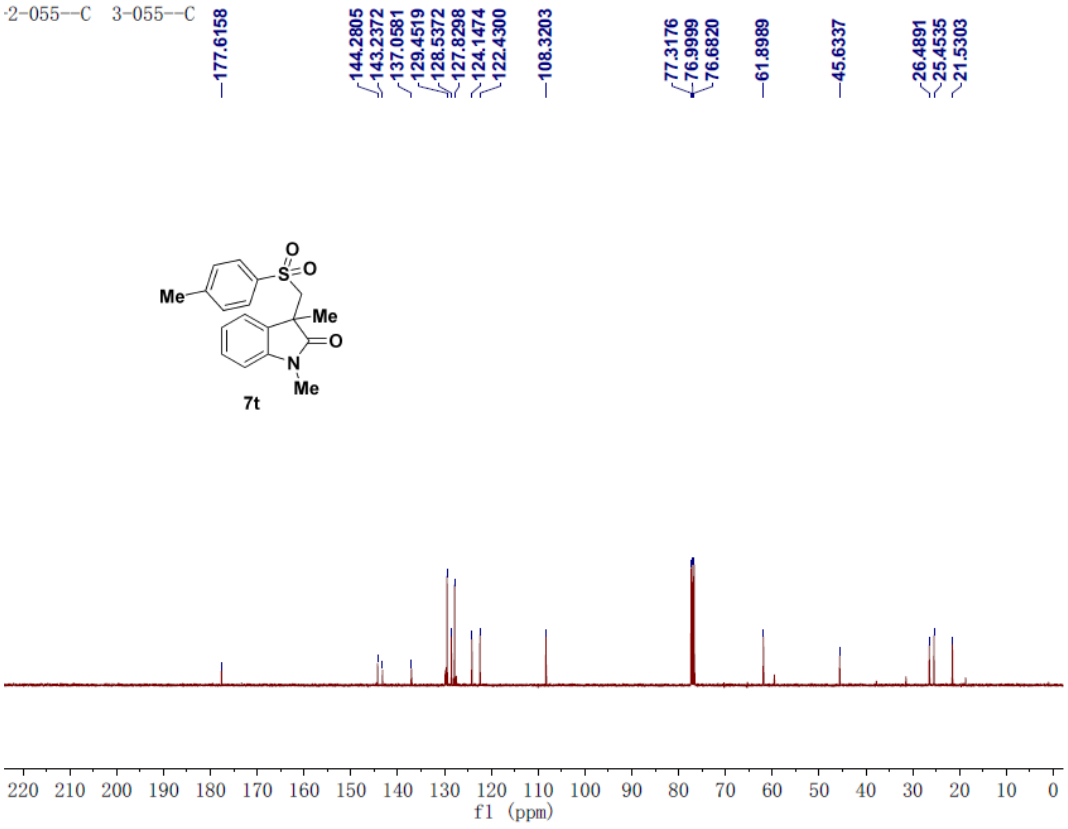
^{13}C NMR of **7s** (100 M, $CDCl_3$)



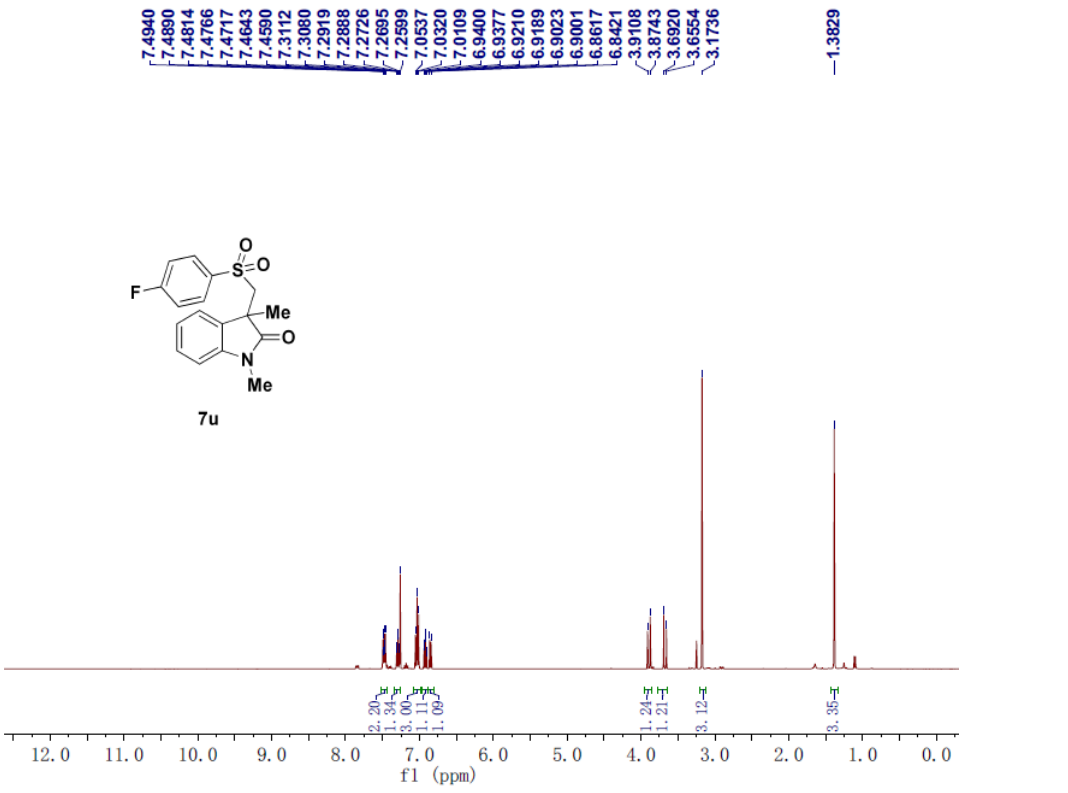
^{1}H NMR of **7t** (400 M, $CDCl_3$)



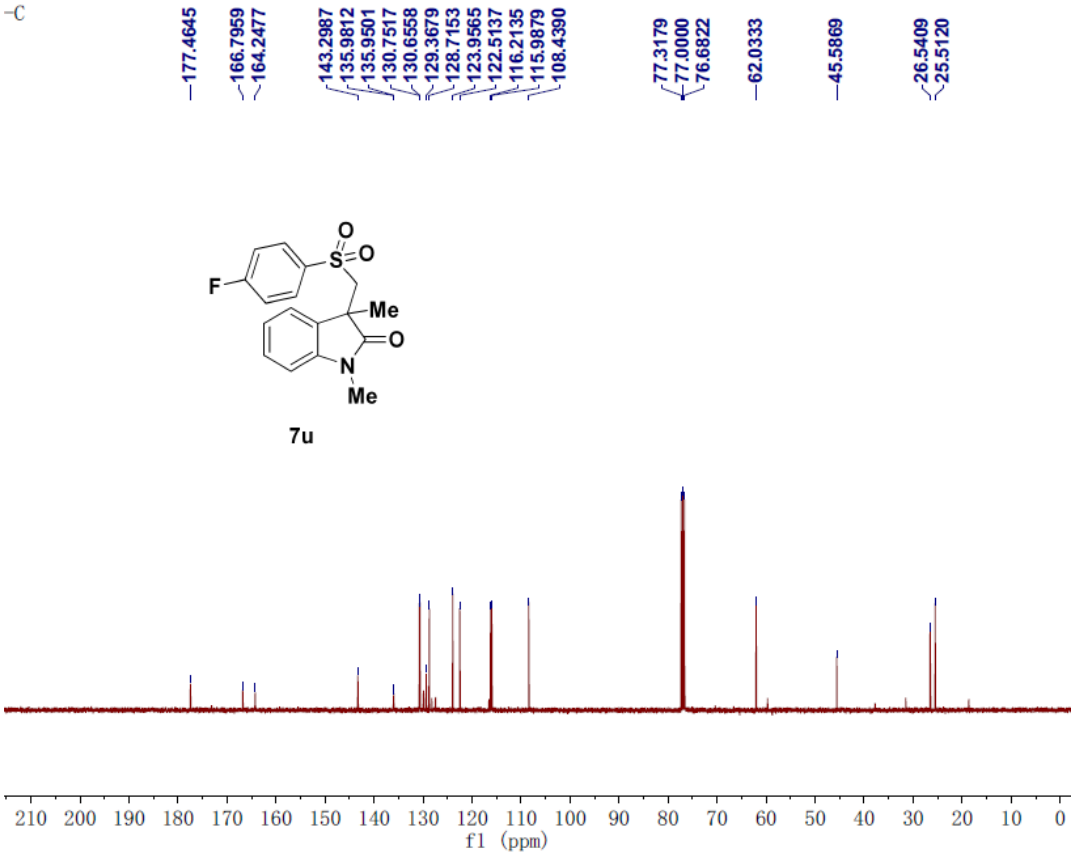
^{13}C NMR of **7t** (100 M, $CDCl_3$)



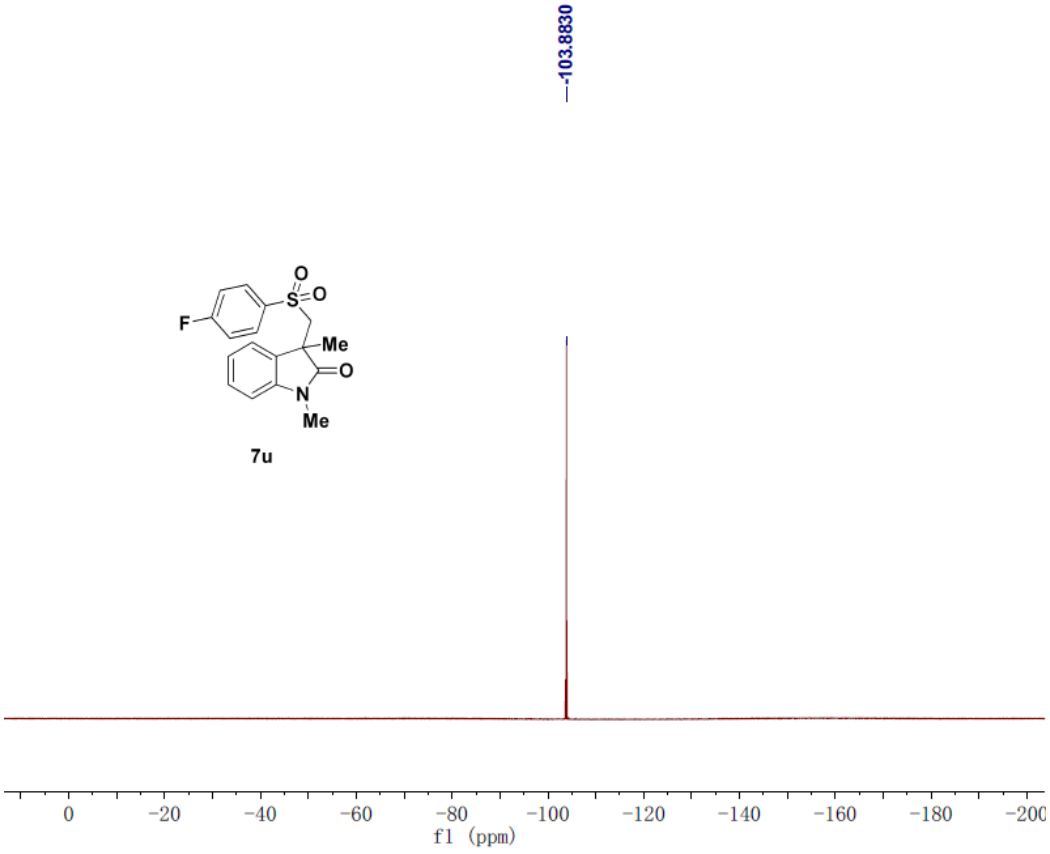
^{1}H NMR of **7u** (400 M, $CDCl_3$)



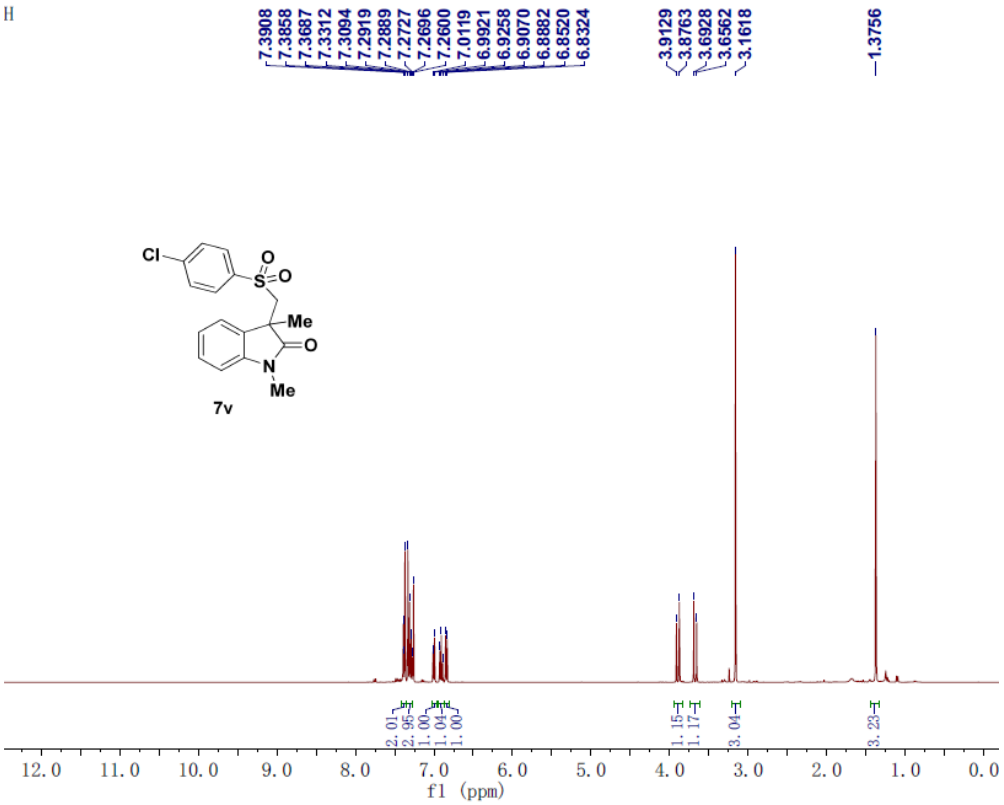
^{13}C NMR of **7u** (100 M, $CDCl_3$)



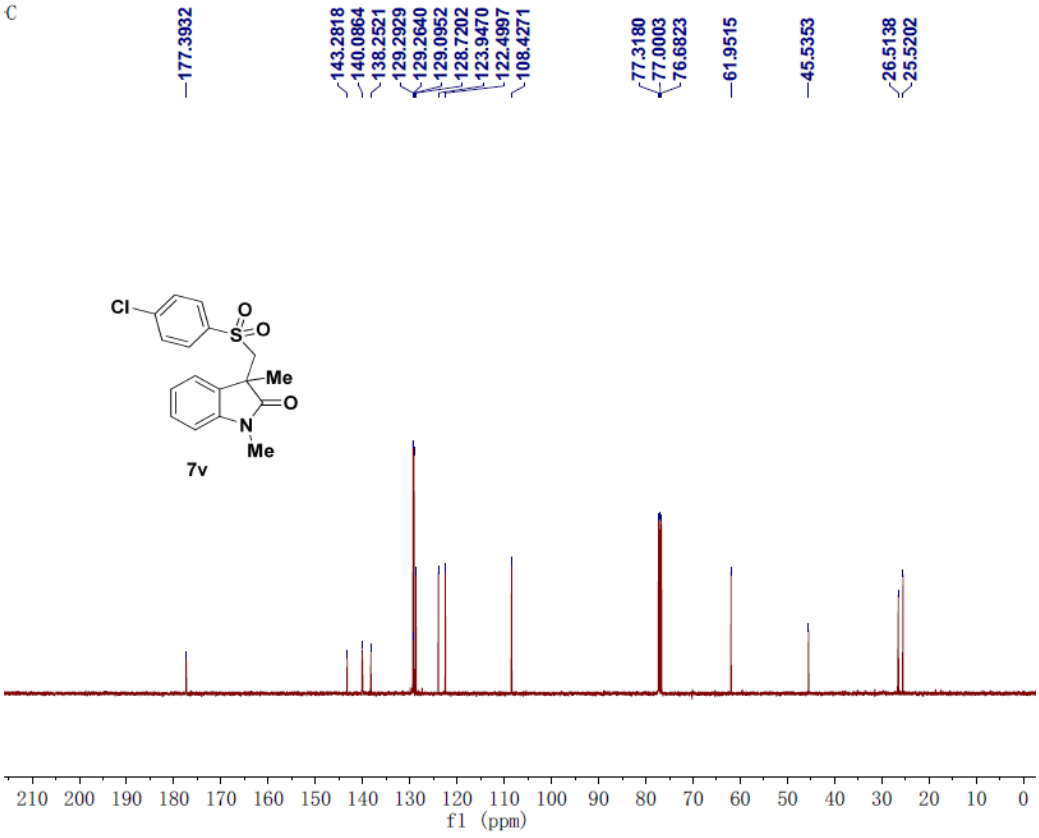
^{19}F NMR of **7u** (376 M, $CDCl_3$)



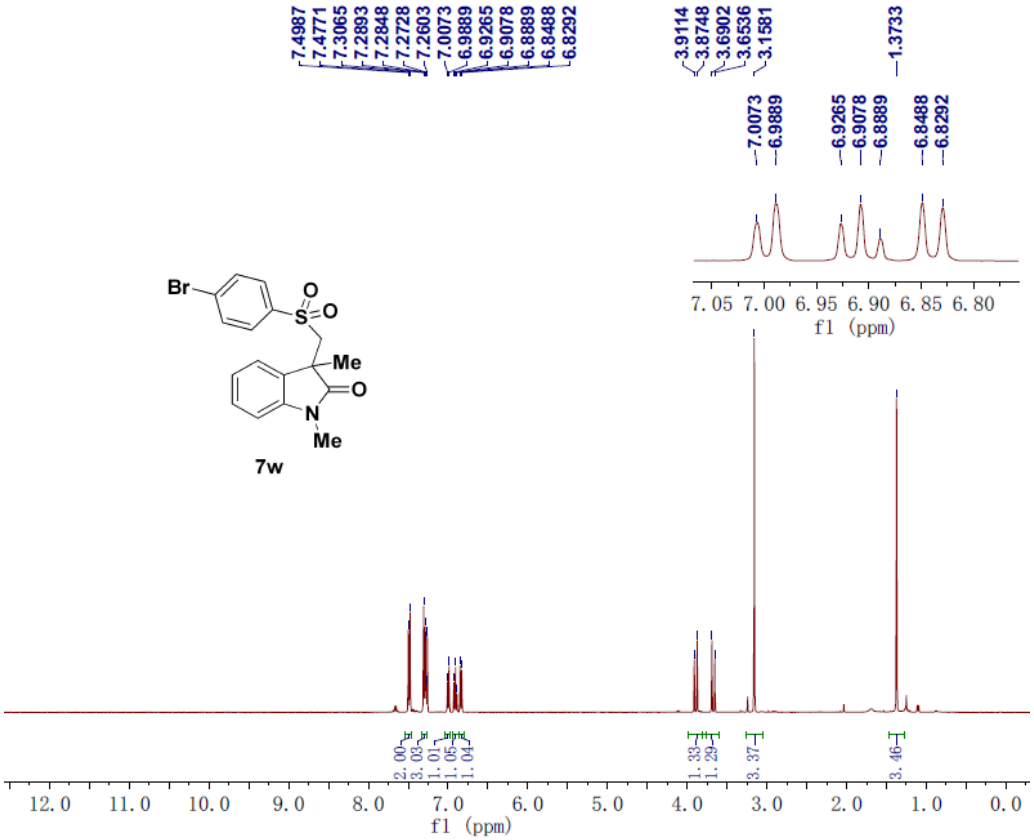
^{1}H NMR of **7v** (400 M, $CDCl_3$)



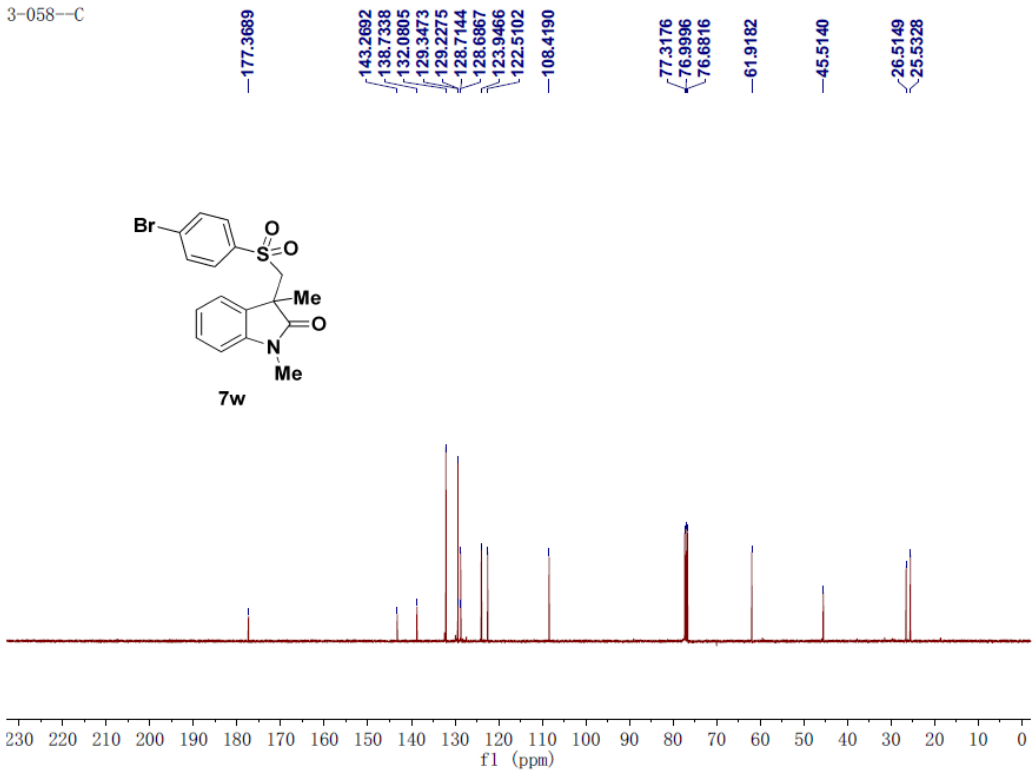
^{13}C NMR of **7v** (100 M, $CDCl_3$)



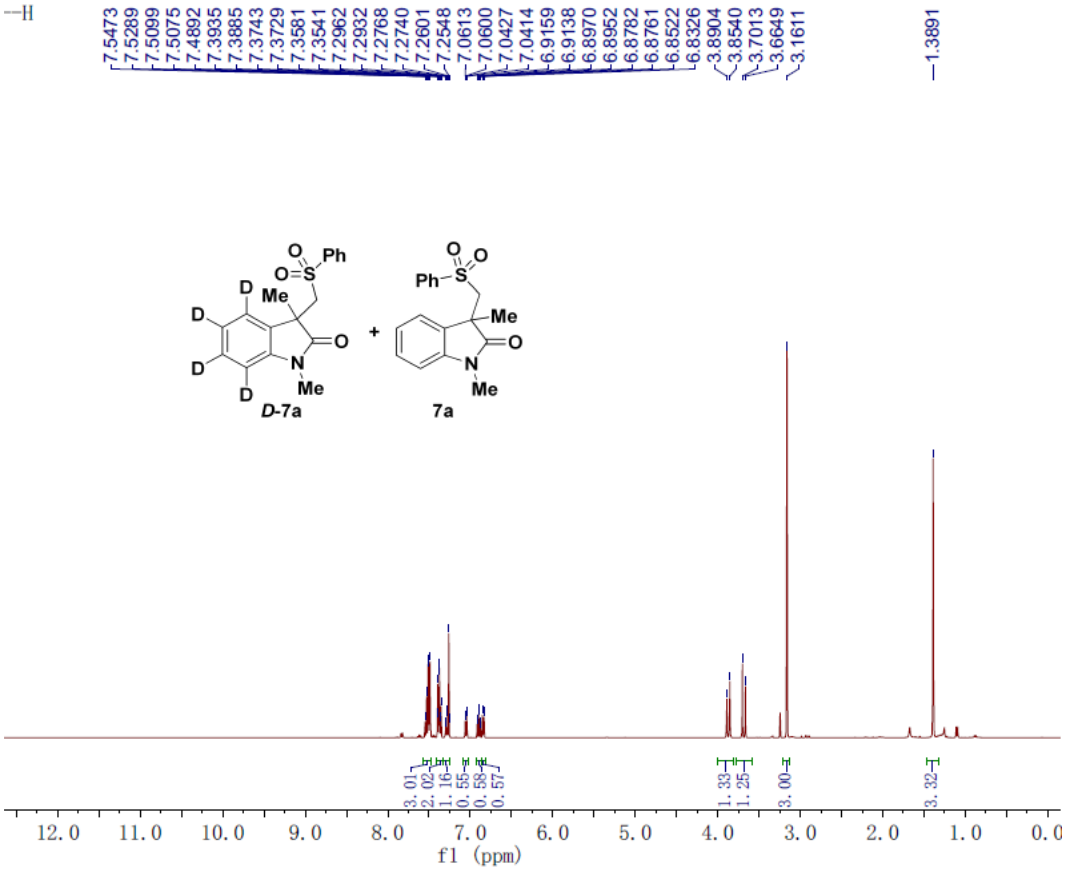
^{1}H NMR of **7w** (400 M, $CDCl_3$)



^{13}C NMR of **7w** (100 M, $CDCl_3$)



^{1}H NMR of ***D*-7a**+**7a** (400 M, $CDCl_3$)



^{13}C NMR of ***D*-7a**+**7a** (100 M, $CDCl_3$)