Supporting Information

Rhodium-Catalyzed Three-Component Reaction of 3-Diazooxindoles with Indoles and Isatin-Derived Ketimines: A Facile and Versatile Approach to Functionalized 3,3',3''-Trisindoles

Liang-Yong Mei,[a] *Xiang-Ying Tang,*[b*] *and Min Shi*[ab*]

[a]Key Laboratory for Advanced Materials and Institute of Fine Chemicals, School of Chemistry & Molecular Engineering, East China University of Science and Technology, 130 Mei Long Road, Shanghai 200237, China.

[b]State Key Laboratory of Organometallic Chemistry, Shanghai Institute of Organic Chemistry, Chinese Academy of Sciences, 345 Lingling Road, Shanghai 200032 China. siocxiangying@sioc.ac.cn, Mshi@mail.sioc.ac.cn. Fax 86-21-64166128

CONTENTS

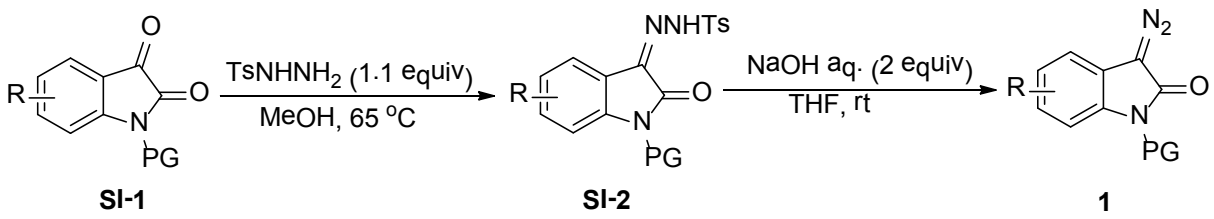
1. General Remarks. MP was obtained with a Yanagimoto micro melting point apparatus and is uncorrected. Infra-red spectra were measured on a spectrometer. ^{1}H NMR spectra were recorded for solution in $CDCl_3$ with tetramethylsilane (TMS) as internal standard; ^{19}F NMR spectra were recorded for a solution in $CDCl_3$ with $CFCl_3$ as the external reference. *J*-values are in Hz. Mass spectra were recorded with a HP-5989 instrument and HRMS was measured by a Finnigan MA+ mass spectrometer. Organic solvents used were dried by standard methods when necessary. Commercially obtained reagents were used without further purification. All reactions were monitored by TLC with Huanghai GF_{254} silica gel coated plates. Flash column chromatography was carried out using 300-400 mesh silica gel at increased pressure. All reactions were performed under argon using standard Schlenk techniques.

3-Diazooxindoles **1a**, **1b**, **1d** were prepared according to the previously reported procedures.[1]

Indoles **2** were prepared according to the previously reported procedures.[2]

Isatin-derived N-Boc ketimines **3** were prepared according to the previously reported procedures.[3]

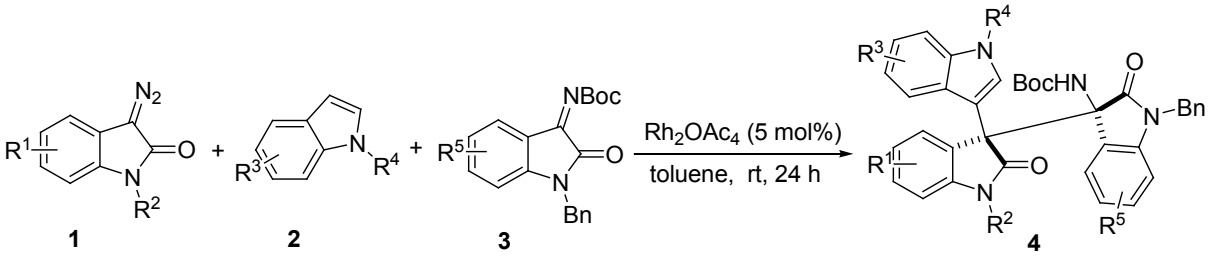
2. General procedure for the synthesis of 3-diazooxindoles 1.



Isatin SI-1 (5.0 mmol, 1.00 equiv) was suspended in MeOH (20 mL). The suspension was heated to 60 °C, whereupon a deep-red solution was obtained. To this hot solution was added tosylhydrazine (5.5 mmol, 1.1 equiv) in one portion. A yellow product started precipitating from the hot mixture. The reaction mixture was stirred at 60 °C for 18 h, and then allowed to reach room temperature. The intermediate tosylhydrazone SI-2 was collected by filtration and was used without further purification.

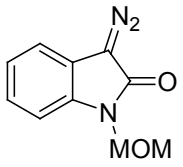
A solution of the tosylhydrazone SI-2 (5.0 mmol, 1.00 equiv) in THF (20 mL) was treated with a solution of NaOH (10.0 mmol, 2.00 equiv) in H_2O (50 mL). The reaction mixture was stirred for 3 h at room temperature. EtOAc (40 mL) was added to the reaction mixture and the layers were separated. The aqueous layer was adjusted to pH = 7 by addition of dry-ice, and extracted with EtOAc (60 mL). The combined organic layers were dried over Na_2SO_4, filtered, and the solvent was evaporated in vacuo. Column chromatography (3:17 EtOAc/PE) afforded **1** as deep-orange solids.

3. General procedure for Rhodium-Catalyzed Coupling Reaction of 3-Diazooxindoles with Indoles and Isatin-Derived Ketimines.



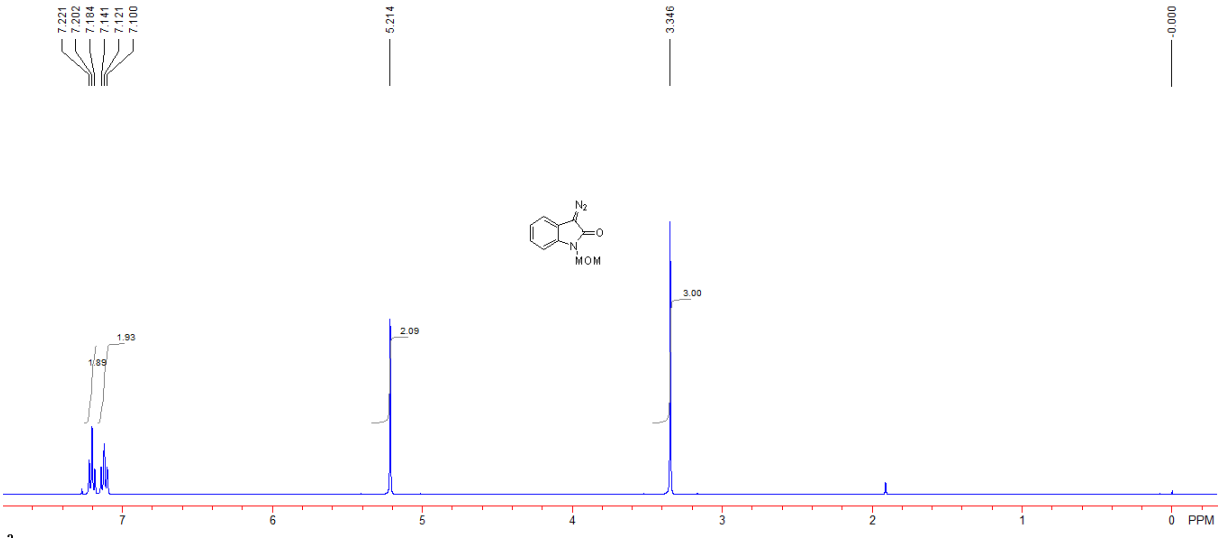
To the mixture of indoles **2** (0.1 mmol), isatin-derived N-Boc ketimines **3** (0.12 mmol) and $Rh_2(OAc)_4$ (2.2 mg, 5 mol%) in toluene (0.5 mL) was added a solution of 3-diazooxindoles **1** (0.12 mmol) in toluene (1.0 mL) *via* a syringe pump over 1 h. When the addition was completed, the reaction mixture was further stirred for 12 hours and then directly subjected to flash column chromatography (petroleum ether/EtOAc, 8:1 to 2:1) to afford the corresponding pure products **4**.

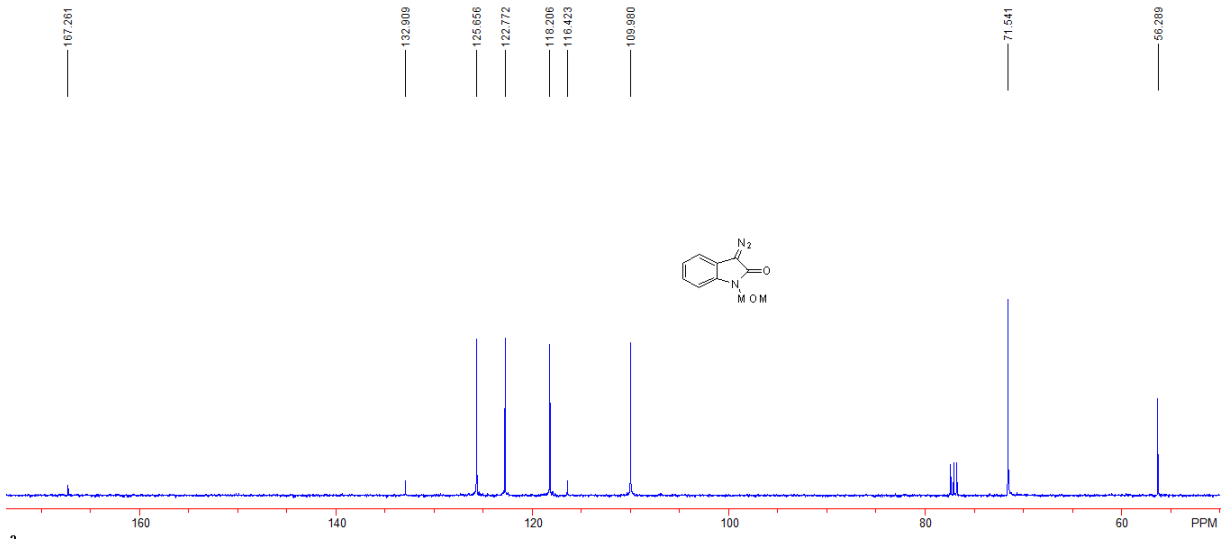
4. Characterization and spectra charts for 3-diazooxindoles 1

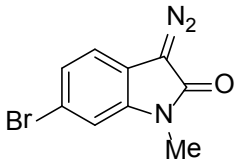


3-diazo-1-(methoxymethyl)indolin-2-one 1c.

5.0 mmol scale, a red solid, 73% yield for two steps (741 mg). M.p.: 95-98 ^{o}C. ^{1}H NMR ($CDCl_3$, 400 MHz, TMS) δ 3.35 (s, 3H, CH_3), 5.21 (s, 2H, CH_2), 7.10-7.15 (m, 2H, ArH), 7.18-7.23 (m, 2H, ArH). ^{13}C NMR ($CDCl_3$, 100 MHz, TMS) δ 56.3, 71.5, 110.0, 116.4, 118.2, 122.8, 125.7, 132.9, 167.3. IR (CH_2Cl_2) ν 2935, 2825, 2086, 1679, 1608, 1481, 1467, 1396, 1337, 1229, 1184, 1116, 1093, 1072, 1020, 913, 743, 724, 705, 686 cm^{-1}. MS (ESI) *m/z* (%): 226.1 (100) [M^++H]; HRMS (ESI) Calcd. for $C_{10}H_9N_3NaO_2^+$ (M^++H) requires 226.0587, found: 226.0589.

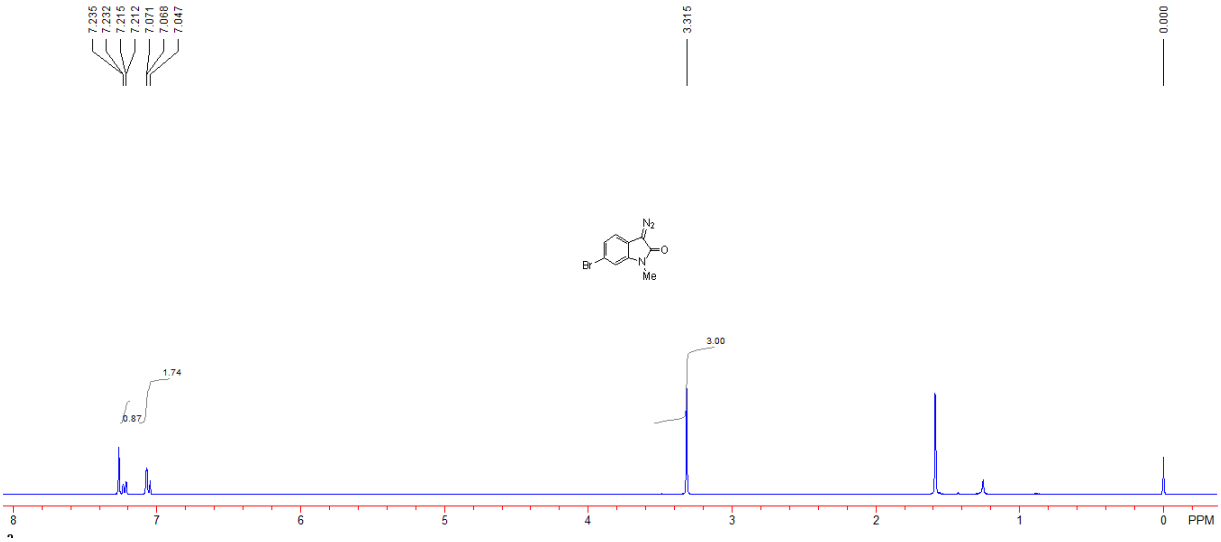


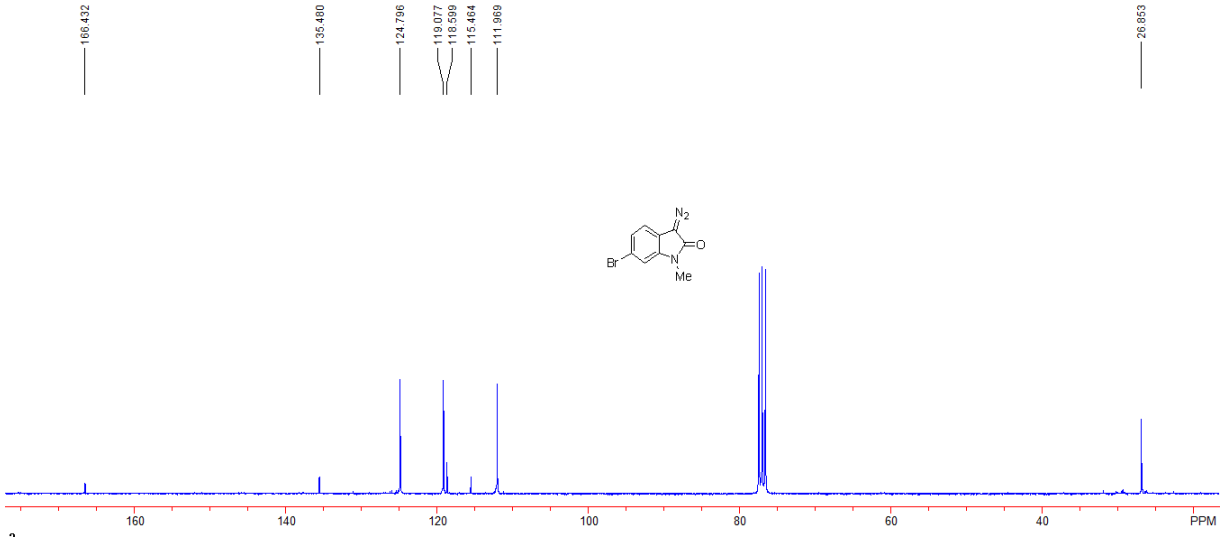


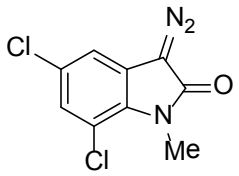


6-bromo-3-diazo-1-methylindolin-2-one 1e.

5.0 mmol scale, a red solid, 64% yield for two steps (803 mg). M.p.: 188-190 ^{o}C. ^{1}H NMR ($CDCl_3$, 400 MHz, TMS) δ 3.32 (s, 3H, CH_3), 7.04-7.08 (m, 2H, ArH), 7.21-7.24 (m, 1H, ArH). ^{13}C NMR ($CDCl_3$, 75 MHz, TMS) δ 26.9, 112.0, 115.5, 118.6, 119.1, 124.8, 135.5, 166.4. IR (CH_2Cl_2) ν 2923, 2853, 2092, 1673, 1608, 1488, 1436, 1398, 1364, 1250, 1198, 1102, 1062, 1027, 870, 795, 764, 749, 710 cm^{-1}. MS (ESI) *m/z* (%): 252.0 (100) [M^++H]; HRMS (ESI) Calcd. for $C_9H_7BrN_3O^+$ (M^++H) requires 251.9767, Found: 251.9766.

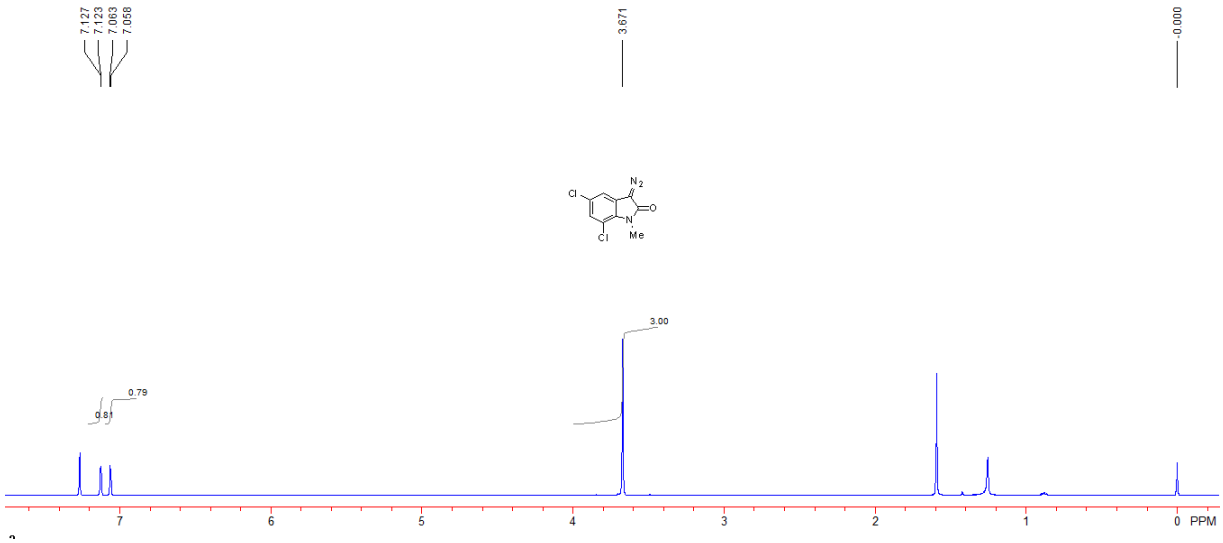


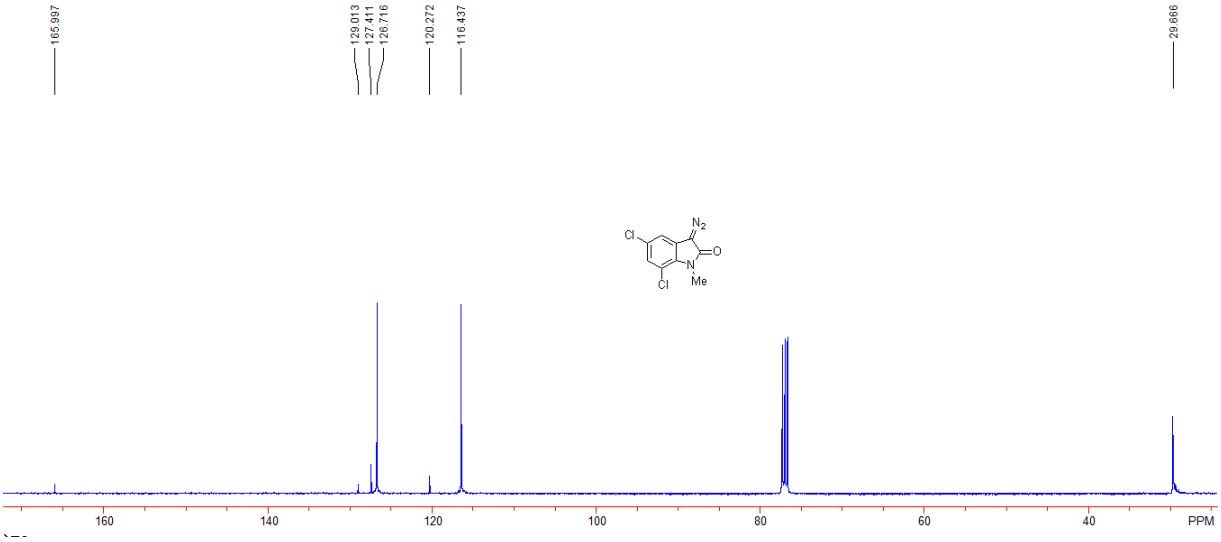




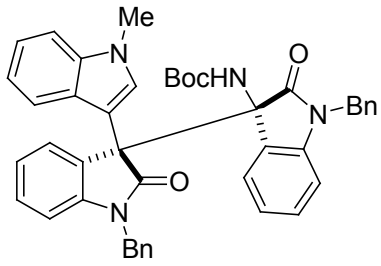
5,7-dichloro-3-diazo-1-methylindolin-2-one 1f.

5.0 mmol scale, a yellow solid, 52% yield for two steps (627 mg). M.p.: 195-198 ^{o}C. ^{1}H NMR ($CDCl_3$, 400 MHz, TMS) δ 3.67 (s, 3H, CH_3), 7.06 (d, J = 2.0 Hz, 1H, ArH), 7.13 (d, J = 2.0 Hz, 1H, ArH). ^{13}C NMR ($CDCl_3$, 100 MHz, TMS) δ 29.7, 116.4, 120.3, 126.7, 127.4, 129.0, 166.0. IR (CH_2Cl_2) ν 2923, 2852, 2144, 2115, 1669, 1603, 1571, 1466, 1417, 1380, 1339, 1252, 1181, 1122, 1047, 881, 840, 745, 712 cm^{-1}. MS (ESI) *m/z* (%): 242.0 (100) [M^++H]; HRMS (ESI) Calcd. for $C_9H_6Cl_2N_3O^+$ (M^++H) requires 241.9888, found: 241.9882.



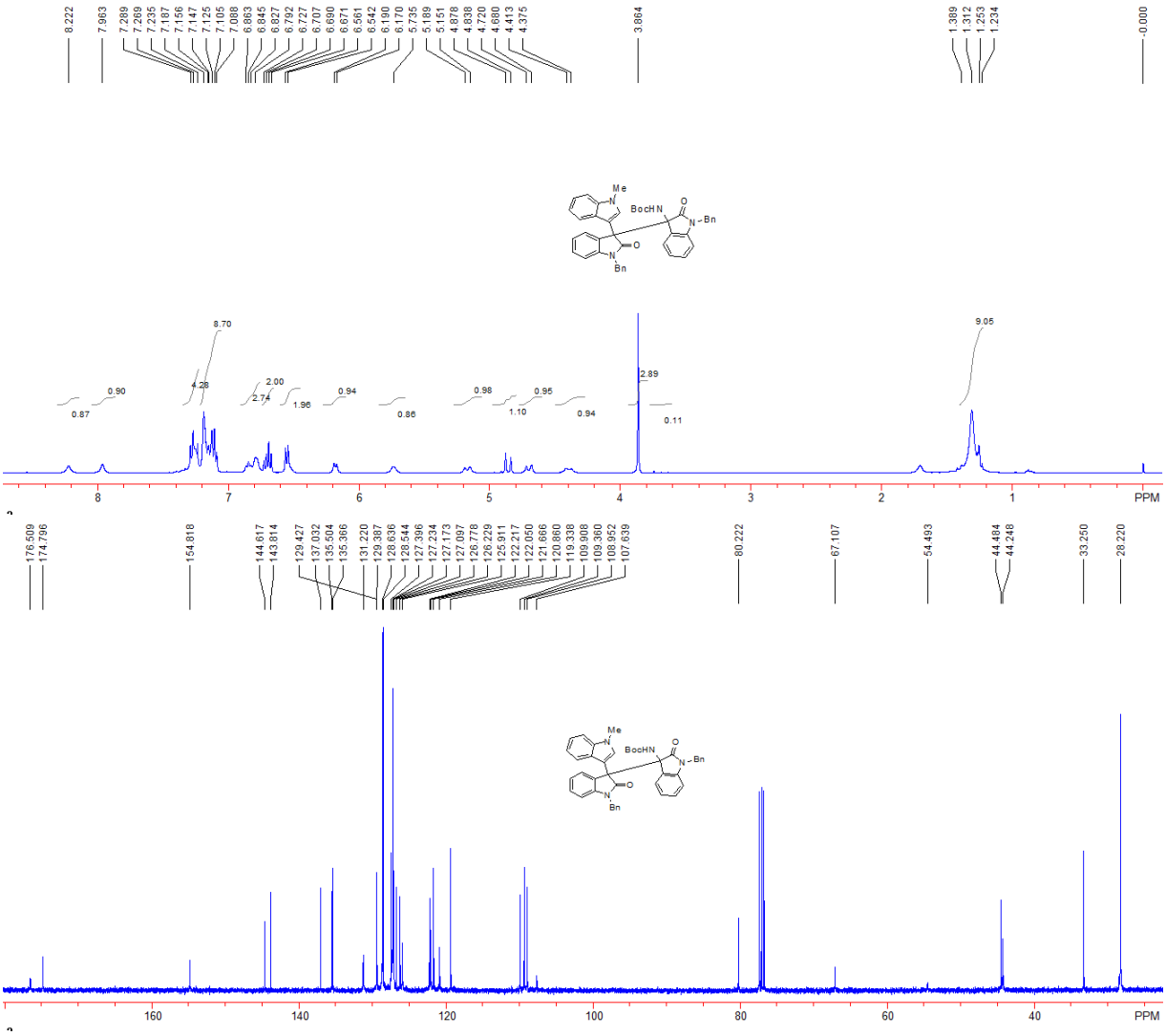


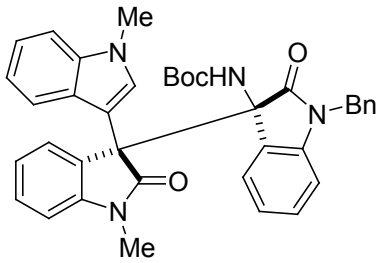
5. Characterization and spectra charts for 4



tert-butyl-1-benzyl-3-(1-benzyl-3-(1-methyl-1H-indol-3-yl)-2-oxoindolin-3-yl)-2-oxoindolin-3-ylcarbamate 4a (major isomer).

A colorless solid, 94% yield (65 mg), >20:1 dr. M.p.: 127-130 ^{o}C. ^{1}H NMR ($CDCl_3$, 400 MHz, TMS) δ 1.23-1.39 (m, 9H, CH_3), 3.86 (s, 3H, CH_3), 4.39 (d, J = 15.2 Hz, 1H, CH_2), 4.70 (d, J = 16.0 Hz, 1H, CH_2), 4.86 (d, J = 16.0 Hz, 1H, CH_2), 5.17 (d, J = 15.2 Hz, 1H, CH_2), 5.74 (s, 1H, ArH), 6.18 (d, J = 8.0 Hz, 1H, ArH), 6.54-6.57 (m, 2H, ArH), 6.67-6.73 (m, 2H, ArH), 6.79-6.87 (m, 3H, ArH), 7.08-7.19 (m, 9H, ArH), 7.23-7.29 (m, 4H, ArH), 7.96 (s, 1H, ArH), 8.22 (s, 1H, NH). ^{13}C NMR ($CDCl_3$, 100 MHz, TMS) δ 28.2, 33.3, 44.2, 44.5, 54.5, 67.1, 80.2, 107.6, 109.0, 109.4, 109.9, 119.3, 120.9, 121.7, 122.1, 122.2, 125.9, 126.2, 126.8, 127.1, 127.17, 127.2, 127.4, 128.5, 128.6, 129.39, 129.4, 131.2, 135.4, 135.5, 137.0, 143.8, 144.6, 154.8, 174.8, 176.5. IR (CH_2Cl_2) ν 3319, 3059, 2978, 2926, 1717, 1697, 1609, 1486, 1465, 1365, 1276, 1158, 1104, 1075, 1018, 956, 898, 877, 734, 697, 661 cm^{-1}. MS (ESI) *m/z* (%): 689.3 (100) [M^++H]; HRMS (ESI) Calcd. for $C_{44}H_{41}N_4O_4^+$ (M^++H) requires 689.3128, found: 689.3139.

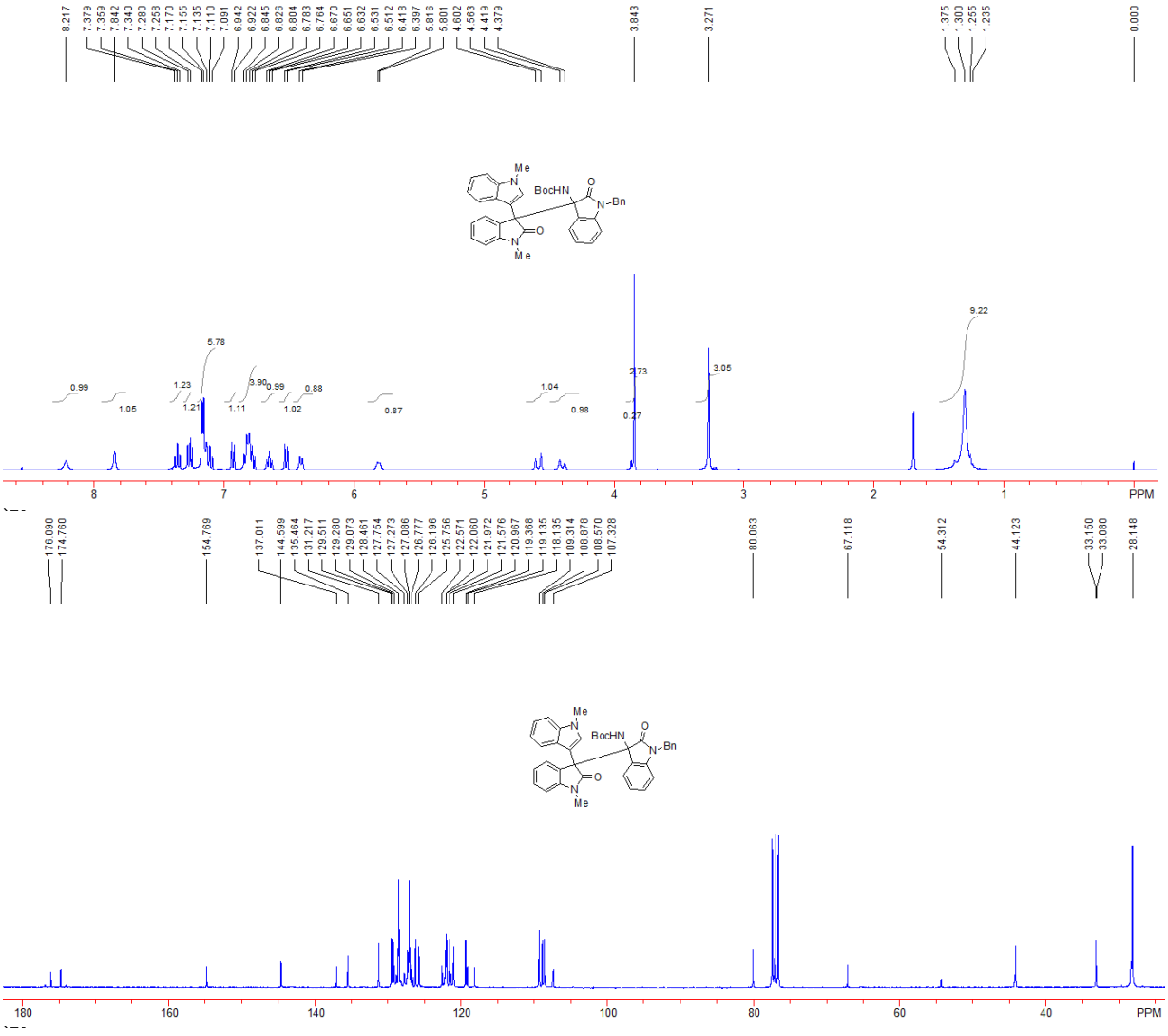


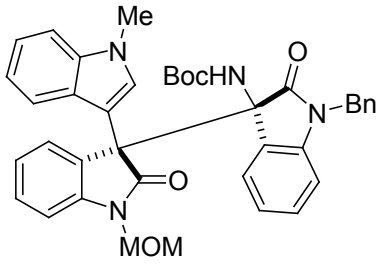


tert-butyl-1-benzyl-3-(1-methyl-3-(1-methyl-1H-indol-3-yl)-2-oxoindolin-3-yl)-2-oxoindolin-3-ylcarbamate 4b (major isomer).

A colorless solid, 90% yield (55 mg), 10:1 dr. M.p.: 130-133 ^{o}C. ^{1}H NMR ($CDCl_3$, 400 MHz, TMS) δ 1.23-1.38 (m, 9H, CH_3), 3.27 (s, 3H, CH_3), 3.84 (s, 3H, CH_3), 4.40 (d, J = 16.0 Hz, 1H, CH_2), 4.58 (d, J = 16.0 Hz, 1H, CH_2), 5.81 (d, J = 6.0 Hz, 1H, ArH), 6.41 (d, J = 8.4 Hz, 1H, ArH), 6.52 (d, J = 7.6 Hz, 1H, ArH), 6.65 (dd, J = 7.6 Hz, 7.6 Hz, 1H, ArH), 6.76-6.85 (m, 4H, ArH), 6.93 (d, J = 8.0 Hz, 1H, ArH), 7.09-7.17 (m, 6H, ArH), 7.27 (d, J = 8.4 Hz, 1H,

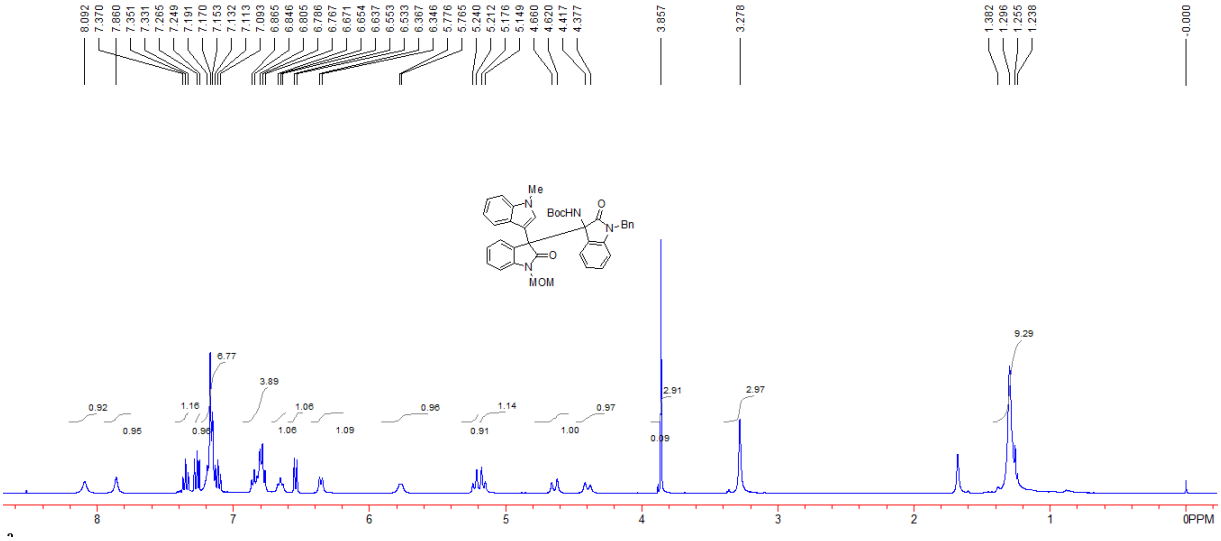
ArH), 7.36 (dd, J = 8.0 Hz, 8.0 Hz, 1H, ArH), 7.84 (s, 1H, ArH), 8.22 (s, 1H, NH). ^{13}C NMR ($CDCl_3$, 75 MHz, TMS) δ 28.1, 33.1, 33.2, 44.1, 54.3, 67.1, 80.1, 107.3, 108.6, 108.9, 109.3, 118.1, 119.1, 119.4, 121.0, 121.6, 122.0, 122.1, 122.6, 125.8, 126.2, 126.8, 127.1, 127.3, 127.8, 128.5, 129.1, 129.3, 129.5, 131.2, 135.5, 137.0, 144.6, 154.8, 174.8, 176.1. IR (CH_2Cl_2) ν 3311, 3055, 2977, 2923, 1717, 1698, 1610, 1489, 1467, 1368, 1276, 1161, 1131, 1067, 1028, 911, 882, 750, 697 cm^{-1}. MS (ESI) *m/z* (%): 613.3 (100) [M^++H]; HRMS (ESI) Calcd. for $C_{38}H_{37}N_4O_4^+$ (M^++H) requires 613.2815, found: 613.2809.

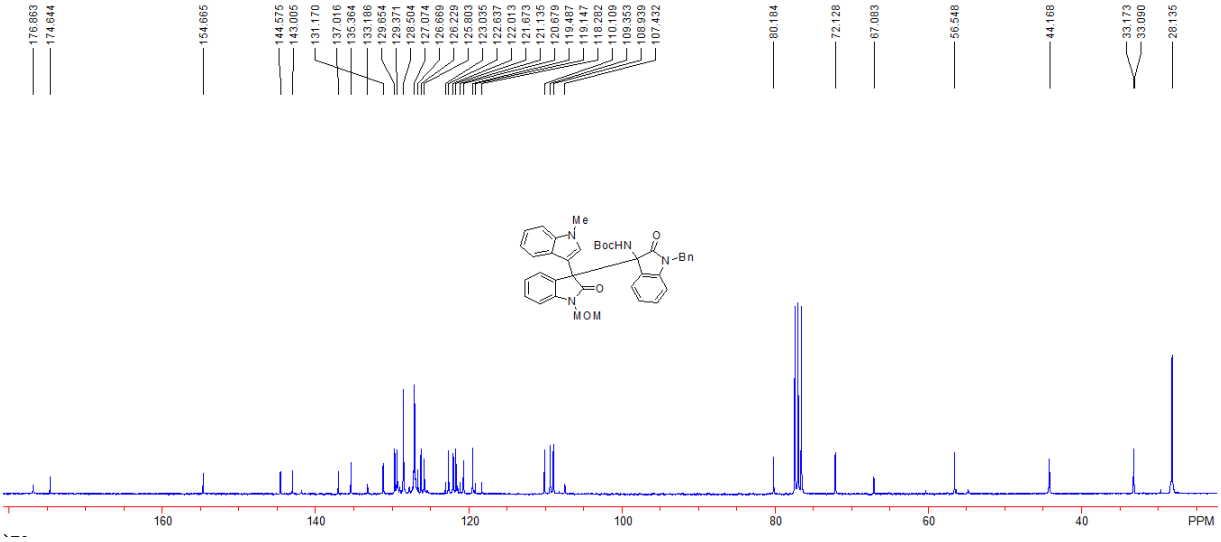


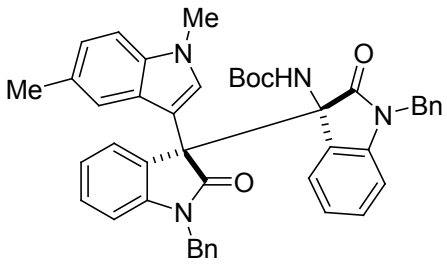


tert-butyl-1-benzyl-3-(1-(methoxymethyl)-3-(1-methyl-1H-indol-3-yl)-2-oxoindolin-3-yl)-2-oxoindolin-3-ylcarbamate 4c (major isomer).

A colorless solid, 87% yield (56 mg), >20:1 dr. M.p.: 128-131 ^{o}C. ^{1}H NMR ($CDCl_3$, 400 MHz, TMS) δ 1.23-1.39 (m, 9H, CH_3), 3.28 (s, 3H, CH_3), 3.86 (s, 3H, CH_3), 4.40 (d, J = 16.0 Hz, 1H, CH_2), 4.64 (d, J = 16.0 Hz, 1H, CH_2), 5.16 (d, J = 11.2 Hz, 1H, CH_2), 5.23 (d, J = 11.2 Hz, 1H, CH_2), 5.77 (d, J = 4.4 Hz, 1H, ArH), 6.36 (d, J = 8.4 Hz, 1H, ArH), 6.54 (d, J = 8.0 Hz, 1H, ArH), 6.65 (dd, J = 6.8 Hz, 6.8 Hz, 1H, ArH), 6.76-6.87 (m, 4H, ArH), 7.09-7.20 (m, 7H, ArH), 7.25 (d, J = 6.8 Hz, 1H, ArH), 7.35 (dd, J = 8.0 Hz, 8.0 Hz, 1H, ArH), 7.86 (s, 1H, ArH), 8.09 (s, 1H, NH). ^{13}C NMR ($CDCl_3$, 75 MHz, TMS) δ 28.1, 33.1, 33.2, 44.2, 56.5, 67.1, 72.1, 80.2, 107.4, 108.9, 109.4, 110.1, 118.3, 119.1, 119.5, 120.7, 121.1, 121.7, 122.0, 122.6, 123.0, 125.8, 126.2, 126.7, 127.1, 128.5, 129.4, 129.7, 131.2, 133.2, 135.4, 137.0, 143.0, 144.6, 154.7, 174.6, 176.9. IR (CH_2Cl_2) ν 3325, 3055, 2978, 2931, 1717, 1610, 1485, 1466, 1366, 1275, 1159, 1123, 1093, 1028, 1008, 910, 881, 736, 700, 664 cm^{-1}. MS (ESI) *m/z* (%): 643.3 (100) [M^++H]; HRMS (ESI) Calcd. for $C_{39}H_{39}N_4O_5^+$(M^++H) requires 643.2920, found: 643.2908.

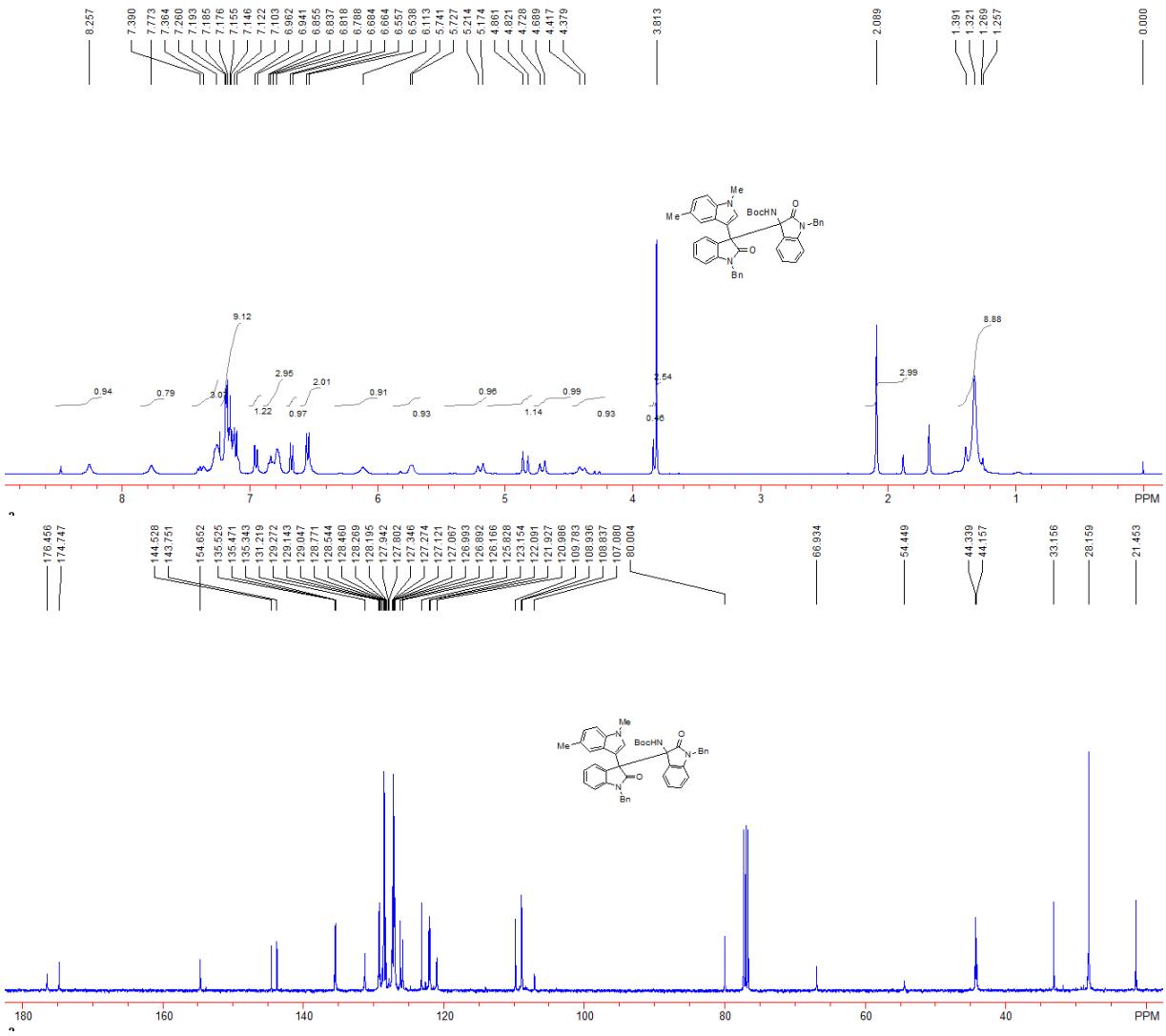


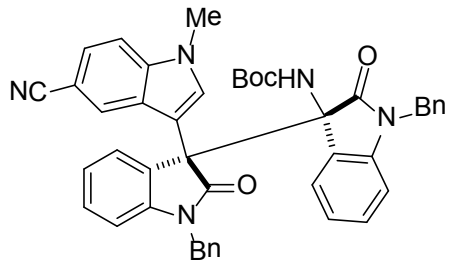




tert-butyl-1-benzyl-3-(1-benzyl-3-(1,5-dimethyl-1H-indol-3-yl)-2-oxoindolin-3-yl)-2-oxoindolin-3-ylcarbamate 4d (major isomer).

A colorless solid, 97% yield (68 mg), 5:1 dr. M.p.: 133-136 ^{o}C. ^{1}H NMR ($CDCl_3$, 400 MHz, TMS) δ 1.25-1.40 (m, 9H, CH_3), 2.09 (s, 3H, CH_3), 3.81 (s, 3H, CH_3), 4.40 (d, J = 15.2 Hz, 1H, CH_2), 4.71 (d, J = 15.2 Hz, 1H, CH_2), 4.84 (d, J = 16.0 Hz, 1H, CH_2), 5.19 (d, J = 16.0 Hz, 1H, CH_2), 5.73 (d, J = 5.6 Hz, 1H, ArH), 6.11 (s, 1H, ArH), 6.53-6.56 (m, 2H, ArH), 6.67 (d, J = 8.0 Hz, 1H, ArH), 6.78-6.86 (m, 3H, ArH), 6.95 (d, J = 8.0 Hz, 1H, ArH), 7.10-7.20 (m, 9H, ArH), 7.26-7.39 (m, 3H, ArH), 7.77 (s, 1H, ArH), 8.26 (s, 1H, NH). ^{13}C NMR ($CDCl_3$, 100 MHz, TMS) δ 21.5, 28.2, 33.2, 44.2, 44.3, 54.4, 66.9, 80.0, 107.1, 108.8, 108.9, 109.8, 121.0, 121.9, 122.1, 123.2, 125.8, 126.2, 126.9, 127.0, 127.07, 127.1, 127.3, 127.35, 127.8, 127.9, 128.2, 128.3, 128.46, 128.5, 128.8, 129.0, 129.1, 129.3, 131.2, 135.3, 135.47, 135.5, 143.8, 144.5, 154.7, 174.7, 176.5. IR (CH_2Cl_2) ν 3312, 3051, 2971, 2925, 1716, 1608, 1491, 1468, 1367, 1276, 1159, 1090, 1027, 972, 909, 870, 734, 698 cm^{-1}. MS (ESI) *m/z* (%): 703.3 (100) [M^++H]; HRMS (ESI) Calcd. for $C_{45}H_{43}N_4O_4^+$ (M^++H) requires 703.3284, Found: 703.3275.

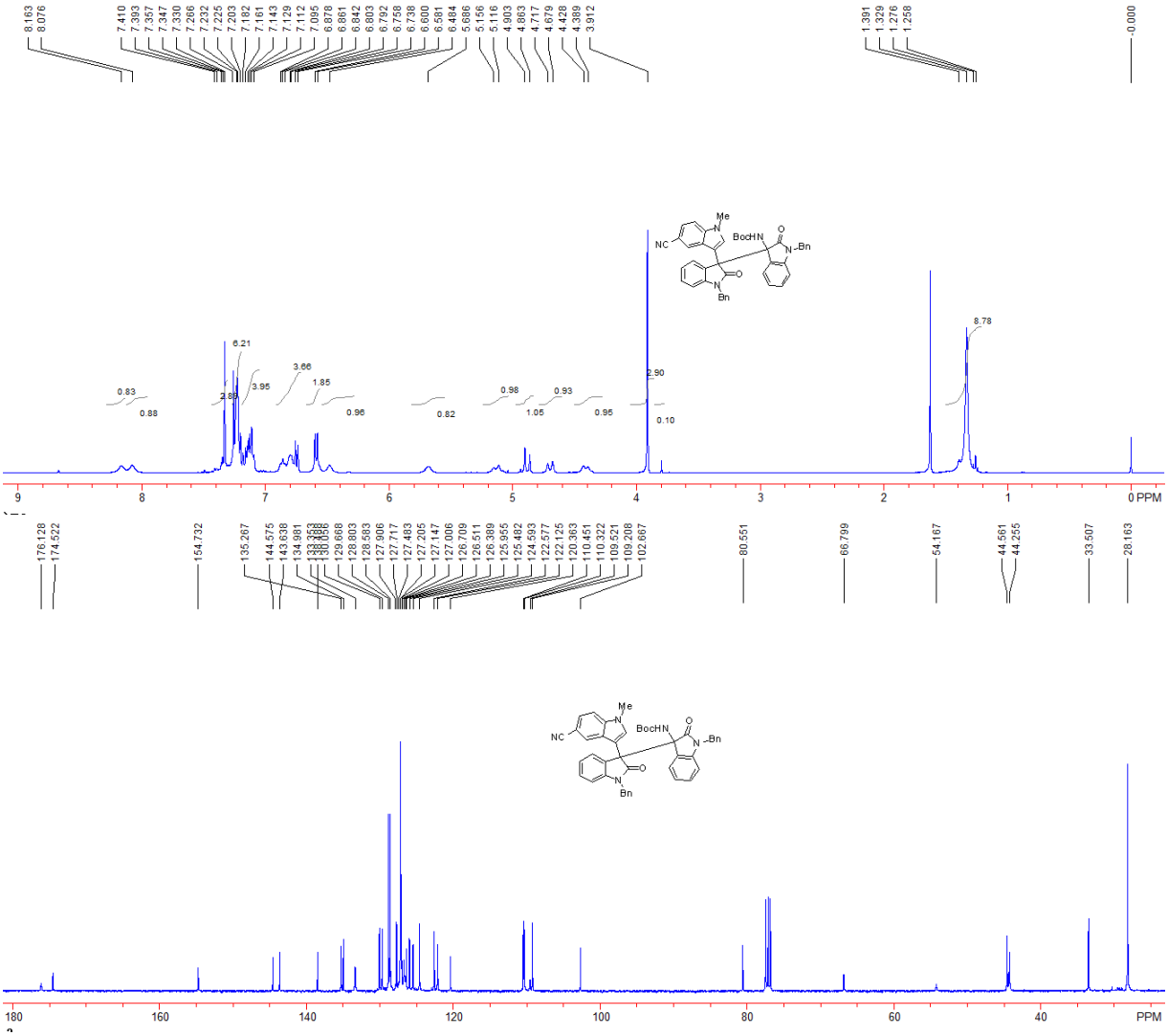


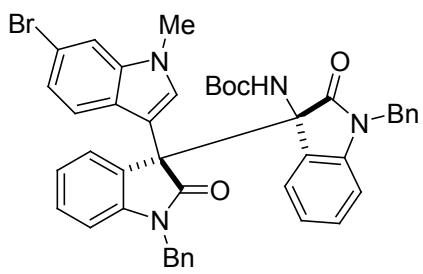


tert-butyl-1-benzyl-3-(1-benzyl-3-(5-cyano-1-methyl-1H-indol-3-yl)-2-oxoindolin-3-yl)-2-oxoindolin-3-ylcarbamate 4e (major isomer).

A colorless solid, 96% yield (68 mg), >20:1 dr. M.p.: 144-147 ^{o}C. ^{1}H NMR ($CDCl_3$, 400 MHz, TMS) δ 1.25-1.40 (m, 9H, CH_3), 3.91 (s, 3H, CH_3), 4.41 (d, J = 15.6 Hz, 1H, CH_2), 4.70 (d, J = 15.6 Hz, 1H, CH_2), 4.88 (d, J = 16.0 Hz, 1H, CH_2), 5.14 (d, J = 16.0 Hz, 1H, CH_2), 5.69 (s, 1H, ArH), 6.48 (s, 1H, ArH), 6.58-6.60 (m, 2H, ArH), 6.73-6.88 (m, 4H, ArH), 7.09-7.19 (m, 4H, ArH), 7.20-7.27 (m, 6H, ArH), 7.33-7.41 (m, 3H, ArH), 8.08 (s, 1H, ArH), 8.16 (s, 1H,

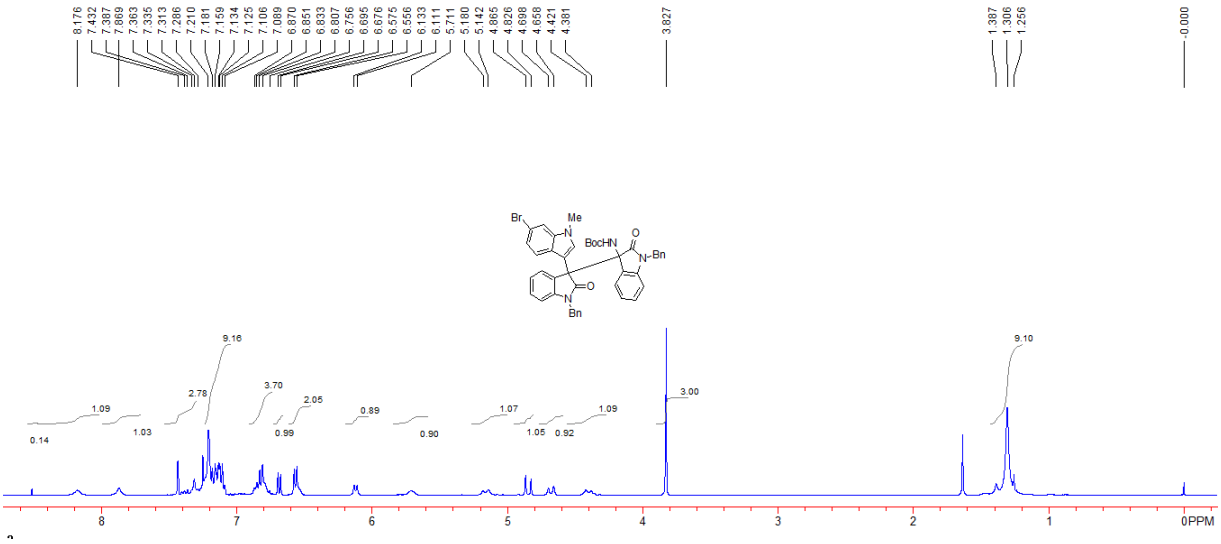
NH). ^{13}C NMR ($CDCl_3$, 100 MHz, TMS) δ 28.2, 33.5, 44.3, 44.6, 54.2, 66.8, 80.6, 102.7, 109.2, 109.5, 110.3, 110.5, 120.4, 122.1, 122.6, 124.6, 125.5, 126.0, 126.4, 126.5, 126.7, 127.0, 127.1, 127.2, 127.5, 127.7, 127.9, 128.6, 128.8, 129.7, 130.1, 133.4, 135.0, 135.3, 138.5, 143.6, 144.6, 154.7, 174.5, 176.1. IR (CH_2Cl_2) ν 3323, 3053, 2978, 2923, 2221, 1720, 1698, 1610, 1487, 1467, 1456, 1367, 1276, 1163, 1079, 1017, 899, 803, 733, 698 cm^{-1}. MS (ESI) *m/z* (%): 731.3 (100) [M^++NH_4]; HRMS (ESI) Calcd. for $C_{45}H_{43}N_6O_4^+$ (M^++NH_4) requires 731.3346, found: 731.3340.

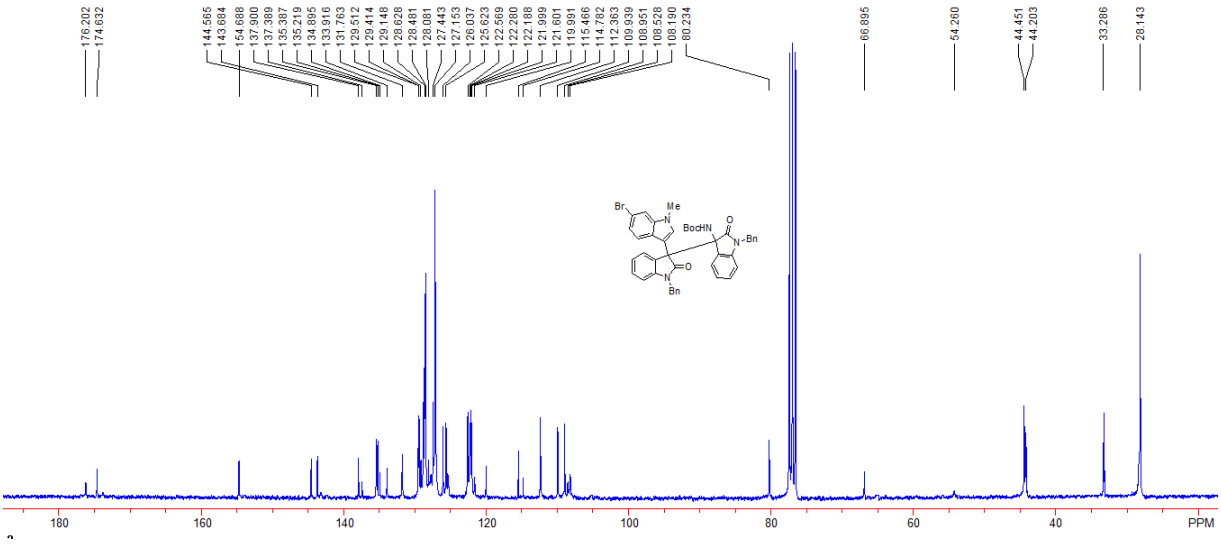


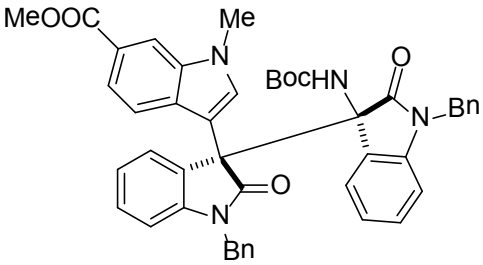


tert-butyl-1-benzyl-3-(1-benzyl-3-(6-bromo-1-methyl-1H-indol-3-yl)-2-oxoindolin-3-yl)-2-oxoindolin-3-ylcarbamate 4f (major isomer).

A colorless solid, 95% yield (73 mg), 9:1 dr. M.p.: 137-140 ^{o}C. ^{1}H NMR ($CDCl_3$, 400 MHz, TMS) δ 1.25-1.39 (m, 9H, CH_3), 3.83 (s, 3H, CH_3), 4.40 (d, J = 16.0 Hz, 1H, CH_2), 4.68 (d, J = 16.0 Hz, 1H, CH_2), 4.85 (d, J = 15.2 Hz, 1H, CH_2), 5.16 (d, J = 15.2 Hz, 1H, CH_2), 5.71 (s, 1H, ArH), 6.12 (d, J = 8.8 Hz, 1H, ArH), 6.55-6.58 (m, 2H, ArH), 6.69 (d, J = 7.6 Hz, 7.6 Hz, 1H, ArH), 6.75-6.87 (m, 4H, ArH), 7.08-7.21 (m, 9H, ArH), 7.28-7.44 (m, 3H, ArH), 7.87 (s, 1H, ArH), 8.18 (s, 1H, NH).^{13}C NMR ($CDCl_3$, 75 MHz, TMS) δ 28.1, 33.3, 44.2, 44.5, 54.3, 66.9, 80.2, 108.2, 108.5, 109.0, 109.9, 112.4, 114.8, 115.5, 120.0, 121.7, 122.0, 122.2, 122.3, 122.6, 125.6, 126.0, 127.2, 127.4, 128.1, 128.5, 128.6, 129.1, 129.4, 129.5, 131.8, 133.9, 134.9, 135.2, 135.4, 137.4, 137.9, 143.7, 144.6, 154.7, 174.6, 176.2. IR (CH_2Cl_2) ν 3319, 3059, 2978, 2927, 1716, 1696, 1609, 1486, 1466, 1365, 1275, 1160, 1103, 1075, 1017, 955, 898, 879, 733, 697 cm^{-1}. MS (ESI) *m/z* (%): 767.2 (100) [M^++H]; HRMS (ESI) Calcd. for $C_{44}H_{40}BrN_4O_4^+$ (M^++H) requires 767.2233, found: 767.2227.





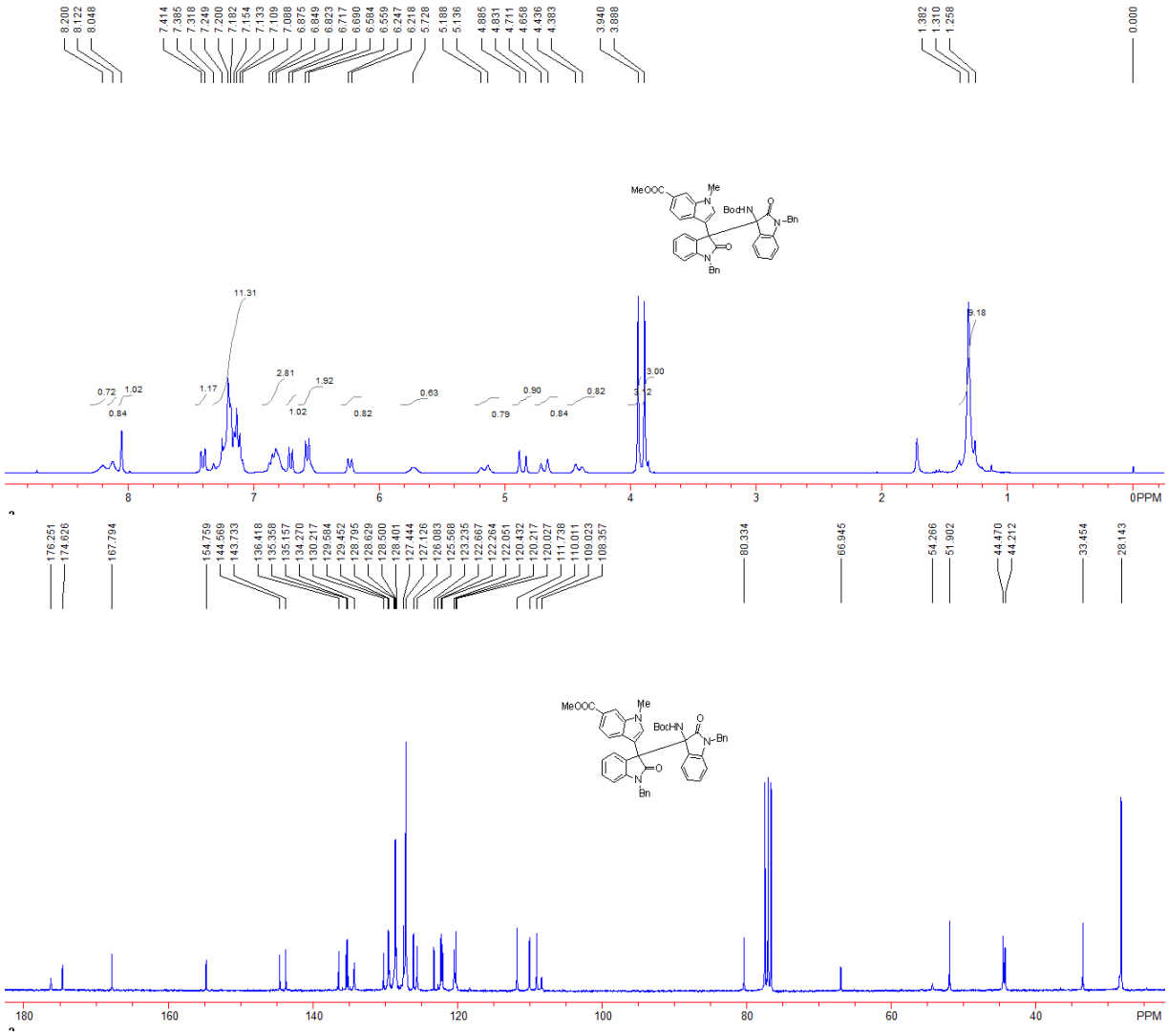


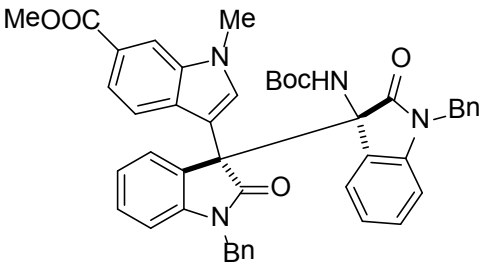
methyl

3-(1-benzyl-3-(1-benzyl-3-(tert-butoxycarbonyl)-2-oxoindolin-3-yl)-2-oxoindolin-3-yl)-1-methyl-1H-indole-6-carboxylate 4g (major isomer).

A colorless solid, 92% yield (68 mg), 5:1 dr (two isolated isomers). M.p.: 99-102 ^{o}C. ^{1}H NMR ($CDCl_3$, 300 MHz, TMS) δ 1.25-1.39 (m, 9H, CH_3), 3.89 (s, 3H, CH_3), 3.94 (s, 3H, CH_3), 4.41 (d, J = 15.9 Hz, 1H, CH_2), 4.68 (d, J = 16.2 Hz, 1H, CH_2), 4.86 (d, J = 16.2 Hz, 1H, CH_2), 5.16 (d, J = 15.9 Hz, 1H, CH_2), 5.73 (s, 1H, ArH), 6.23 (d, J = 8.7 Hz, 1H, ArH), 6.55-6.59 (m, 2H, ArH), 6.70 (d, J = 8.1 Hz, 1H, ArH), 6.82-6.88 (m, 3H, ArH), 7.08-7.32 (m, 11H, ArH), 7.40 (d, J = 8.7 Hz, 1H, ArH), 8.05 (s, 1H, ArH), 8.12 (s, 1H, ArH), 8.20 (s, 1H, NH). ^{13}C NMR ($CDCl_3$, 75 MHz, TMS) δ 28.1, 33.5, 44.2, 44.5, 51.9, 54.3, 66.9, 80.3, 108.4, 109.0, 110.0, 111.7, 120.0, 120.2, 120.4, 122.1, 122.3, 122.7, 123.2, 125.6, 126.1, 127.1, 127.4, 128.4, 128.5, 128.6, 128.8, 129.5, 129.6, 130.2, 134.3, 135.2, 135.4, 136.4, 143.7, 144.6, 154.8, 167.8, 174.6, 176.3. IR (CH_2Cl_2) ν 3366, 3051, 2982, 2928, 2088, 1709, 1610, 1533, 1484, 1465, 1434, 1363, 1312, 1265, 1227, 1162, 1096, 1078, 1030, 902, 832, 751, 734, 698, 670 cm^{-1}. MS (ESI) *m/z* (%): 747.3 (100) [M^++H]; HRMS (ESI) Calcd. for $C_{46}H_{43}N_4O_6^+$

(M^++H) requires 747.3177, found: 747.3179.



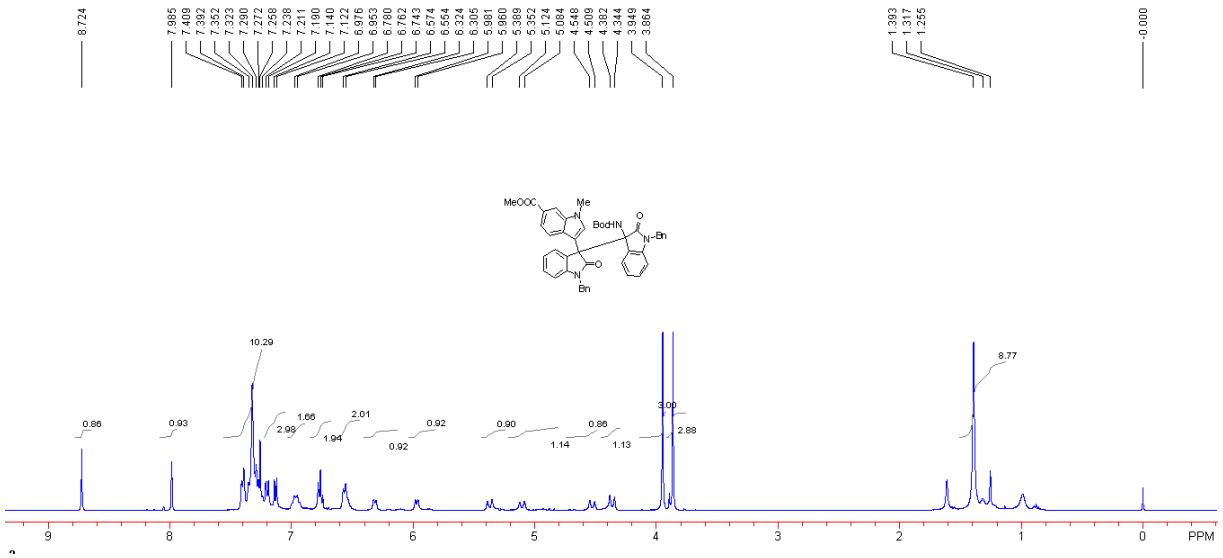


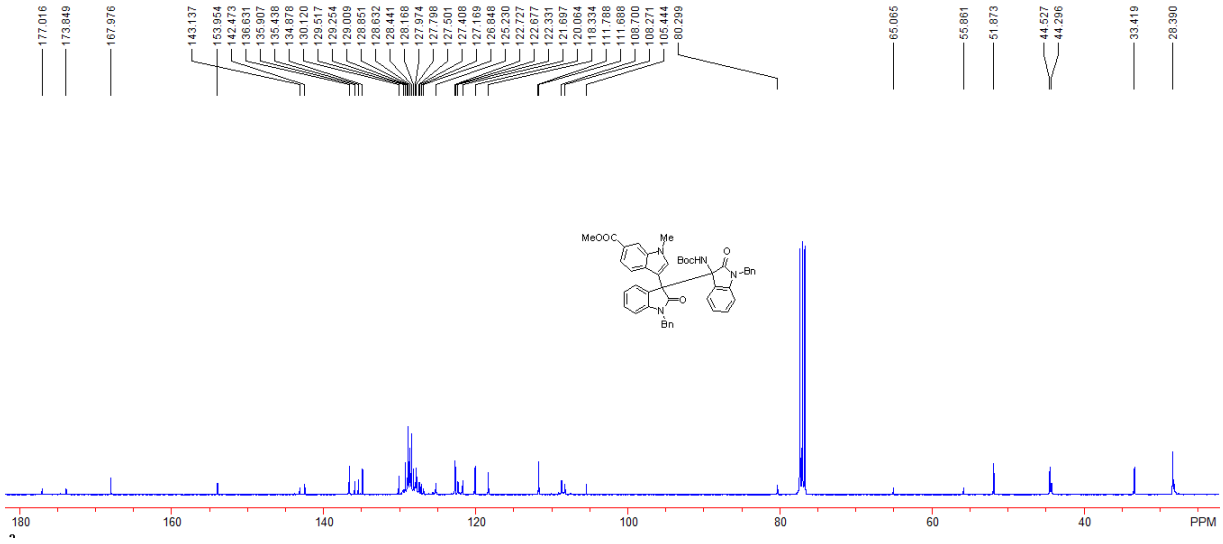
methyl

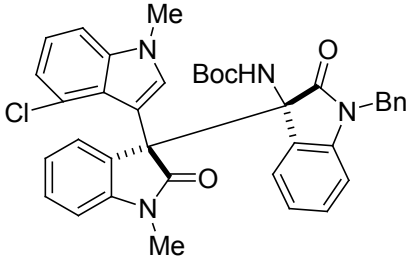
3-(1-benzyl-3-(1-benzyl-3-(tert-butoxycarbonyl)-2-oxoindolin-3-yl)-2-oxoindolin-3-yl)-1-methyl-1H-indole-6-carboxylate 4g' (minor isomer).

A colorless solid. ^{1}H NMR ($CDCl_3$, 400 MHz, TMS) δ 1.25-1.40 (m, 9H, CH_3), 3.86 (s, 3H, CH_3), 3.95 (s, 3H, CH_3), 4.36 (d, J = 15.2 Hz, 1H, CH_2), 4.53 (d, J = 16.0 Hz, 1H, CH_2), 5.10 (d, J = 16.0 Hz, 1H, CH_2), 5.37 (d, J = 15.2 Hz, 1H, CH_2), 5.97 (d, J = 8.4 Hz, 1H, ArH), 6.31

(d, *J* = 7.6 Hz, 1H, ArH), 6.55-6.58 (m, 2H, ArH), 6.74-6.78 (m, 2H, ArH), 6.95-6.98 (m, 2H, ArH), 7.12-7.19 (m, 3H, ArH), 7.21-7.41 (m, 10H, ArH), 7.99 (s, 1H, ArH), 8.72 (s, 1H, NH). ^{13}C NMR ($CDCl_3$, 100 MHz, TMS) δ 28.4, 33.4, 44.3, 44.5, 51.9, 55.9, 65.1, 80.3, 105.4, 108.3, 108.7, 111.7, 111.8, 118.3, 120.1, 121.7, 122.3, 122.7, 122.73, 125.2, 126.8, 127.2, 127.4, 127.5, 127.8, 128.0, 128.2, 128.4, 128.6, 128.9, 129.0, 129.3, 129.5, 130.1, 134.9, 135.4, 135.9, 136.6, 142.5, 143.1, 154.0, 168.0, 173.8, 177.0.

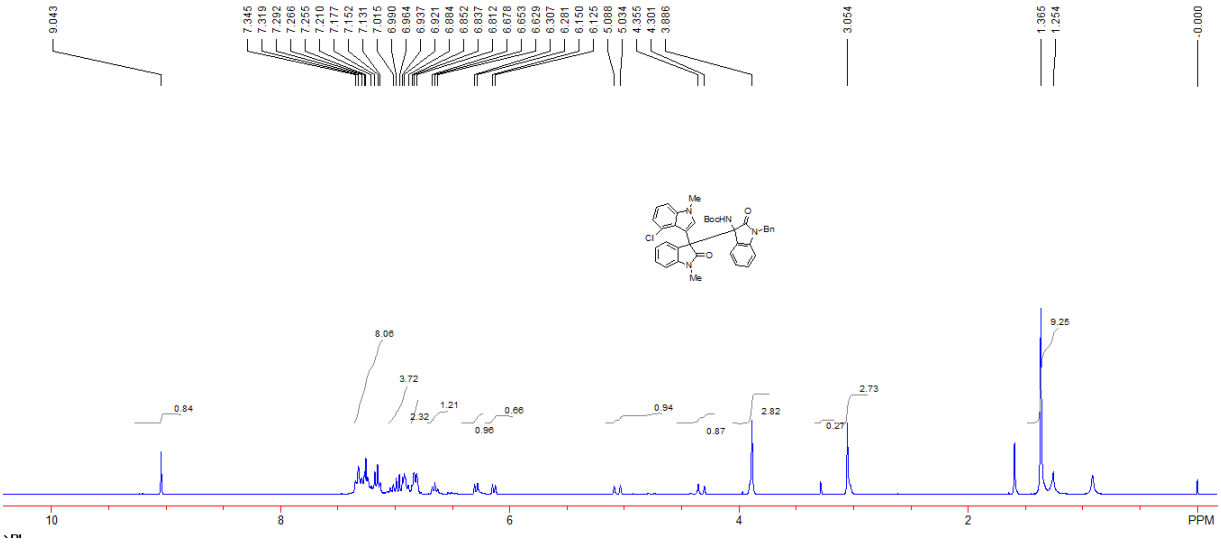


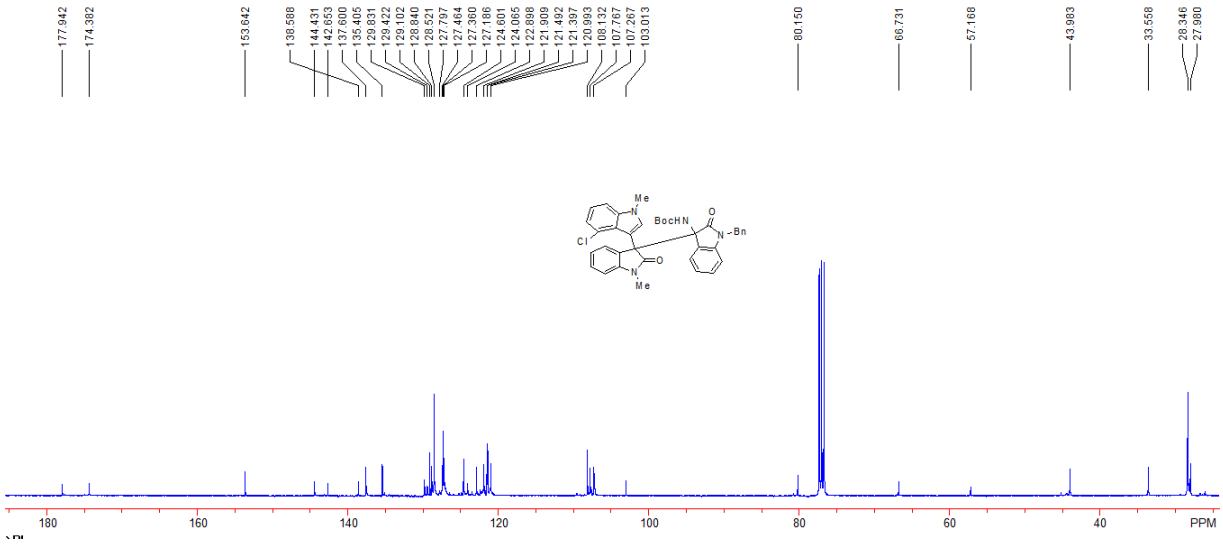


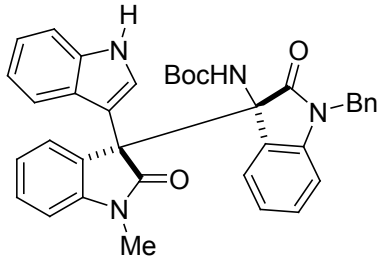


tert-butyl-1-benzyl-3-(3-(4-chloro-1-methyl-1H-indol-3-yl)-1-methyl-2-oxoindolin-3-yl)-2-oxoindolin-3-ylcarbamate 4h (major isomer).

A colorless solid, 70% yield (45 mg), 10:1 dr. M.p.: 142-145 ^{o}C. ^{1}H NMR ($CDCl_3$, 300 MHz, TMS) δ 1.25-1.37 (m, 9H, CH_3), 3.05 (s, 3H, CH_3), 3.89 (s, 3H, CH_3), 4.33 (d, J = 16.2 Hz, 1H, CH_2), 5.06 (d, J = 16.2 Hz, 1H, CH_2), 6.14 (d, J = 7.5 Hz, 1H, ArH), 6.29 (d, J = 7.8 Hz, 1H, ArH), 6.65 (dd, J = 7.5 Hz, 7.5 Hz, 1H, ArH), 6.81-6.86 (m, 2H, ArH), 6.88-7.02 (m, 4H, ArH), 7.13-7.35 (m, 8H, ArH), 9.04 (s, 1H, NH). ^{13}C NMR ($CDCl_3$, 100 MHz, TMS) δ 28.0, 28.3, 33.6, 44.0, 57.2, 66.7, 80.2, 103.0, 107.3, 107.8, 108.1, 121.0, 121.4, 121.5, 121.9, 122.9, 124.1, 124.6, 127.2, 127.4, 127.5, 127.8, 128.5, 128.8, 129.1, 129.4, 129.8, 135.4, 137.6, 138.6, 142.7, 144.4, 153.6, 174.4, 177.9. IR (CH_2Cl_2) ν 3321, 3044, 2979, 2920, 1717, 1611, 1479, 1465, 1393, 1368, 1340, 1303, 1286, 1248, 1147, 1099, 1019, 1003, 925, 887, 838, 735, 698 cm^{-1}. MS (ESI) *m/z* (%): 647.2 (100) [(M^++H]; HRMS (ESI) Calcd. for $C_{38}H_{36}ClN_4O_4^+$ (M^++H) requires 647.2420, found: 647.2422.

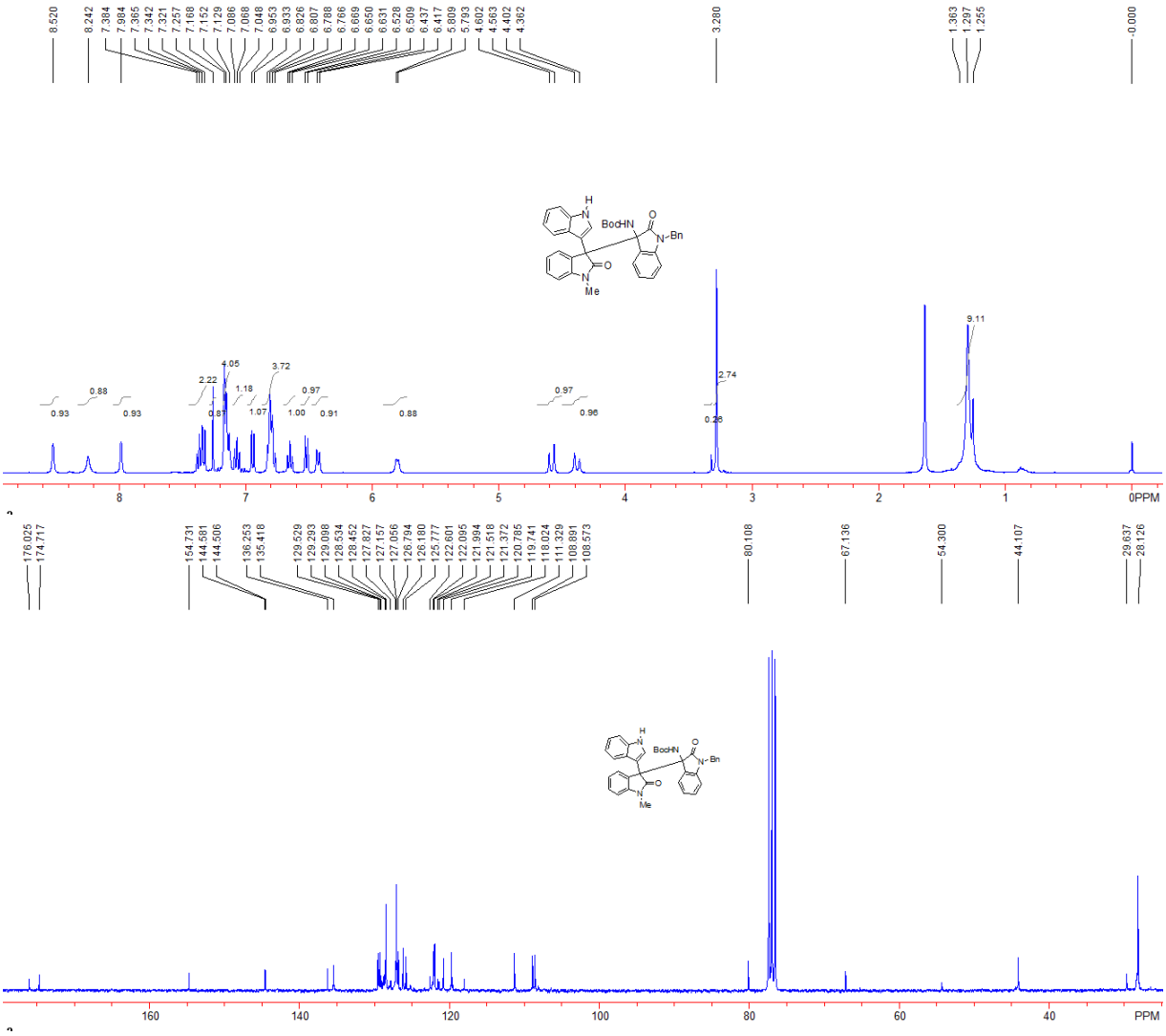


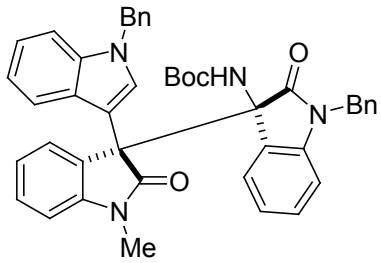




tert-butyl-3-(3-(1H-indol-3-yl)-1-methyl-2-oxoindolin-3-yl)-1-benzyl-2-oxoindolin-3-ylcarbamate 4i (major isomer).

A colorless solid, 93% yield (56 mg), 11:1 dr. M.p.: 153-156 ^{o}C. ^{1}H NMR ($CDCl_3$, 400 MHz, TMS) δ 1.25-1.37 (m, 9H, CH_3), 3.28 (s, 3H, CH_3), 4.38 (d, J = 16.0 Hz, 1H, CH_2), 4.58 (d, J = 16.0 Hz, 1H, CH_2), 5.80 (d, J = 6.4 Hz, 1H, ArH), 6.43 (d, J = 8.0 Hz, 1H, ArH), 6.52 (d, J = 7.6 Hz, 1H, ArH), 6.66 (dd, J = 7.6 Hz, 7.6 Hz, 1H, ArH), 6.76-6.83 (m, 4H, ArH), 6.94 (d, J = 8.0 Hz, 1H, ArH), 7.07 (dd, J = 8.0 Hz, 8.0 Hz, 1H, ArH), 7.12-7.17 (m, 4H, ArH), 7.26 (s, 1H, ArH), 7.32-7.39 (m, 2H, ArH), 7.98 (s, 1H, ArH), 8.24 (s, 1H, NH), 8.52 (s, 1H, NH). ^{13}C NMR ($CDCl_3$, 75 MHz, TMS) δ 28.1, 29.6, 44.1, 54.3, 67.1, 80.1, 108.6, 108.9, 111.3, 118.0, 119.7, 120.8, 121.4, 121.5, 122.0, 122.1, 122.6, 125.8, 126.2, 126.8, 127.1, 127.2, 127.8, 128.45, 128.5, 129.1, 129.3, 129.5, 135.4, 136.3, 144.5, 144.6, 154.7, 174.7, 176.0. IR (CH_2Cl_2) ν 3329, 3053, 2977, 2925, 1705, 1611, 1490, 1467, 1369, 1276, 1162, 1067, 906, 750, 697 cm^{-1}. MS (ESI) *m/z* (%): 599.3 (100) [M^++H]; HRMS (ESI) Calcd. for $C_{37}H_{35}N_4O_4^+$ (M^++H) requires 599.2658, Found: 599.2647.

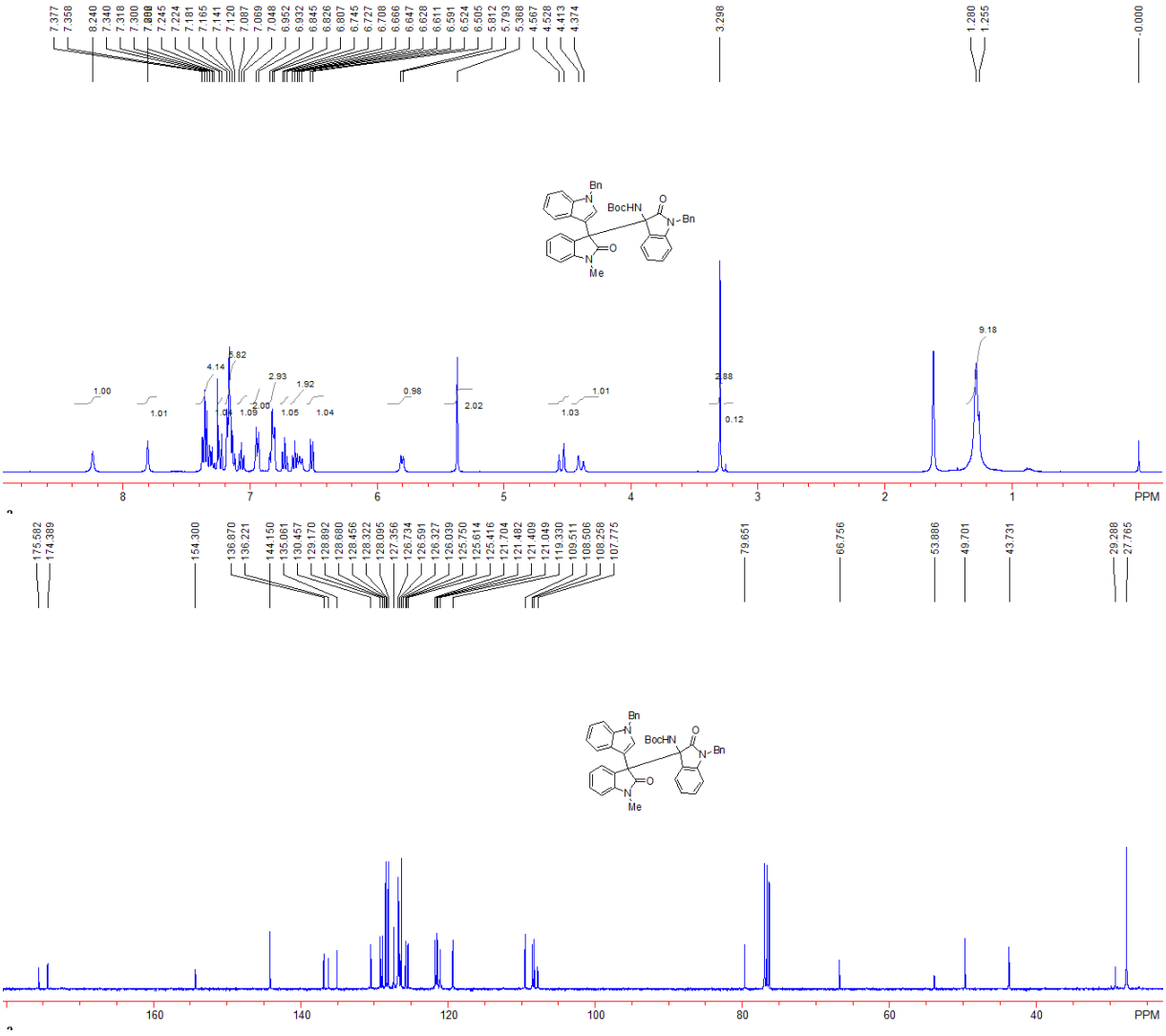


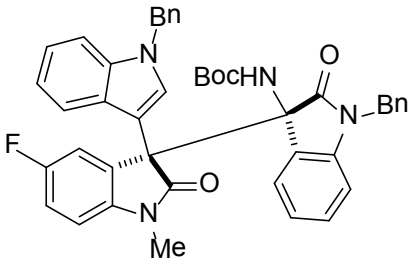


tert-butyl-1-benzyl-3-(3-(1-benzyl-1H-indol-3-yl)-1-methyl-2-oxoindolin-3-yl)-2-oxoindolin-3-ylcarbamate 4j (major isomer).

A colorless solid, 94% yield (65 mg), >20:1 dr. M.p.: 134-138 ^{o}C. ^{1}H NMR ($CDCl_3$, 400 MHz, TMS) δ 1.25-1.28 (m, 9H, CH_3), 3.30 (s, 3H, CH_3), 4.39 (d, J = 15.6 Hz, 1H, CH_2), 4.55 (d, J = 15.6 Hz, 1H, CH_2), 5.37 (s, 2H, CH_2), 5.80 (d, J = 7.6 Hz, 1H, ArH), 6.51 (d, J = 7.6 Hz, 1H, ArH), 6.59-6.67 (m, 2H, ArH), 6.73 (dd, J = 7.6 Hz, 7.6 Hz, 1H, ArH), 6.80-6.85 (m, 3H, ArH), 6.94 (d, J = 8.0 Hz, 2H, ArH), 7.07 (dd, J = 8.4 Hz, 8.4 Hz, 1H, ArH), 7.12-7.19 (m, 6H,

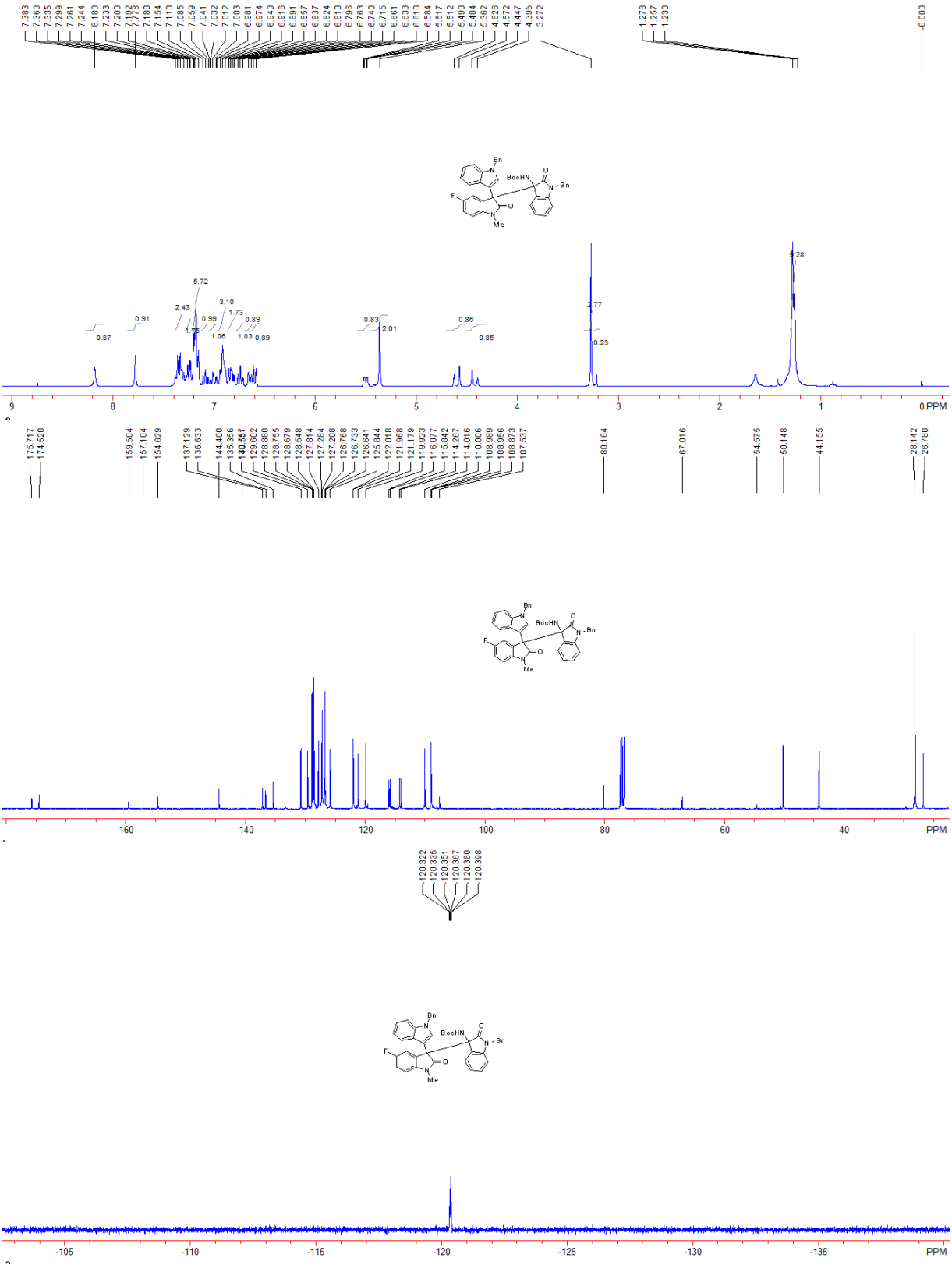
ArH), 7.23 (d, J = 8.4 Hz, 1H, ArH), 7.28-7.38 (m, 4H, ArH), 7.81 (s, 1H, ArH), 8.24 (s, 1H, NH). ^{13}C NMR ($CDCl_3$, 100 MHz, TMS) δ 27.8, 29.3, 43.7, 49.7, 53.9, 66.8, 79.7, 107.8, 108.3, 108.5, 109.5, 119.3, 121.0, 121.4, 121.5, 121.7, 125.4, 125.6, 125.8, 126.0, 126.3, 126.6, 126.7, 127.4, 128.1, 128.3, 128.5, 128.7, 128.9, 129.2, 130.5, 135.1, 136.2, 136.9, 144.2, 154.3, 174.4, 175.6. IR (CH_2Cl_2) ν 3313, 3051, 2977, 2926, 1719, 1692, 1610, 1490, 1466, 1367, 1276, 1161, 1131, 1077, 1028, 906, 882, 750, 697 cm^{-1}. MS (ESI) *m/z* (%): 689.3 (100) [M$^+$+H]; HRMS (ESI) Calcd. for $C_{44}H_{41}N_4O_4^+$ (M$^+$+H) requires 689.3128, found: 689.3114.

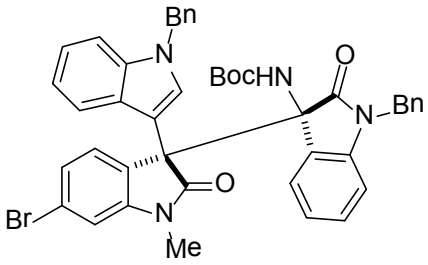




tert-butyl-1-benzyl-3-(3-(1-benzyl-1H-indol-3-yl)-5-fluoro-1-methyl-2-oxoindolin-3-yl)-2-oxoindolin-3-ylcarbamate 4k (major isomer).

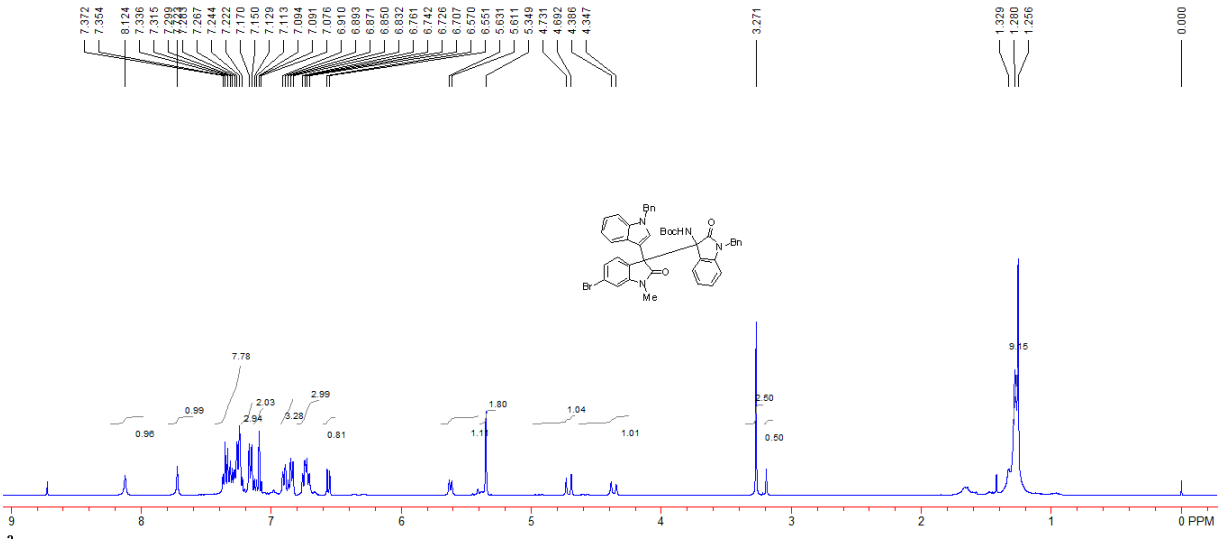
A colorless solid, 90% yield (64 mg), 12:1 dr. M.p.: 125-128 ^{o}C. ^{1}H NMR ($CDCl_3$, 300 MHz, TMS) δ 1.23-1.28 (m, 9H, CH_3), 3.27 (s, 3H, CH_3), 4.42 (d, J = 15.6 Hz, 1H, CH_2), 4.60 (d, J = 15.6 Hz, 1H, CH_2), 5.36 (s, 2H, CH_2), 5.50 (dd, J = 1.8 Hz, 8.4 Hz, 1H, ArH), 6.60 (d, J = 7.8 Hz, 1H, ArH), 6.65 (d, J = 7.8 Hz, 1H, ArH), 6.74 (dd, J = 7.5 Hz, 7.5 Hz, 1H, ArH), 6.79-6.86 (m, 2H, ArH), 6.89-6.94 (m, 3H, ArH), 6.97-7.05 (m, 1H, ArH), 7.09 (dd, J = 7.5 Hz, 7.5 Hz, 1H, ArH), 7.15-7.20 (m, 6H, ArH), 7.23-7.27 (m, 2H, ArH), 7.29-7.39 (m, 2H, ArH), 7.78 (s, 1H, ArH), 8.18 (s, 1H, NH). ^{13}C NMR ($CDCl_3$, 100 MHz, TMS) δ 26.8, 28.1, 44.2, 50.1, 54.6, 67.0, 80.2, 107.5, 108.9 (d, J = 8.3 Hz), 109.0, 110.0, 114.1 (d, J = 25.1 Hz), 116.0 (d, J = 23.5 Hz), 119.9, 121.2, 122.0 (d, J = 5.0 Hz), 125.8, 126.6, 126.7, 126.8, 127.2, 127.3, 127.8, 128.5, 128.7, 128.8, 128.9, 129.6, 130.8, 135.4, 136.6, 137.1, 140.6, 144.4, 155.9 (d, J = 247.5 Hz), 159.5, 174.5, 175.7. ^{19}F NMR ($CDCl_3$, 282 MHz, $CFCl_3$) δ -120.4. IR (CH_2Cl_2) ν 3311, 3051, 2976, 2925, 1717, 1699, 1604, 1485, 1470, 1368, 1351, 1276, 1252, 1159, 1110, 1064, 1028, 911, 879, 843, 735, 701 cm^{-1}. ^{19}F NMR ($CDCl_3$, 282 MHz, $CFCl_3$) δ -120.4. MS (ESI) *m/z* (%): 707.3 (100) [M^++H]; HRMS (ESI) Calcd. for $C_{44}H_{40}FN_4O_4^+$ (M^++H) requires 707.3034, Found: 707.3029.

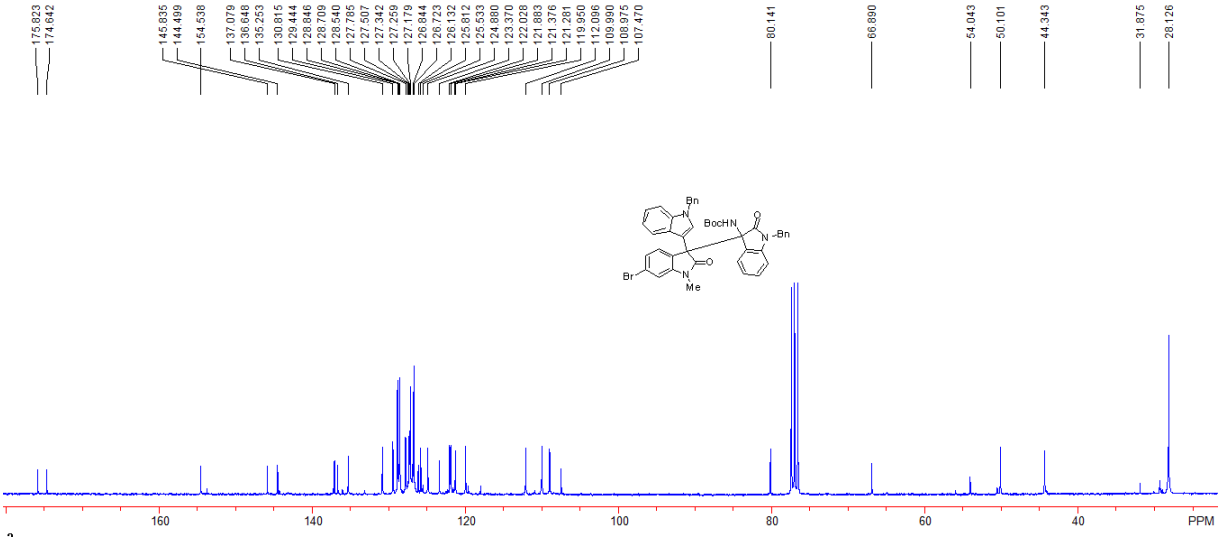


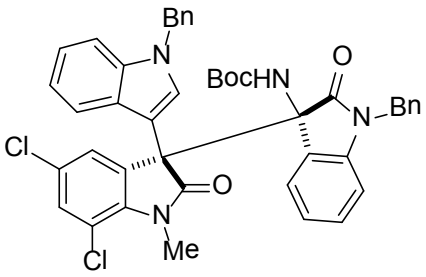


tert-butyl-1-benzyl-3-(3-(1-benzyl-1H-indol-3-yl)-6-bromo-1-methyl-2-oxoindolin-3-yl)-2-oxoindolin-3-ylcarbamate 4l (major isomer).

A colorless solid, 94% yield (72 mg), 5:1 dr. M.p.: 127-130 ^{o}C. ^{1}H NMR ($CDCl_3$, 400 MHz, TMS) δ 1.25-1.33 (m, 9H, CH_3), 3.27 (s, 3H, CH_3), 4.37 (d, J = 15.6 Hz, 1H, CH_2), 4.71 (d, J = 15.6 Hz, 1H, CH_2), 5.35 (s, 2H, CH_2), 6.62 (d, J = 8.0 Hz, 1H, ArH), 6.56 (d, J = 8.0 Hz, 1H, ArH), 6.70-6.77 (m, 3H, ArH), 6.83-6.91 (m, 3H, ArH), 7.07-7.13 (m, 2H, ArH), 7.15-7.17 (m, 3H, ArH), 7.22-7.38 (m, 8H, ArH), 7.72 (s, 1H, ArH), 8.12 (s, 1H, NH). ^{13}C NMR ($CDCl_3$, 75 MHz, TMS) δ 28.1, 31.9, 44.3, 50.1, 54.0, 66.9, 80.1, 107.5, 109.0, 110.0, 112.1, 120.0, 121.3, 121.4, 121.9, 122.0, 123.4, 124.9, 125.5, 125.8, 126.1, 126.7, 126.8, 127.2, 127.26, 127.3, 127.5, 127.8, 128.5, 128.7, 128.8, 129.4, 130.8, 135.3, 136.6, 137.1, 144.5, 145.8, 154.5, 174.6, 175.8. IR (CH_2Cl_2) ν 3323, 3051, 2974, 2922, 1716, 1600, 1489, 1465, 1455, 1364, 1275, 1258, 1159, 1099, 1075, 1028, 965, 912, 883, 843, 809, 732, 697 cm^{-1}. MS (ESI) *m/z* (%): 767.2 (100) [M^++H]; HRMS (ESI) Calcd. for $C_{44}H_{40}BrN_4O_4^+$ (M^++H) requires 767.2233, Found: 767.2226.

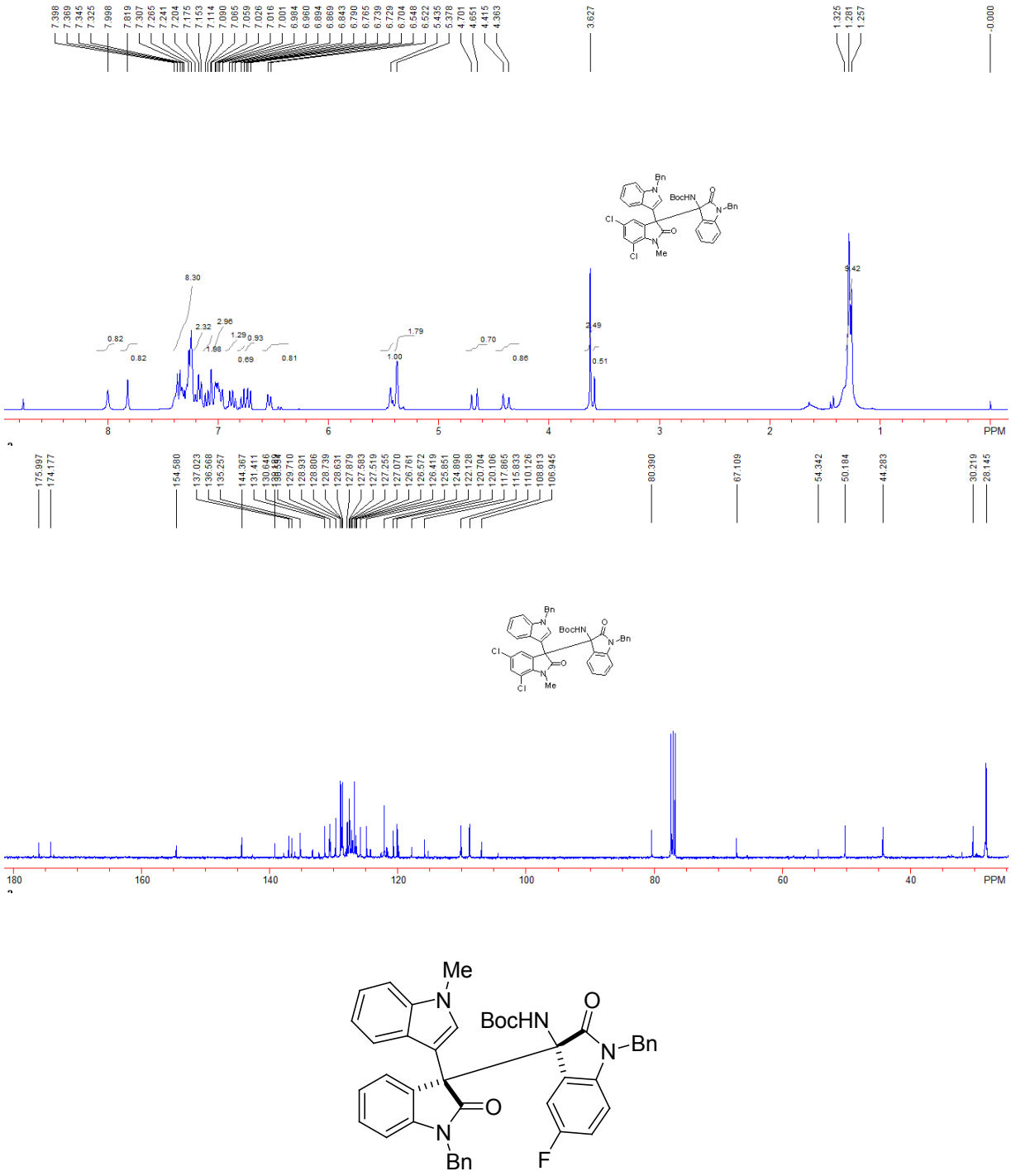






tert-butyl-1-benzyl-3-(3-(1-benzyl-1H-indol-3-yl)-5,7-dichloro-1-methyl-2-oxoindolin-3-yl)-2-oxoindolin-3-ylcarbamate 4m (major isomer).

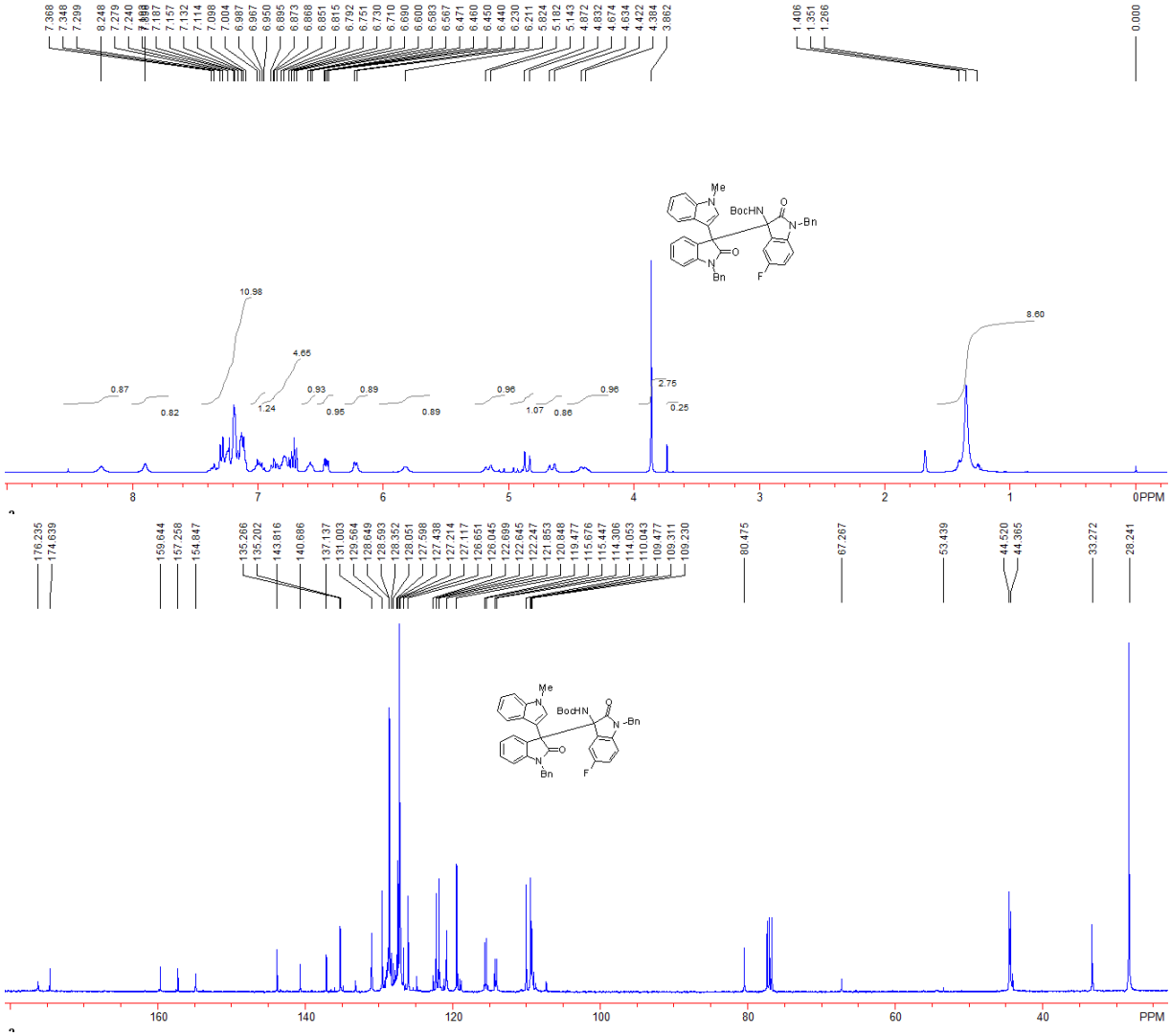
A colorless solid, 93% yield (70 mg), 5:1 dr. M.p.: 124-127 ^{o}C. ^{1}H NMR ($CDCl_3$, 300 MHz, TMS) δ 1.25-1.33 (m, 9H, CH_3), 3.63 (s, 3H, CH_3), 4.39 (d, J = 15.6 Hz, 1H, CH_2), 4.68 (d, J = 15.6 Hz, 1H, CH_2), 5.38 (s, 2H, CH_2), 5.44 (s, 1H, ArH), 6.53 (d, J = 7.8 Hz, 1H, ArH), 6.72 (d, J = 7.5 Hz, 1H, ArH), 6.77 (dd, J = 7.5 Hz, 7.5 Hz, 1H, ArH), 6.87 (dd, J = 7.8 Hz, 7.8 Hz, 1H, ArH), 6.96-7.03 (m, 3H, ArH), 7.05-7.12 (m, 2H, ArH), 7.15-7.21 (m, 2H, ArH), 7.24-7.40 (m, 8H, ArH), 7.82 (s, 1H, ArH), 8.00 (s, 1H, NH). ^{13}C NMR ($CDCl_3$, 100 MHz, TMS) δ 28.1, 30.2, 44.3, 50.2, 54.3, 67.1, 80.4, 106.9, 108.8, 110.1, 115.8, 117.9, 120.1, 120.7, 122.1, 124.9, 125.9, 126.4, 126.6, 126.8, 127.1, 127.3, 127.5, 127.6, 127.9, 128.6, 128.7, 128.8, 128.9, 129.7, 130.55, 130.6, 131.4, 135.3, 136.6, 137.0, 139.2, 144.4, 154.6, 174.2, 176.0. IR (CH_2Cl_2) ν 3325, 3062, 2978, 2924, 1716, 1611, 1577, 1487, 1464, 1366, 1275, 1253, 1160, 1118, 1075, 1028, 918, 861, 738, 697 cm^{-1}. MS (ESI) *m/z* (%): 757.2 (100) [M^++H]; HRMS (ESI) Calcd. for $C_{44}H_{39}Cl_2N_4O_4^+$ (M^++H) requires 757.2349, found: 757.2346.

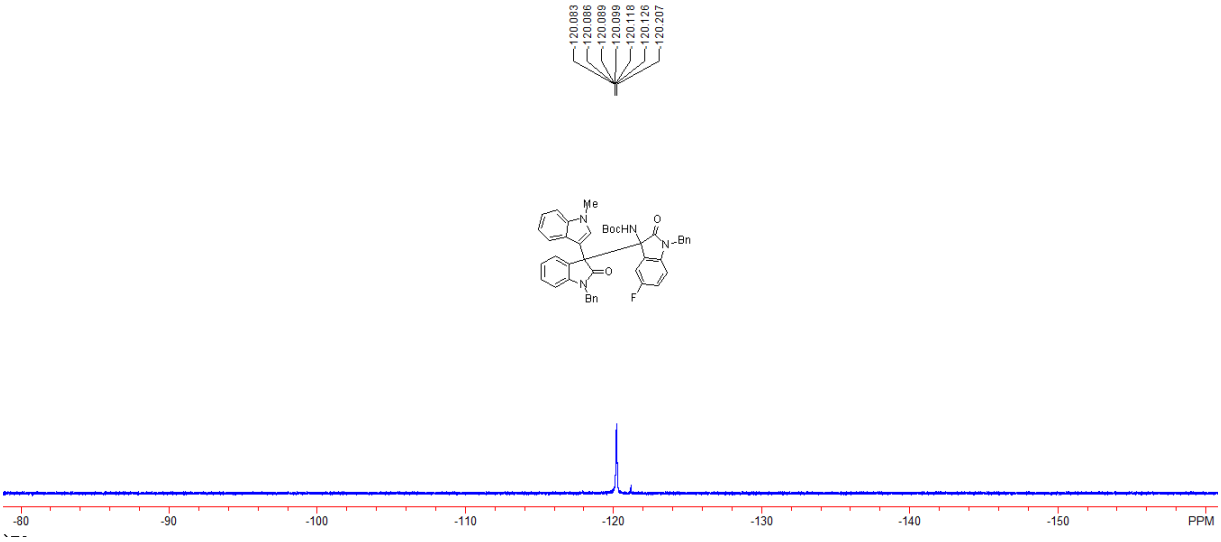


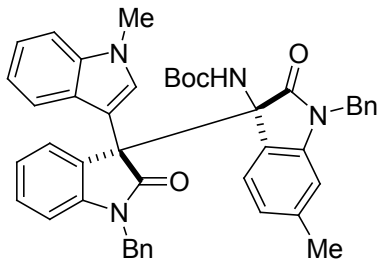
tert-butyl-1-benzyl-3-(1-benzyl-3-(1-methyl-1H-indol-3-yl)-2-oxoindolin-3-yl)-5-fluoro-2-oxoindolin-3-ylcarbamate 4o (major isomer).

A colorless solid, 93% yield (66 mg), 11:1 dr. M.p.: 115-118 ^{o}C. ^{1}H NMR ($CDCl_3$, 400 MHz, TMS) δ 1.26-1.41 (m, 9H, CH_3), 3.86 (s, 3H, CH_3), 4.40 (d, J = 15.6 Hz, 1H, CH_2), 4.65 (d, J = 16.0 Hz, 1H, CH_2), 4.85 (d, J = 16.0 Hz, 1H, CH_2), 5.16 (d, J = 15.6 Hz, 1H, CH_2), 5.82 (s, 1H, ArH), 6.22 (d, J = 7.6 Hz, 1H, ArH), 6.46 (dd, J = 4.0 Hz, 8.0 Hz, 1H, ArH), 6.58 (dd, J = 6.8 Hz, 6.8 Hz, 1H, ArH), 6.69-6.90 (m, 5H, ArH), 6.95-7.01 (m, 1H, ArH), 7.09-7.37 (m, 11H,

ArH), 7.90 (s, 1H, ArH), 8.25 (s, 1H, NH). ^{13}C NMR ($CDCl_3$, 100 MHz, TMS) δ 28.2, 33.3, 44.4, 44.5, 53.4, 67.3, 80.5, 109.3 (d, J = 8.1 Hz), 109.5, 110.0, 114.2 (d, J = 25.3 Hz), 115.7 (d, J = 22.9 Hz), 119.5, 120.8, 121.9, 122.2, 122.7 (d, J = 5.4 Hz), 126.7, 127.1, 127.2, 127.4, 127.6, 128.1, 128.4, 128.6, 128.65, 129.6, 131.0, 135.2, 135.3, 137.1, 140.7, 143.8, 154.8, 158.5 (d, J = 238.6 Hz), 174.6, 176.2. ^{19}F NMR ($CDCl_3$, 376 MHz, $CFCl_3$) δ -120.1. IR (CH_2Cl_2) ν 3385, 3062, 2978, 2924, 1714, 1702, 1610, 1507, 1469, 1424, 1368, 1348, 1249, 1160, 1130, 1067, 1020, 912, 878, 845, 810, 736, 699, 669 cm^{-1}. MS (ESI) *m/z* (%): 707.3 (100) [M^++H]; HRMS (ESI) Calcd. for $C_{44}H_{40}FN_4O_4^+$ (M^++H) requires 707.3034, found: 707.3028.

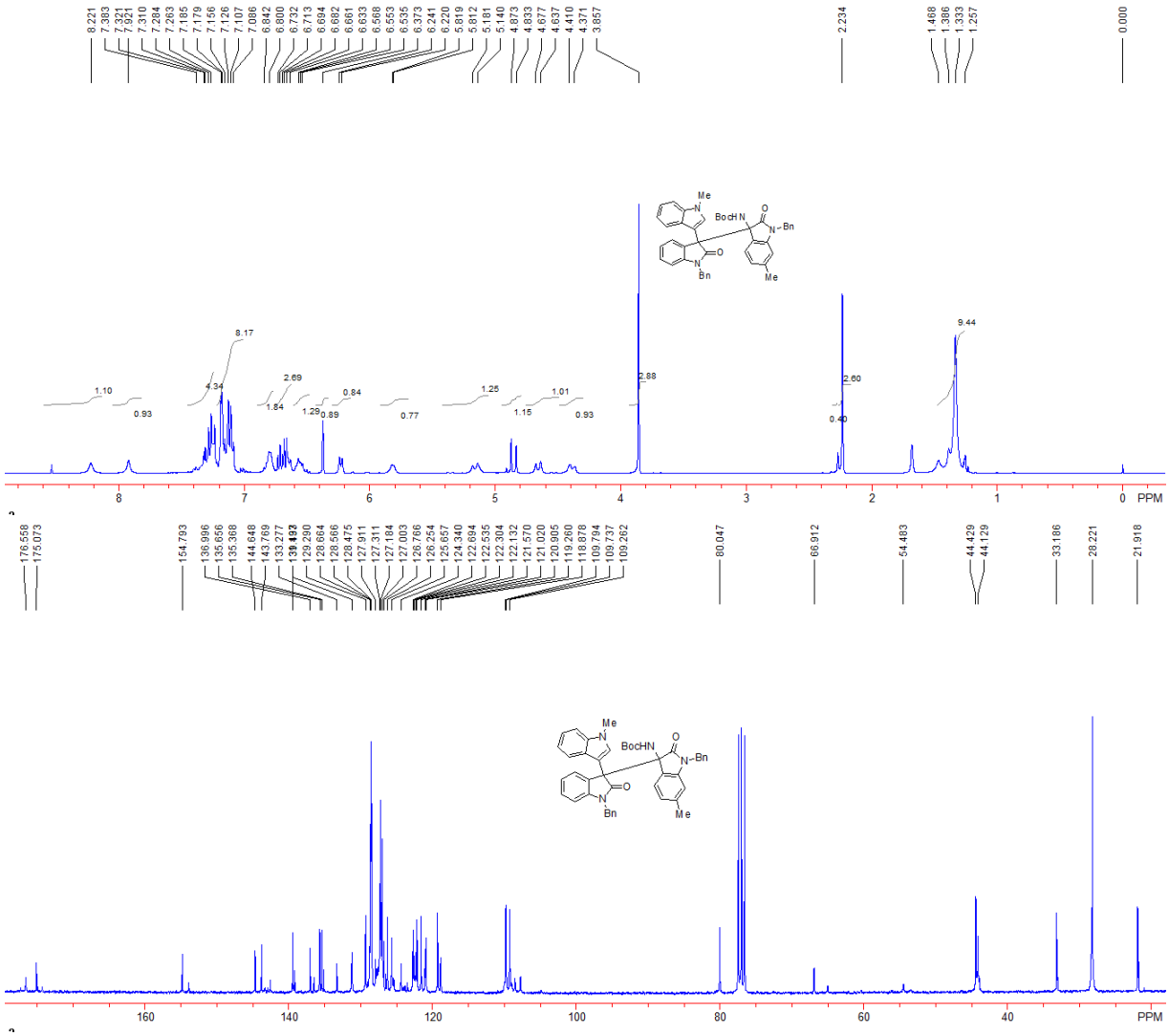


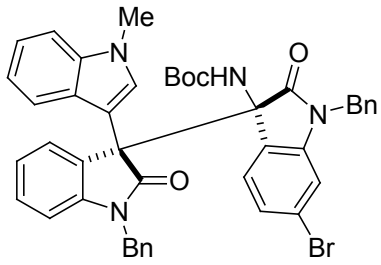




tert-butyl-1-benzyl-3-(1-benzyl-3-(1-methyl-1H-indol-3-yl)-2-oxoindolin-3-yl)-6-methyl-2-oxoindolin-3-ylcarbamate 4p (major isomer).

A colorless solid, 94% yield (66 mg), 7:1 dr. M.p.: 122-125 ^{o}C. ^{1}H NMR ($CDCl_3$, 400 MHz, TMS) δ 1.25-1.47 (m, 9H, CH_3), 2.23 (s, 3H, CH_3), 3.86 (s, 3H, CH_3), 4.39 (d, J = 15.6 Hz, 1H, CH_2), 4.66 (d, J = 16.0 Hz, 1H, CH_2), 4.85 (d, J = 16.0 Hz, 1H, CH_2), 5.16 (d, J = 15.6 Hz, 1H, CH_2), 5.82 (d, J = 2.8 Hz, 1H, ArH), 6.23 (d, J = 8.4 Hz, 1H, ArH), 6.37 (s, 1H, ArH), 6.53-6.57 (m, 1H, ArH), 6.63-6.74 (m, 3H, ArH), 6.80-6.85 (m, 2H, ArH), 7.08-7.19 (m, 8H, ArH), 7.26-7.39 (m, 4H, ArH), 7.92 (s, 1H, ArH), 8.22 (s, 1H, NH). ^{13}C NMR ($CDCl_3$, 75 MHz, TMS) δ 21.9, 28.2, 33.2, 44.1, 44.4, 54.5, 66.9, 80.0, 109.3, 109.7, 109.8, 118.9, 119.3, 120.9, 121.0, 121.6, 122.1, 122.3, 122.5, 122.7, 124.3, 125.7, 126.3, 126.8, 127.0, 127.2, 127.3, 127.9, 128.5, 128.6, 128.7, 129.3, 131.2, 133.3, 135.4, 135.7, 137.0, 139.4, 143.8, 144.6, 154.8, 175.1, 176.6. IR (CH_2Cl_2) ν 3324, 3055, 2977, 2926, 1719, 1618, 1610, 1487, 1466, 1366, 1276, 1162, 1115, 1077, 1016, 899, 848, 749, 698 cm^{-1}. MS (ESI) *m/z* (%): 703.3 (100) [M^++H]; HRMS (ESI) Calcd. for $C_{45}H_{43}N_4O_4^+$ (M^++H) requires 703.3284, found: 703.3280.

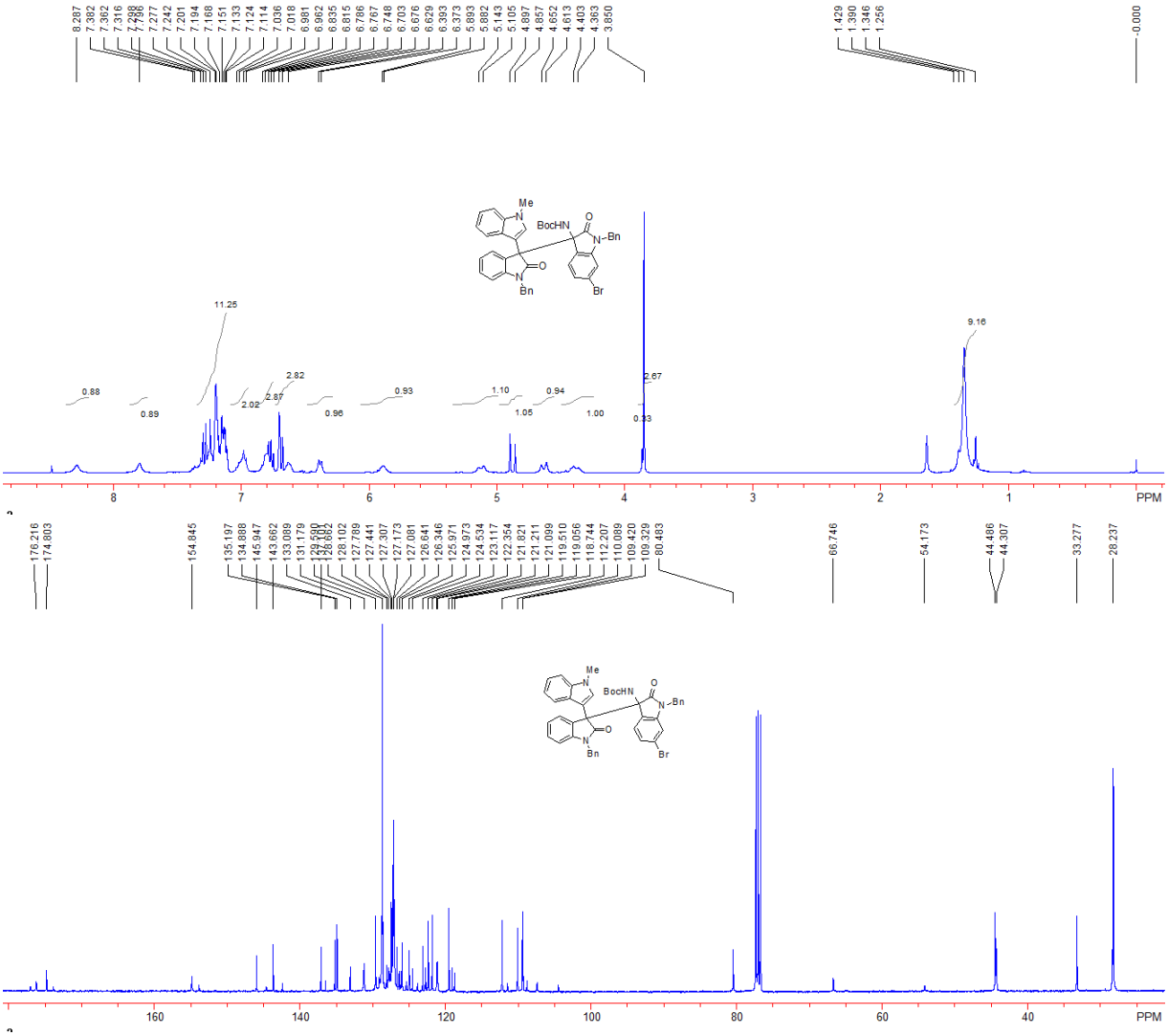


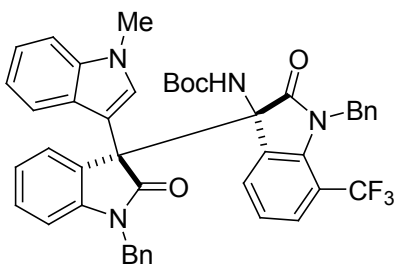


tert-butyl-1-benzyl-3-(1-benzyl-3-(1-methyl-1H-indol-3-yl)-2-oxoindolin-3-yl)-6-bromo-2-oxoindolin-3-ylcarbamate 4q (major isomer).

A colorless solid, 91% yield (70 mg), 8:1 dr. M.p.: 135-138 ^{o}C. ^{1}H NMR ($CDCl_3$, 400 MHz, TMS) δ 1.25-1.43 (m, 9H, CH_3), 3.85 (s, 3H, CH_3), 4.38 (d, J = 16.0 Hz, 1H, CH_2), 4.63 (d, J = 15.2 Hz, 1H, CH_2), 4.88 (d, J = 16.0 Hz, 1H, CH_2), 5.13 (d, J = 15.2 Hz, 1H, CH_2), 5.89 (d, J = 4.4 Hz, 1H, ArH), 6.38 (d, J = 8.0 Hz, 1H, ArH), 6.62-6.71 (m, 3H, ArH), 6.74-6.84 (m, 3H, ArH), 6.96-7.04 (m, 2H, ArH), 7.11-7.39 (m, 11H, ArH), 7.80 (s, 1H, ArH), 8.29 (s, 1H,

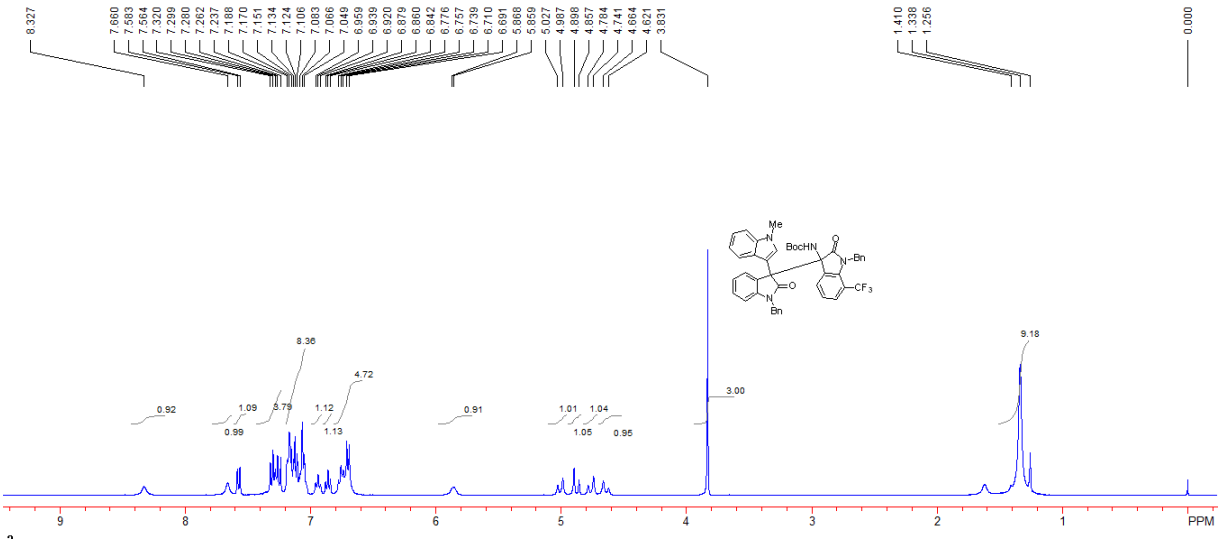
NH). ^{13}C NMR ($CDCl_3$, 100 MHz, TMS) δ 28.2, 33.3, 44.3, 44.5, 54.2, 66.7, 80.5, 109.3, 109.4, 110.1, 112.2, 118.7, 119.1, 119.5, 121.1, 121.2, 121.8, 122.4, 123.1, 124.5, 125.0, 126.0, 126.3, 126.6, 127.1, 127.2, 127.3, 127.4, 127.8, 128.1, 128.7, 129.6, 131.2, 133.1, 134.9, 135.2, 137.1, 143.7, 145.9, 154.8, 174.8, 176.2. IR (CH_2Cl_2) ν 3318, 3059, 2978, 2923, 1718, 1695, 1603, 1485, 1466, 1367, 1276, 1159, 1110, 1064, 1018, 898, 878, 843, 735, 697, 670 cm^{-1}. MS (ESI) *m/z* (%): 767.2 (100) [M^++H]; HRMS (ESI) Calcd. for $C_{44}H_{40}BrN_4O_4^+$ (M^++H) requires 767.2233, found: 767.2231.

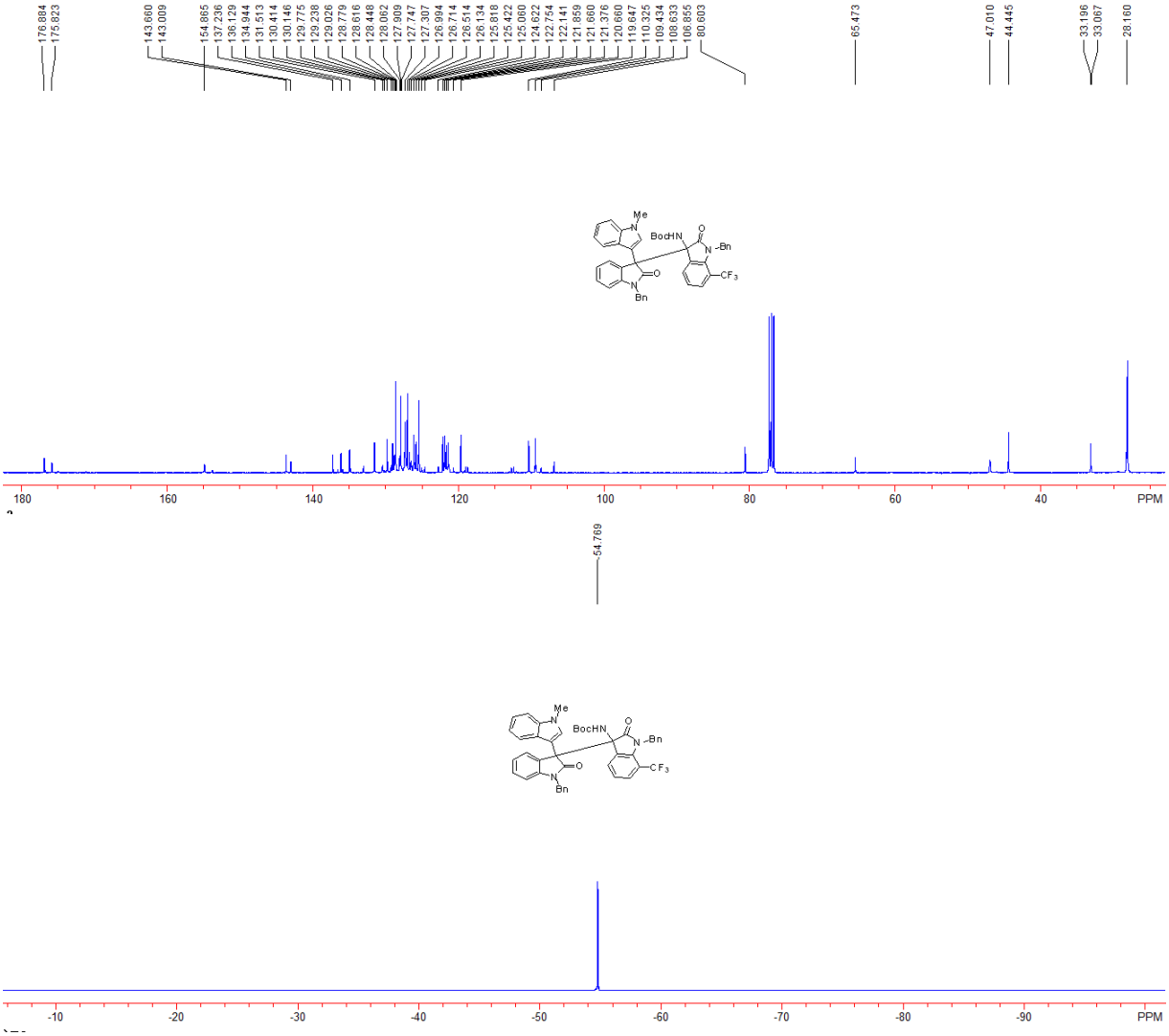


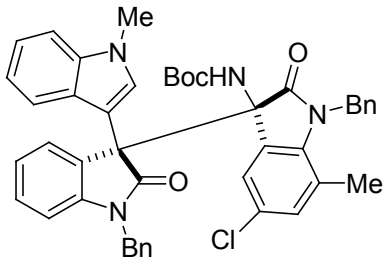


tert-butyl-1-benzyl-3-(1-benzyl-3-(1-methyl-1H-indol-3-yl)-2-oxoindolin-3-yl)-2-oxo-7-(trifluoromethyl)indolin-3-ylcarbamate 4r (major isomer).

A colorless solid, 94% yield (71 mg), >20:1 dr. M.p.: 133-136 °C. ^{1}H NMR ($CDCl_3$, 400 MHz, TMS) δ 1.25-1.41 (m, 9H, CH_3), 3.83 (s, 3H, CH_3), 4.64 (d, J = 17.2 Hz, 1H, CH_2), 4.76 (d, J = 17.2 Hz, 1H, CH_2), 4.88 (d, J = 16.0 Hz, 1H, CH_2), 5.01 (d, J = 16.0 Hz, 1H, CH_2), 5.86 (d, J = 3.6 Hz, 1H, ArH), 6.69-6.78 (m, 5H, ArH), 6.86 (dd, J = 7.6 Hz, 7.6 Hz, 1H, ArH), 6.94 (dd, J = 7.6 Hz, 7.6 Hz, 1H, ArH), 7.04-7.19 (m, 8H, ArH), 7.23-7.32 (m, 4H, ArH), 7.57 (d, J = 7.6 Hz, 1H, ArH), 7.66 (s, 1H, ArH), 8.33 (s, 1H, NH). ^{13}C NMR ($CDCl_3$, 100 MHz, TMS) 28.2, 33.1, 33.2, 44.4, 47.0, 65.5, 80.6, 106.9, 108.6, 109.4, 110.3, 119.6, 120.7, 121.4, 121.7, 122.1, 122.8, 125.1, 125.4, 125.8, 126.0 (q, J = 268.5 Hz), 126.1, 126.5, 126.7, 127.0, 127.7, 127.9, 128.1, 128.60 (q, J = 33.1 Hz), 128.62, 129.0, 129.2, 129.8, 130.4, 131.5, 134.9, 136.1, 137.2, 143.0, 143.7, 154.9, 175.8, 176.9. ^{19}F NMR ($CDCl_3$, 376 MHz, $CFCl_3$) δ -54.8. IR (CH_2Cl_2) ν 3310, 3040, 2978, 2928, 1716, 1699, 1609, 1596, 1491, 1470, 1452, 1438, 1368, 1332, 1282, 1252, 1160, 1122, 1097, 1020,967, 904, 888, 834, 790, 735, 697 cm^{-1}. MS (ESI) *m/z* (%): 774.3 (100) [(M^++NH_4]; HRMS (ESI) Calcd. for $C_{45}H_{43}F_3N_5O_4^+$ (M^++NH_4) requires 774.3262, found: 774.3254.



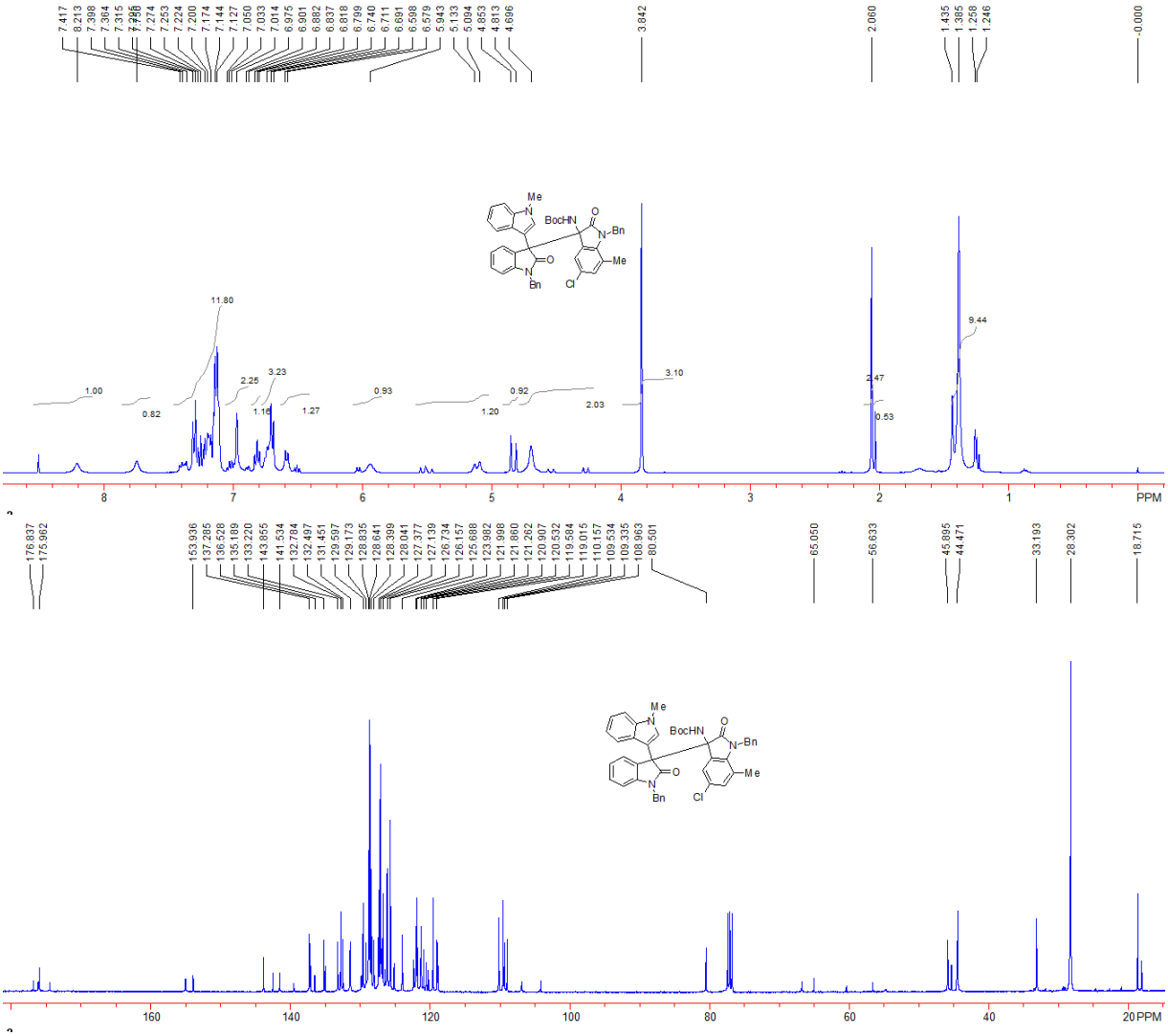




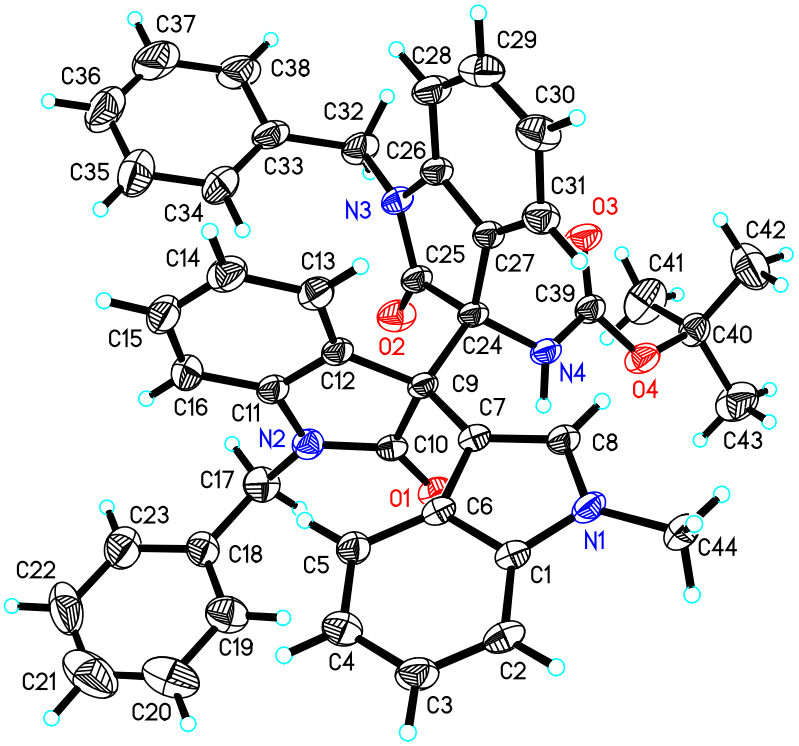
tert-butyl-1-benzyl-3-(1-benzyl-3-(1-methyl-1H-indol-3-yl)-2-oxoindolin-3-yl)-5-chloro-7-methyl-2-oxoindolin-3-ylcarbamate 4s (major isomer).

A colorless solid, 92% yield (68 mg), 5:1 dr. M.p.: 130-133 ^{o}C. ^{1}H NMR ($CDCl_3$, 400 MHz, TMS) δ 1.24-1.44 (m, 9H, CH_3), 2.06 (s, 3H, CH_3), 3.84 (s, 3H, CH_3), 4.70 (br, 2H, CH_2), 4.83 (d, J = 16.0 Hz, 1H, CH_2), 5.11 (d, J = 16.0 Hz, 1H, CH_2), 5.94 (s, 1H, ArH), 6.59 (d, J = 7.6 Hz, 1H, ArH), 6.69-6.74 (m, 3H, ArH), 6.82 (dd, J = 7.6 Hz, 7.6 Hz, 1H, ArH), 6.88-7.05 (m, 2H, ArH), 7.12-7.42 (m, 12H, ArH), 7.75 (s, 1H, ArH), 8.21 (s, 1H, NH). ^{13}C NMR

($CDCl_3$, 100 MHz, TMS) δ 18.7, 28.3, 33.2, 44.5, 45.9, 56.6, 65.1, 80.5, 109.0, 109.3, 109.5, 110.2, 119.0, 119.6, 120.5, 120.9, 121.3, 121.9, 122.0, 124.0, 125.7, 126.2, 126.7, 127.1, 127.4, 128.0, 128.4, 128.6, 128.8, 129.2, 129.6, 131.5, 132.5, 132.8, 133.2, 135.2, 136.5, 137.3, 141.5, 143.9, 153.9, 176.0, 176.8. IR (CH_2Cl_2) ν 3325, 3062, 2977, 2928, 1716, 1608, 1486, 1466, 1366, 1276, 1160, 1077, 1029, 913, 870, 839, 738, 697 cm^{-1}. MS (ESI) *m/z* (%): 737.3 (100) [M^++H]; HRMS (ESI) Calcd. for $C_{45}H_{42}ClN_4O_4^+$ (M^++H) requires 737.2895, found: 737.2892.



6. X-ray data of products **4a**



The crystal data of **4a** have been deposited in CCDC with number 942511. Empirical Formula: $C_{46}H_{46}N_4O_5$; Formula Weight: 734.87; Crystal Color, Habit: colorless; Crystal Dimensions: 0.212 x 0.156 x 0.129 mm; Crystal System: Triclinic; Lattice Type: Primitive; Lattice Parameters: a = 8.9744(11)Å, b = 18.096(2)Å, c = 24.959(3)Å, α = 97.516(3)°, β = 99.857(3)°, γ = 93.864(2)°, V = 3942.5(8)Å^3; Space group: P-1; Z = 4; D_{calc}= 1.238 g/cm^3; F_{000} = 1560; Final R indices [I>2sigma(I)] R1 = 0.0670, wR2 = 0.1805.

7. References

[1] Z.-Y. Cao, F. Zhou, Y.-H. Yu, J. Zhou, *Org. Lett.* **2012**, *15*, 42-45.

[2] M. Chen, Z.-T. Huang, Q.-Y. Zheng, *Chem. Commun.*, **2012**, *48*, 11686-11688.

[3] a) Y.-L. Liu, J. Zhou, *Chem. Commun.*, **2013**, *49*, 4421-4423; b) F.-L Hu, Y. Wei, M. Shi, S. Pindi, G. Li, *Org. Biomol. Chem.* **2013**, *11*, 1921-1924.