Electronic Supplementary Material (ESI) for Organic & Biomolecular Chemistry.

Construction of indeno[1,2-*a*]fluorene via domino reaction of 1,3-indanedione and 3-arylideneindolin-2-ones or chalcones

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Supporting Information

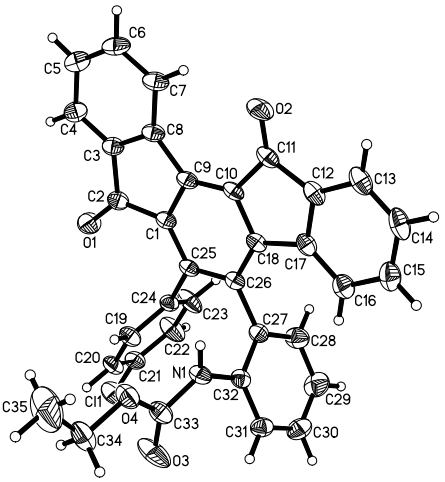


Fig. s1 ORTEP drawing (30%) of the crystal structure of **1d** (CCDC 1912388)

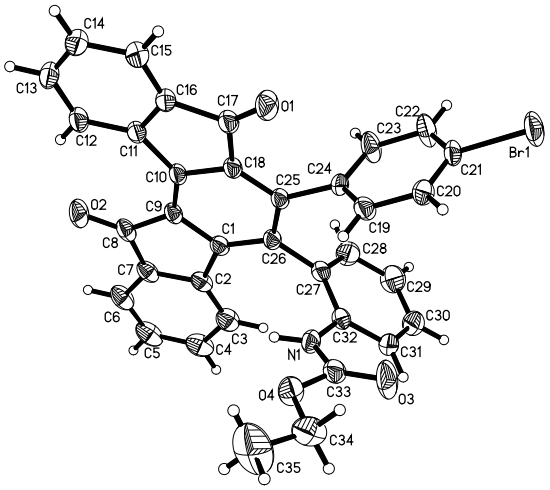


Fig. s2 ORTEP drawing (30%) of the crystal structure of **1e** (CCDC 1912389)

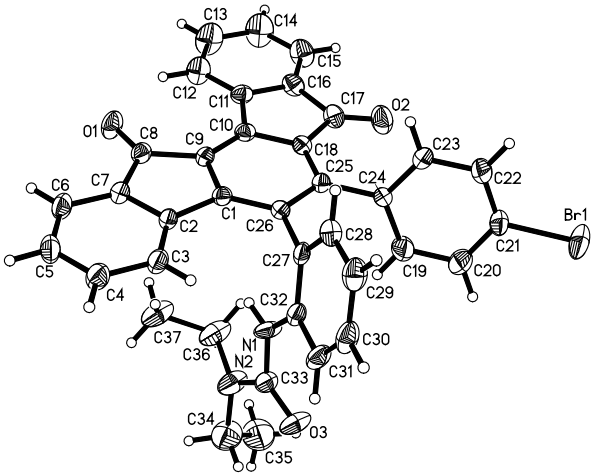


Fig. s3 ORTEP drawing (30%) of the crystal structure of **3b** (CCDC 1912393)

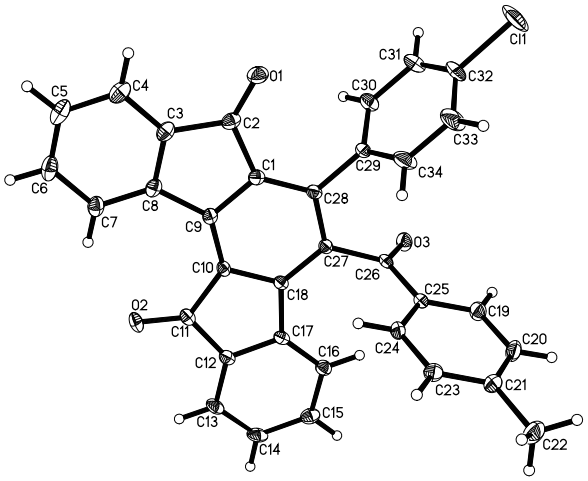


Fig. s4 ORTEP drawing (30%) of the crystal structure of **4c** (CCDC 1912395)

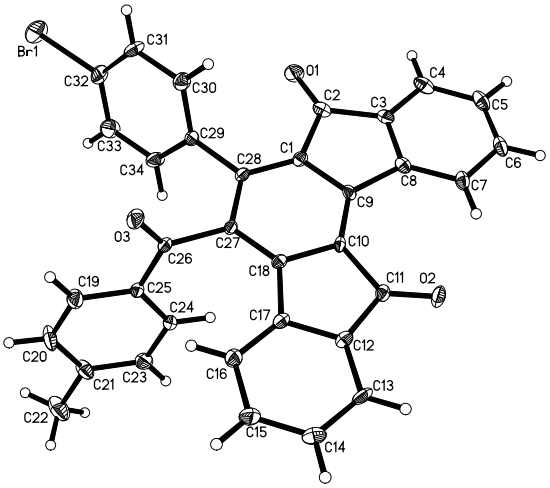


Fig. s5 ORTEP drawing (30%) of the crystal structure of **4d** (CCDC 1912396)

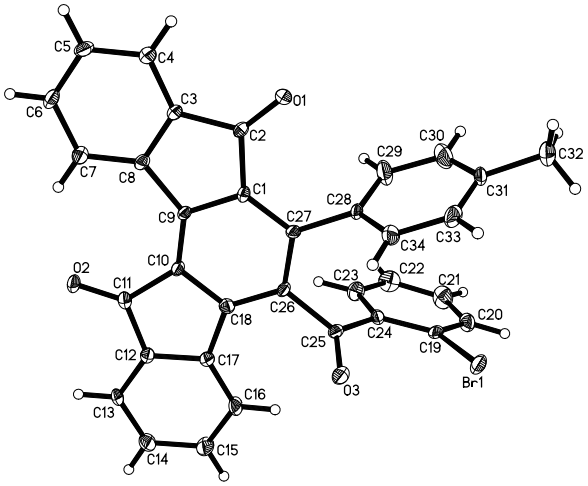


Fig. s6 ORTEP drawing (30%) of the crystal structure of **4l** (CCDC 1912398)

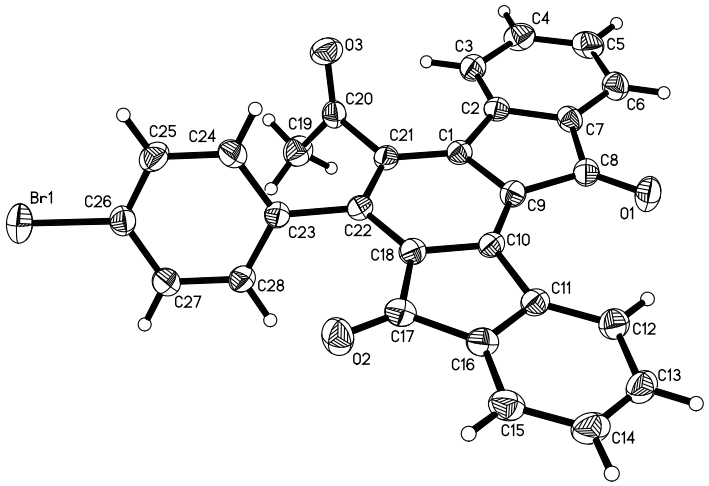
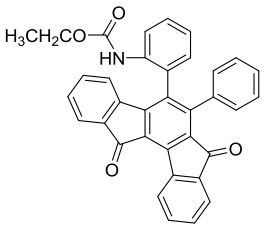


Fig. s7 ORTEP drawing (30%) of the crystal structure of **4p** (CCDC 1912399)

Experimental section

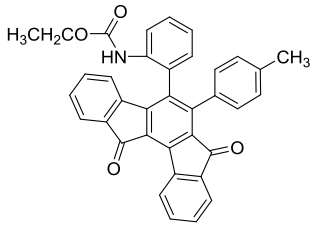
1. 1. General procedure for the preparation of indeno[1,2-*a*]fluorene-7,12-diones 1a-1q: A mixture of 1,3-indanedione (2.2 mmol) and 2-arylideneoxindolin-2-one (1.0 mmol) in ethanol (methyl, n-propanol) in the presence of triethylamine was refluxed for 24 hours. The solvent was removed by rotatory evaporation at reduced pressure, the residue was subjected to silicon column chromatography with a mixture of light petroleum, methylene dichloride and ethyl acetate (V/V/V = 6:3:1) to give pure product for analysis.

Ethyl (2-(7,12-dioxo-6-phenyl-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)carbamate (1a):



yellow solid, 70%, m.p. 289-291 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 9.09 (d, *J* = 7.6 Hz, 1H, ArH), 7.98-7.96 (m, 1H, ArH), 7.71 (d, *J* = 7.2 Hz, 1H, ArH), 7.66-7.58 (m, 2H, ArH), 7.42 (t, *J* = 7.2 Hz, 1H, ArH), 7.34 (t, *J* = 7.2 Hz, 1H, ArH), 7.28-7.00 (m, 9H, ArH), 6.41 (s, 1H, NH), 6.20 (d, *J* = 7.6 Hz, 1H, ArH), 4.17-4.02 (m, 2H, CH_2), 1.18 (t, *J* = 7.2 Hz, 3H, CH_3); ^{13}C{^{1}H} NMR (150 MHz, $CDCl_3$) δ: 192.31, 191.29, 153.1, 147.6, 146.5, 143.7, 142.5, 141.1, 135.7, 135.3, 135.2, 135.1, 133.4, 132.7, 132.6, 131.1, 130.8, 130.7, 130.6, 130.4, 130.2, 129.8, 129.6, 128.7, 127.6, 124.2, 123.7, 123.6, 122.4, 120.8, 61.4, 14.4; IR (KBr) υ: 3230, 2975, 1705, 1608, 1575, 1512, 1454., 1377, 1327, 1235, 1187, 1084, 1055, 1000, 832, 756 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{35}H_{23}NNaO_4$ ([M+Na]$^{+}$): 544.1519, found: 544.1512.

Ethyl (2-(7,12-dioxo-6-(*p*-tolyl)-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)carbamate (1b):



yellow solid, 82%, m.p. 258-260 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 9.09 (d, *J* = 7.6 Hz, 1H, ArH), 7.99-7.98 (m, 1H, ArH), 7.71 (d, *J* = 7.2 Hz, 1H, ArH), 7.65-7.58 (m, 2H, ArH), 7.44-7.34 (m, 2H, ArH), 7.28-7.24 (m, 1H, ArH), 7.19-7.15 (m, 1H, ArH), 7.12-7.00 (m, 5H, ArH), 6.89 (d, *J* = 7.6 Hz, 1H, ArH), 6.40 (s, 1H, NH), 6.16 (d, *J* = 7.6 Hz, 1H, ArH), 4.16-4.01 (m, 2H, CH_2), 2.30 (s, 3H, CH_3), 1.18 (t, *J* = 7.2 Hz, 3H, CH_3); ^{13}C{^{1}H} NMR (150 MHz, $CDCl_3$) δ: 192.4, 191.4, 153.2, 148.2, 147.4, 143.8, 142.8, 141.2, 137.8, 135.7, 135.3, 135.2, 135.1, 135.0, 133.1, 132.6, 131.4, 130.9, 130.6, 130.0, 129.5, 128.9, 128.4, 128.3, 128.2, 127.8, 127.5, 124.1, 123.7, 123.6, 61.2, 21.4, 14.4; IR (KBr) υ: 3232, 2974, 1703, 1601, 1573, 1510, 1459., 1375, 1325, 1239, 1187, 1089, 1057, 1000, 835, 754 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{36}H_{25}NNaO_4$ ([M+Na]$^{+}$): 558.1676, found:

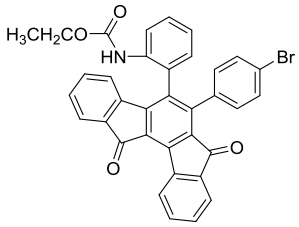
558.1681.

Ethyl (2-(6-(4-methoxyphenyl)-7,12-dioxo-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)carbamate (1c): yellow solid, 68%, m.p. 297-299 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 9.14 (d, *J* = 7.6 Hz, 1H, ArH), 8.00-7.99 (m, 1H, ArH), 7.77 (d, *J* = 6.8 Hz, 1H, ArH), 7.69-7.63 (m, 2H, ArH), 7.47-7.44 (m, 1H, ArH), 7.39-7.30 (m, 2H, ArH), 7.21 (t, *J* = 7.6 Hz, 1H, ArH), 7.08- 7.02 (m, 3H, ArH), 6.93 (d, *J* = 8.4 Hz, 1H, ArH), 6.78-6.72 (m, *2*H, ArH), 6.27 (s, 1H, NH), 6.20 (d, *J* = 7.2 Hz, 1H, ArH), 4.15-4.00 (m, 2H, CH_2), 3.77 (s, 3H, CH_3), 1.17 (t, *J* = 6.8 Hz, 3H, CH_3); ^{13}C NMR (100 MHz, $CDCl_3$) δ: 192.4, 191.5, 159.2, 153.1, 147.8, 147.4, 143.9, 142.7, 141.2, 135.6, 135.3, 135.1, 135.0, 133.2, 132.5, 130.9, 130.5, 130.4, 130.0, 129.5, 128.3, 127.6, 126.3, 124.1, 123.7, 123.6, 113.0, 112.9, 77.1, 61.2, 55.0, 14.4; IR (KBr) υ: 3250, 3070, 2983, 1706, 1602, 1574, 1511, 1461, 1411, 1379, 1327, 1290, 1242, 1178, 1093, 1060, 999, 938, 836, 759 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{36}H_{25}NNaO_5$ ([M+Na]$^{+}$): 574.1625, found: 574.1627.

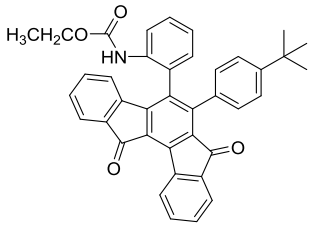
Ethyl (2-(6-(4-chlorophenyl)-7,12-dioxo-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)carbamate (1d): yellow solid, 82%, m.p. 292-294 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 9.10 (d, *J* = 7.2 Hz, 1H, ArH), 8.00-7.98 (m, 1H, ArH), 7.74 (d, *J* = 6.8 Hz, 1H, ArH), 7.67-7.59 (m, 2H, ArH), 7.46-7.36 (m, 2H, ArH), 7.32-7.28 (m, 1H, ArH), 7.22-7.17 (m, 3H, ArH), 7.06-7.02 (m, 3H, ArH), 6.95 (d, *J* = 7.6 Hz, 1H, ArH), 6.33 (s, 1H, NH), 6.20 (d, *J* = 7.6 Hz, 1H, ArH), 4.16-4.02 (m, 2H, CH_2), 1.18 (t, *J* = 6.8 Hz, 3H, CH_3); ^{13}C NMR (150 MHz, $CDCl_3$) δ: 192.3, 191.3, 153.1, 147.6, 146.5, 143.8, 142.6, 141.2, 135.7, 135.3, 135.2, 135.1, 134.1, 132.9, 132.8, 132.6, 131.1, 130.4, 130.2, 129.8, 129.4, 128.7, 127.8, 127.7, 127.6, 124.3, 123.8, 123.6, 61.4, 14.4; IR (KBr) υ:

3338, 2982, 1704, 1601, 1573, 1521, 1457, 1391, 1297, 1215, 1088, 1057, 1002, 833, 759 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{35}H_{22}ClNNaO_4$ ($[M+Na]^+$): 578.1130, found: 578.1134.

Ethyl (2-(6-(4-bromophenyl)-7,12-dioxo-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)carbamate (1e): yellow solid, 75%, m.p. 285-287 °C; ^1H NMR (400 MHz, $CDCl_3$) δ: 9.07 (d, *J* = 7.6 Hz, 1H, ArH), 8.00-7.99 (m, 1H, ArH), 7.71 (d, *J* = 7.2 Hz, 1H, ArH), 7.63 (t, *J* = 7.6 Hz, 1H, ArH), 7.58 (d, *J* = 7.2 Hz, 1H, ArH), 7.43-7.32 (m, 4H, ArH), 7.29-7.27 (m, 1H, ArH), 7.18 (t, *J* = 7.6 Hz, 1H, ArH), 7.08-7.07 (m, 2H, ArH), 6.98 (d, *J* = 8.0 Hz, 1H, ArH), 6.89 (d, *J* = 8.0 Hz, 1H, ArH), 6.39 (s, 1H, NH), 6.19 (d, *J* = 7.6 Hz, 1H, ArH), 4.16-4.02 (m, 2H, CH_2), 1.18 (t, *J* = 7.2 Hz, 3H, CH_3); ^{13}C NMR (150 MHz, $CDCl_3$) δ: 192.3, 191.3, 153.1, 147.6, 146.5, 143.7, 142.5, 141.2, 135.7, 135.3, 135.2, 135.1, 133.4, 132.7, 132.6, 131.1, 130.8, 130.7, 130.6, 130.4, 130.2, 129.8, 129.6, 128.7, 127.7, 124.3, 124.2, 123.8, 123.6, 122.4, 61.4, 14.4; IR (KBr) υ:3327, 3069, 2981, 1891, 1703, 1572, 1521, 1457, 1387, 1297, 1216, 1060, 1000, 831, 760 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{35}H_{22}BrNNaO_4$ ($[M+Na]^+$): 622.0624, found: 622.0631.



Ethyl (2-(6-(4-(tert-butyl)phenyl)-7,12-dioxo-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)carbamate (1f): yellow solid, 63%, m.p. 247-249 °C; ^1H NMR (400 MHz, $CDCl_3$) δ: 9.10 (d, *J* = 7.2 Hz, 1H, ArH), 7.98-7.96 (m, 1H, ArH), 7.72 (d, *J* = 6.8 Hz, 1H, ArH), 7.66-7.60 (m, 2H, ArH), 7.43 (t, *J* = 6.8Hz, 1H, ArH), 7.34 (t, *J* = 7.2 Hz, 1H, ArH), 7.29-7.26 (m, 1H, ArH), 7.24-7.15 (m, 3H, ArH), 7.05-7.02 (m, 3H, ArH), 6.93 (d, *J* = 8.0 Hz, 1H, ArH), 6.35 (s, 1H, NH), 6.19 (d, *J* = 7.2 Hz, 1H, ArH), 4.13-4.02 (m, 2H, CH_2), 1.27 (s, 9H, CH_3), 1.17 (t, *J* = 6.4 Hz, 3H, CH_3); ^{13}C NMR (150 MHz, $CDCl_3$) δ: 192.5, 191.5, 153.2, 150.9, 148.3, 147.4, 143.9, 142.8, 141.2, 135.8, 135.3,

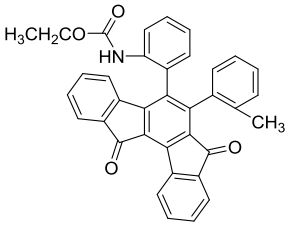


135.3, 135.1, 135.0, 133.3, 132.5, 131.3, 130.9, 130.6, 130.0, 129.4, 128.8, 128.3, 127.8, 127.6, 124.3, 124.1, 123.7, 123.5, 61.2, 34.5, 31.2, 14.4; IR (KBr) υ: 3353, 2977, 1709, 1602, 1577, 1525, 1456, 1392, 1346, 1298, 1215, 1091, 1054, 1002, 893, 829, 756 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{39}H_{31}NNaO_4$ ($[M+Na]^+$): 600.2145, found: 600.2155.

Ethyl (2-(6-(4-isopropylphenyl)-7,12-dioxo-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)carbamate (1g): yellow solid, 68%, m.p. 252-254 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 9.13 (d, *J* = 7.6 Hz, 1H, ArH), 7.98-7.96 (m, 1H, ArH), 7.76 (d, *J* = 7.2 Hz, 1H, ArH), 7.68-7.62 (m, 2H, ArH), 7.45 (t, *J* = 7.2 Hz, 1H, ArH), 7.36-7.28 (m, 2H, ArH), 7.20 (t, *J* = 7.2 Hz, 1H, ArH), 7.09-7.00 (m, 5H, ArH), 6.92 (d, *J* = 8.0 Hz, 1H, ArH), 6.30 (s, 1H, NH), 6.20 (d, *J* = 8.0 Hz, 1H, ArH), 4.15-4.00 (m, 2H, CH_2), 2.88-2.81 (m, 1H, CH), 1.22 (s, 3H, CH_3), 1.20 (s, 3H, CH_3), 1.18 (t, *J* = 7.2 Hz, 3H, CH_3); ^{13}C NMR (150 MHz, $CDCl_3$) δ: 192.4, 191.5, 153.2, 148.5, 148.3, 147.4, 143.8, 142.8, 141.2, 135.8, 135.3, 135.2, 135.1, 135.0, 133.2, 132.5, 131.6, 130.9, 130.6, 130.0, 129.4, 129.0, 128.3, 128.0, 127.5, 125.5, 125.3, 124.1, 123.7, 123.6, 123.5, 61.2, 33.7, 23.8, 23.7, 14.4; IR (KBr) υ: 3392, 2986, 1710, 1576, 1520, 1451, 1396, 1346, 1301, 1215, 1091, 1056, 1001, 833, 796, 756 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{38}H_{29}NNaO_4$ ($[M+Na]^+$): 586.1989, found: 586.1987.

Ethyl (2-(7,12-dioxo-6-(*m*-tolyl)-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)carbamate (1h): yellow solid, 58%, m.p. 267-269 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ: *A*-isomer: 9.06 (d, *J* = 7.2 Hz, 1H, ArH), 7.98-7.96 (m, 1H, ArH), 7.66 (d, *J* = 7.2 Hz, 1H, ArH), 7.61 (t, *J* = 7.2 Hz, 1H, ArH), 7.56 (d, *J* = 6.8 Hz, 1H, ArH), 7.40 (t, *J* = 7.2 Hz, 1H, ArH), 7.34 (t, *J* = 7.6 Hz, 1H, ArH), 7.22 (t, *J* = 7.2 Hz, 1H, ArH), 7.16-7.06 (m, 5H, ArH), 6.95 (s, 1H, ArH), 6.81-6.80 (m, 1H, ArH), 6.52 (s, 1H,

NH), 6.19 (d, *J* = 7.2 Hz, 1H, ArH), 4.15-4.03 (m, 2H, CH_2), 2.27 (s, 3H, CH_3), 1.20 (t, *J* = 6.8 Hz, 3H, CH_3); *B*-isomer: 6.46 (s, 1H, NH), 6.17 (d, *J* = 7.2 Hz, 1H, ArH), 2.20 (s, 3H, CH_3), 1.18 (t, *J* = 6.8 Hz, 3H, CH_3); ratio of *A/B* iosmer = 0.53:0.47; ^{13}C NMR (150 MHz, DMSO-d_6) δ: 192.4, 192.3, 190.6, 153.7, 153.6, 147.9, 147.7, 147.5, 147.2, 143.2, 143.0, 142.0, 141.9, 140.74, 140.72, 136.5, 136.4, 135.7, 135.5, 135.2, 135.1, 135.0, 134.9, 134.62, 134.59, 134.5, 134.3, 131.5, 131.3, 131.0, 130.7, 130.5, 130.0, 129.9, 129.6, 128.8, 128.7, 128.2, 128.0, 127.9, 127.8, 127.3, 127.2, 126.8, 126.7, 126.6, 125.9, 125.0, 123.6, 123.4, 123.3, 123.2, 123.0, 122.28, 122.26, 122.2, 60.1, 60.0, 20.9, 14.4, 14.3; IR (KBr) υ: 3415, 2981, 1709, 1577, 1519, 1456, 1384, 1301, 1200, 1090, 1051, 1000, 887, 751 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{36}H_{25}NNaO_4$ ([M+Na]$^+$): 558.1676, found: 558.1672.



Ethyl (2-(7,12-dioxo-6-(*o*-tolyl)-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)carbamate (1i): yellow solid, 68%, m.p. 282-284 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ: *A*-isomer: 9.13 (d, *J* = 6.0 Hz, 1H, ArH), 8.02-7.95 (m, 1H, ArH), 7.77 (d, *J* = 4.0 Hz, 1H, ArH), 7.69-7.61 (m, 2H, ArH), 7.45 (t, *J* = 7.2 Hz, 1H, ArH), 7.34-7.30 (m, 2H, ArH), 7.23-6.98 (m, 6H, ArH), 6.89 (d, *J* = 6.8 Hz, 1H, ArH), 6.44 (s, 1H, NH), 6.20 (d, *J* = 7.6 Hz, 1H, ArH), 4.18-4.00 (m, 2H, CH_2), 2.09 (s, 3H, CH_3), 1.20 (t, *J* = 6.8 Hz, 3H, CH_3); *B*-isomer: 6.23 (s, 1H, NH), 6.17 (d, *J* = 8.8 Hz, 1H, ArH), 2.11 (s, 3H, CH_3), 1.14 (t, *J* = 7.2 Hz, 3H, CH_3); ratio of *A/B* iosmer = 3:2; ^{13}C NMR (150 MHz, $CDCl_3$) δ: 192.5, 191.5, 191.4, 153.1, 148.3, 148.2, 147.5, 147.4, 143.9, 143.8, 142.9, 142.8, 141.4, 141.3, 137.0, 136.9, 135.8, 135.7, 135.4, 135.3, 135.2, 135.1, 134.5, 134.3, 133.2, 133.1, 132.7, 132.6, 131.0, 130.6, 130.5, 130.2, 130.1, 129.7, 129.5, 128.9, 128.8, 128.6, 128.5, 128.4, 127.6, 127.4, 127.3, 126.0, 125.0, 124.3, 124.2, 123.8, 123.7, 123.6, 123.4, 61.4, 61.3, 21.4, 21.3, 14.5; IR (KBr) υ: 3413, 3316,

3065, 1708, 1577, 1518, 1456, 1381, 1300, 1205, 1090, 1051, 1000, 848, 747 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{36}H_{25}NNaO_4$ ($[M+Na]^+$): 558.1676, found: 558.1673.

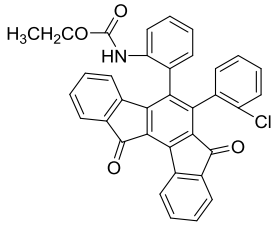
Ethyl (2-(6-(3-methoxyphenyl)-7,12-dioxo-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)carbamate (1j): yellow solid, 60%, m.p. 253-255 °C; ^1H NMR (400 MHz, $CDCl_3$) δ: *A*-isomer: 9.05 (d, *J* = 6.8 Hz, 1H, ArH), 8.02-7.96 (m, 1H, ArH), 7.67 (d, *J* = 6.4 Hz, 1H, ArH), 7.61 (t, *J* = 6.8 Hz, 1H, ArH), 7.55 (d, *J* = 6.4 Hz, 1H, ArH), 7.38-7.36 (m, 2H, ArH), 7.23-7.22 (m, 1H, ArH), 7.17-7.06 (m, 4H, ArH), 6.79 (d, *J* = 6.8 Hz, 1H, ArH), 6.74 (d, *J* = 6.8 Hz, 1H, ArH), 6.67 (s, 1H, ArH), 6.57 (s, 1H, NH), 6.17 (d, *J* = 6.8 Hz, 1H, ArH), 4.16-4.00 (m, 2H, CH_2), 3.67 (s, 3H, OCH_3), 1.17 (t, *J* = 7.2 Hz, 3H, CH_3); *B*-isomer: 6.62 (d, *J* = 6.8 Hz, 1H, ArH), 6.53 (s, 1H, ArH), 6.46 (s, 1H, NH),3.63 (s, 3H, OCH_3); ratio of *A/B* iosmer = 1:1; ^{13}C NMR (150 MHz, $CDCl_3$) δ: 192.4, 191.2, 191.1, 158.8, 158.6, 153.2, 153.1, 147.7, 147.5, 147.4, 147.3, 143.8, 142.8, 142.7, 141.2, 135.8, 135.7, 135.28, 135.26, 135.14, 135.10, 132.9, 132.8, 132.7, 132.6, 131.0, 130.5, 130.4, 130.14, 130.12, 129.6, 129.5, 128.6, 128.5, 128.4, 127.6, 124.2, 123.8, 123.7, 123.6, 123.5, 121.5, 120.4, 114.7, 114.0, 113.9, 113.2, 61.3, 61.2, 55.1, 55.0, 14.4, 14.3; IR (KBr) υ:3413, 2973, 1709, 1576, 1518, 1458, 1388, 1291, 1215, 1090, 1051, 1006, 864, 753 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{36}H_{25}NNaO_5$ ($[M+Na]^+$): 574.1625, found: 574.1624.

Ethyl (2-(6-(2-methoxyphenyl)-7,12-dioxo-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)carbamate (1k): yellow solid, 60%, m.p. 281-283 °C; ^1H NMR (400 MHz, $CDCl_3$) δ: *A*-isomer: 9.13 (d, *J* = 7.6 Hz, 1H, ArH), 7.97-7.95 (m, 1H, ArH), 7.76 (d, *J* = 6.4 Hz, 1H, ArH), 7.66 (t, *J* = 7.6 Hz, 1H, ArH), 7.62 (d, *J* = 7.2 Hz, 1H, ArH), 7.44 (t, *J* = 7.2 Hz, 1H, ArH), 7.33-7.28 (m, 2H, ArH),

7.25-7.22 (m, 1H, ArH), 7.19 (d, *J* = 7.6 Hz, 1H, ArH), 7.07-7.01 (m, 2H, ArH), 6.96-6.94 (m, 1H, ArH), 6.89 (s, 1H, NH), 6.86 (d, *J* = 7.6 Hz, 1H, ArH), 6.81 (d, *J* = 8.4 Hz, 1H, ArH), 6.14 (d, *J* = 7.6 Hz, 1H, ArH), 4.14-3.98 (m, 2H, CH_2), 3.65 (s, 3H, OCH_3), 1.14 (t, *J* = 6.8 Hz, 3H, CH_3); *B*-isomer: 7.14 (d, *J* = 8.0 Hz, 1H, ArH), 6.74 (d, *J* = 8.0 Hz, 1H, ArH), 6.34 (s, 1H, NH), 6.23 (d, *J* = 8.0 Hz, 1H, ArH), 3.62 (s, 3H, OCH_3), 1.19 (t, *J* = 6.8 Hz, 3H, CH_3); ratio of *A/B* iosmer = 4:1; ^{13}C NMR (150 MHz, $CDCl_3$) δ: 192.8, 192.6, 191.4, 191.3, 155.9, 155.8, 153.5, 153.2, 147.5, 147.3, 145.2, 144.4, 143.6, 143.4, 143.0, 142.9, 141.6, 141.5, 136.2, 135.6, 135.5, 135.4, 135.2, 135.2, 135.1, 135.0, 134.0, 133.5, 133.4, 133.2, 131.7, 130.8, 130.7, 130.5, 130.3, 129.9, 129.8, 129.8, 129.6, 129.5, 129.4, 129.1, 128.7, 128.7, 128.6, 128.3, 127.6, 124.1, 124.0, 123.9, 123.8, 123.7, 123.6, 123.5, 123.4, 120.2, 119.9, 110.1, 109.9, 61.2, 60.9, 55.1, 55.0, 14.4, 14.3; IR (KBr) υ: 3335, 2985, 1722, 1604, 1580, 1528, 1458, 1396, 1300, 1226, 1089, 1054, 1002, 840, 756 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{36}H_{25}NNaO_5$ ($[M+Na]^+$): 574.1625, found: 574.1626.

Ethyl (2-(6-(3-chlorophenyl)-7,12-dioxo-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)carbamate (1l): yellow solid, 70%, m.p. 280-282 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ: *A*-isomer: 9.09 (d, *J* = 6.8 Hz, 1H, ArH), 7.99-7.98 (m, 1H, ArH), 7.74-7.60 (m, 3H, ArH), 7.47-7.42 (m, 1H, ArH), 7.40-7.36 (m, 1H, ArH), 7.31-7.29 (m, 1H, ArH), 7.25-7.16 (m, 3H, ArH), 7.13-7.02 (m, 3H, ArH), 6.99 (d, *J* = 7.2 Hz, 1H, ArH), 6.42 (s, 1H, NH), 6.23 (d, *J* = 7.2 Hz, 1H, ArH), 4.22-4.04 (m, 2H, CH_2), 1.22 (t, *J* = 7.6 Hz, 3H, CH_3); *B*-isomer: 9.10 (d, *J* = 6.4 Hz, 1H, ArH), 6.85 (d, *J* = 7.2 Hz, 1H, ArH), 6.35 (s, 1H, NH), 6.21 (d, *J* = 7.2 Hz, 1H, ArH), 1.18 (t, *J* = 7.2 Hz, 3H, CH_3); ratio of *A/B* iosmer = 0.52:0.48; ^{13}C NMR (150 MHz, DMSO-d_6) δ: 192.3, 190.6, 153.7, 153.6, 147.5, 147.3, 145.9, 145.8, 143.0, 142.9, 141.9, 141.8, 140.7, 137.3, 137.2, 136.5, 136.4, 135.3, 135.2,

135.1, 134.53, 134.50, 134.47, 134.4, 134.1, 131.7, 131.7, 131.6, 131.5, 131.2, 130.7, 130.6, 130.1, 129.0, 128.93, 128.89, 128.8, 128.7, 128.3, 128.2, 127.8, 127.7, 127.2, 126.8, 126.7, 126.6, 123.8, 123.6, 123.5, 123.1, 123.0, 122.5, 60.1, 60.0, 14.3, 14.3; IR (KBr) υ: 3417, 3317, 2979, 1708, 1576, 1518, 1457, 1385, 1299, 1202, 1089, 1053, 1003, 864, 752 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{35}H_{22}ClNNaO_4$ ($[M+Na]^+$): 578.1130, found: 578.1147.



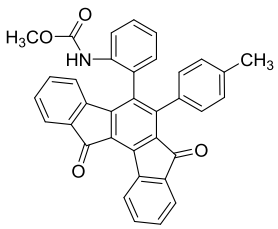
Ethyl (2-(6-(2-chlorophenyl)-7,12-dioxo-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)carbamate (1m): yellow solid, 85%, m.p. 291-293 °C; ^1H NMR (400 MHz, $CDCl_3$) δ: *A*-isomer: 9.08 (d, *J* = 6.8 Hz, 1H, ArH), 8.03-8.02 (m, 1H, ArH), 7.74 (t, *J* = 7.2 Hz, 1H, ArH), 7.67-7.60 (m, 2H, ArH), 7.44 (t, *J* = 7.2 Hz, 1H, ArH), 7.34-7.28 (m, 3H, ArH), 7.21-7.12 (m, 4H, ArH), 7.07-7.00 (m, 2H, ArH), 6.54 (s, 1H, NH), 6.24 (d, *J* = 7.6 Hz, 1H, ArH), 4.19-3.96 (m, 2H, CH_2), 1.20 (t, *J* = 7.2 Hz, 3H, CH_3); *B*-isomer: 9.10 (d, *J* = 7.2 Hz, 1H, ArH), 6.16 (d, *J* = 7.6 Hz, 1H, ArH), 1.12 (t, *J* = 6.8 Hz, 3H, CH_3); ratio of *A/B* iosmer = 11:9; ^{13}C NMR (150 MHz, DMSO-d_6) δ: 192.3, 192.2, 190.3, 190.1, 153.7, 153.4, 148.6, 147.6, 144.2, 143.3, 143.1, 142.7, 141.5, 141.3, 140.9, 136.5, 136.2, 135.5, 135.3, 135.2, 135.1, 134.9, 134.7, 134.6, 134.4, 134.33, 134.31, 133.9, 133.8, 133.4, 132.2, 132.1, 131.9, 131.8, 131.3, 131.1, 131.0, 130.8, 130.2, 130.0, 129.2, 129.1, 129.0, 128.9, 128.8, 128.7, 128.6, 128.5, 128.4, 128.1, 126.8, 126.7, 126.2, 125.6, 123.85, 123.76, 123.63, 123.57, 123.5, 123.1, 123.0, 122.8, 122.4, 121.8, 60.0, 59.9, 14.3, 14.2; IR (KBr) υ: 3408, 3313, 2971, 1709, 1578, 1519, 1457, 1390, 1300, 1214, 1091, 1053, 1000, 839, 749 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{35}H_{22}ClNNaO_4$ ($[M+Na]^+$): 578.1130, found: 578.1130.

Ethyl (2-(6-(3-nitrophenyl)-7,12-dioxo-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)carbamate (1n): yellow solid, 77%, m.p. 278-280 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ: *A*-isomer: 9.01 (d, *J* = 7.6 Hz, 1H, ArH), 8.24 (s, 1H, ArH), 8.13 (s, 1H, ArH), 7.93 (s, 1H, ArH), 7.66-7.09 (m, 11H, ArH), 6.99 (s, 1H, ArH), 6.23 (s, 1H, NH), 4.20-4.04 (m, 2H, CH_2), 1.23 (t, *J* = 7.6 Hz, 3H, CH_3); *B*-isomer: 9.06 (d, *J* = 7.6 Hz, 1H, ArH), 8.15 (s, 1H, ArH), 7.96 (s, 1H, ArH), 6.56 (s, 1H, ArH), 6.25 (s, 1H, NH), 1.20 (t, *J* = 7.6 Hz, 3H, CH_3); ratio of *A/B* iosmer = 0.57:0.43; ^{13}C NMR (150 MHz, DMSO-d_6) δ: 192.1, 190.6, 190.5, 153.6, 153.5, 147.8, 147.4, 146.6, 146.5, 144.6, 144.4, 142.9, 142.8, 141.8, 141.7, 140.7, 140.6, 136.8, 136.7, 136.4, 136.2, 135.6, 135.5, 135.4, 135.3, 135.2, 135.1, 134.3, 134.2, 134.0, 133.9, 131.6, 131.4, 131.24, 131.22, 130.87, 130.85, 130.2, 129.2, 129.1, 128.7, 128.6, 128.5, 128.4, 126.7, 124.1, 123.83, 123.78, 123.75, 123.64, 123.59, 123.5, 123.4, 123.2, 123.1, 122.8, 122.4, 122.3, 60.1, 60.0, 14.3, 14.1; IR (KBr) υ: 3254, 3062, 2960, 1710, 1601, 1573, 1510, 1460, 1410, 1372, 1324, 1192, 1056, 999, 937, 837, 757 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{35}H_{22}N_2NaO_6$ ($[M+Na]^+$): 589.1370, found: 589.1363.

Ethyl (2-(6-(2-nitrophenyl)-7,12-dioxo-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)carbamate (1o): yellow solid, 75%, m.p. 283-285 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ: *A*-isomer: 9.11 (d, *J* = 7.6 Hz, 1H, ArH), 8.14 (d, *J* = 8.0 Hz, 1H, ArH), 8.07 (t, *J* = 9.2 Hz, 1H, ArH), 7.79 (d, *J* = 7.2 Hz, 1H, ArH), 7.70-7.66 (m, 1H, ArH), 7.61-7.58 (m, 1H, ArH), 7.53-7.42 (m, 3H, ArH), 7.36-7.31 (m, 2H, ArH), 7.25-6.98 (m, 4H, ArH), 6.84 (s, 1H, NH), 6.17 (d, *J* = 7.2 Hz, 1H, ArH), 4.06-3.96 (m, 2H, CH_2), 1.13 (t, *J* = 7.2 Hz, 3H, CH_3); *B*-isomer: 7.95 (d, *J* = 8.0 Hz, 1H, ArH), 6.39 (s, 1H, NH), 6.24 (d, *J* = 7.2 Hz, 1H, ArH), 4.19-4.08 (m, 2H, CH_2), 1.22 (t, *J* = 7.2 Hz, 3H,

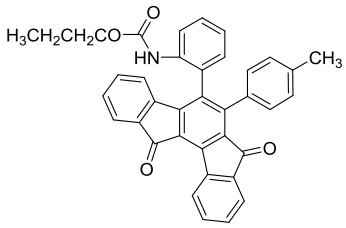
CH_3); ratio of *A/B* iosmer = 11:9; ^{13}C NMR (150 MHz, $CDCl_3$) δ: 192.3, 192.2, 191.6, 191.4, 153.4, 153.2, 148.6, 147.88, 147.85, 147.5, 144.5, 143.6, 143.5, 143.4, 142.7, 142.5, 141.6, 136.5, 135.4, 135.2, 135.19, 135.12, 135.0, 134.9, 133.0, 132.9, 132.2, 132.1, 131.8, 131.78, 131.74, 131.5, 131.1, 131.0, 130.7, 130.4, 130.2, 130.0, 129.9, 129.8, 129.4, 129.3, 129.2, 129.0, 128.9, 128.6, 127.8, 124.6, 124.5, 124.4, 124.3, 124.2, 123.92, 123.90, 123.8, 123.4, 123.1, 120.2, 61.5, 61.2, 14.5, 14.2; IR (KBr) υ: 3243, 3118, 2960, 1707, 1602, 1573, 1509, 1460, 1409, 1376, 1325, 1239, 1192, 1090, 1055, 1003, 838, 763 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{35}H_{22}N_2NaO_6$ ($[M+Na]^+$): 589.1370, found: 589.1369.

Methyl (2-(7,12-dioxo-6-(*p*-tolyl)-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)carbamate



(1p): yellow solid, 77%, m.p. 250-252 °C; ^1H NMR (400 MHz, $CDCl_3$) δ: 9.06 (d, *J* = 7.6 Hz, 1H, ArH), 8.00-7.96 (m, 1H, ArH), 7.68 (d, *J* = 6.8 Hz, 1H, ArH), 7.63-7.56 (m, 2H, ArH), 7.42-7.35 (m, 2H, ArH), 7.24-7.22 (m, 1H, ArH), 7.17-7.00 (m, 6H, ArH), 6.89 (d, *J* = 7.6 Hz, 1H, ArH), 6.47 (s, 1H, NH), 6.14 (d, *J* = 7.2 Hz, 1H, ArH), 3.63 (s, 3H, CH_3), 2.30 (s, 3H, CH_3); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ: 192.3, 191.3, 153.6, 148.1, 147.3, 143.8, 142.7, 141.1, 137.7, 135.5, 135.2, 135.2, 135.0, 135.0, 133.0, 132.6, 131.3, 130.9, 130.6, 130.0, 129.5, 128.8, 128.2, 128.1, 127.7, 127.5, 124.1, 123.7, 123.6, 52.2, 21.3; IR (KBr) υ: 3230, 2975, 1705, 1602, 1510, 1460, 1374, 1326, 1231, 1185, 1081, 1054, 1002, 834, 756 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{35}H_{23}NNaO_4$ ($[M+Na]^+$): 544.1519, found: 544.1510.

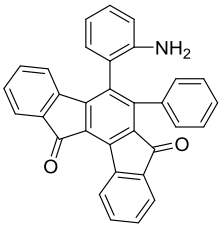
Butyl (2-(7,12-dioxo-6-(*p*-tolyl)-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)carbamate (1q):



yellow solid, 75%, m.p. 239-241 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 9.10 (d, *J* = 8.0 Hz, 1H, ArH), 7.97-7.95 (m, 1H, ArH), 7.72 (d, *J* = 7.2 Hz, 1H, ArH), 7.64 (t, *J* = 7.6 Hz, 1H, ArH), 7.60 (d, *J* = 7.6 Hz, 1H, ArH), 7.42 (t, *J* = 7.6 Hz, 1H, ArH), 7.34 (t, *J* = 7.6 Hz, 1H, ArH), 7.27 (t, *J* = 7.6 Hz, 1H, ArH), 7.17 (t, *J* = 7.6 Hz, 1H, ArH), 7.09-6.97 (m, 5H, ArH), 6.87 (d, *J* = 8.0 Hz, 1H, ArH), 6.31 (s, 1H, NH), 6.15 (d, *J* = 7.2 Hz, 1H, ArH), 4.03-3.89 (m, 2H, CH_2), 2.28 (s, 3H, CH_3), 1.59-1.48 (m, 2H, CH_2), 0.83 (t, *J* = 7.2 Hz, 3H, CH_3); ^{13}C{^{1}H} NMR (150 MHz, $CDCl_3$) δ: 192.4, 191.3, 153.4, 148.2, 147.4, 143.8, 142.8, 141.2, 137.7, 135.8, 135.3, 135.2, 135.1, 135.0, 133.2, 132.6, 131.4, 130.9, 130.7, 130.0, 129.5, 128.8, 128.4, 128.3, 128.2, 127.9, 127.5, 124.1, 123.7, 123.6, 123.5, 66.9, 22.1, 21.4, 10.2; IR (KBr) υ: 3232, 2974, 1707, 1604, 1572, 1514, 1452., 1378, 1325, 1240, 1185, 1083, 1057, 999, 835, 753 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{38}H_{29}NNaO_4$ ([M+Na]$^{+}$): 572.1832, found: 572.1818.

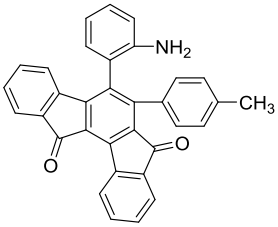
2. General procedure for the preparation of indeno[1,2-*a*]fluorene-7,12-diones 2a-2i: A mixture of 1,3-indanedione (2.2 mmol) and 2-arylideneoxindolin-2-one (1.0 mmol) in acetonitrile in the presence of DABCO (2.0 mmol) was refluxed for 24 hours. The solvent was removed by rotatory evaporation at reduced pressure, the residue was subjected to silicon column chromatography with a mixture of light petroleum, methylene dichloride and ethyl acetate (V/V/V = 6:3:1) to give pure product for analysis.

5-(2-Aminophenyl)-6-phenylindeno[1,2-*a*]fluorene-7,12-dione (2a): yellow solid, 68%, m.p.



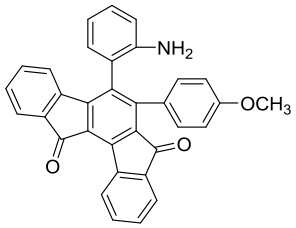
289-291° C; ^{1}H NMR (400 MHz, DMSO) δ: 9.02 (d, *J* = 7.6 Hz, 1H, ArH), 7.79-7.72 (m, 2H, ArH), 7.59-7.52 (m, 2H, ArH), 7.42-7.32 (m, 2H, ArH), 7.26-7.14 (m, 5H, ArH), 7.00 (t, *J* = 8.0 Hz, 1H, ArH), 6.71 (d, *J* = 8.0 Hz, 1H, ArH), 6.61 (d, *J* = 7.6 Hz, 1H, ArH), 6.46 (t, *J* = 7.2 Hz, 1H, ArH), 6.33 (d, *J* = 7.6 Hz, 1H, ArH), 4.88 (s, 2H, NH_2); ^{13}C{^{1}H} NMR (150 MHz, DMSO-d_6) δ: 192.5, 190.7, 148.6, 147.2, 146.1, 143.2, 141.8, 140.8, 135.7, 135.5, 135.2, 134.6, 131.9, 131.1, 130.1, 129.7, 129.3, 129.0, 128.0, 127.5, 127.2, 127.0, 126.7, 126.5, 123.7, 123.4, 123.3, 120.1, 115.9, 114.3; IR (KBr) υ: 3465, 3366, 3023, 1708, 1606, 1573, 1498, 1457, 1385, 1301, 1198, 1085, 1002, 840, 748 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{32}H_{19}NNaO_2$ ([M+Na]$^{+}$): 472.1308, found: 472.1301.

5-(2-Aminophenyl)-6-(*p*-tolyl)indeno[1,2-*a*]fluorene-7,12-dione (2b): yellow solid, 85%, m.p.



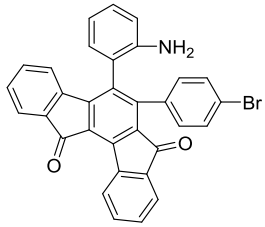
258-260 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 9.11 (d, *J* = 7.6 Hz, 1H, ArH), 7.75 (d, *J* = 7.2 Hz, 1H, ArH), 7.66-7.61 (m, 2H, ArH), 7.42 (t, *J* = 7.2 Hz, 1H, ArH), 7.31 (t, *J* = 7.2 Hz, 1H, ArH), 7. 24 (t, *J* = 7.2 Hz, 1H, ArH), 7.16-7.02 (m, 5H, ArH), 6.86 (d, *J* = 7.2 Hz, 1H, ArH), 6.73-6.67 (m, 2H, ArH), 6.37 (d, *J* = 7.6 Hz, 1H, ArH), 3.56 (s, 2H, NH_2), 2.31 (s, 3H, CH_3); ^{13}C{^{1}H} NMR (150 MHz, $CDCl_3$) δ: 192.8, 191.6, 148.9, 147.3, 143.9, 143.4, 143.3, 141.4, 137.5, 135.4, 135.3, 135.1, 135.0, 134.8, 132.7, 131.9, 130.7, 130.6, 129.8, 129.4, 129.3, 128.4, 128.2, 127.9, 127.7, 127.4, 124.0, 123.7, 123.6, 122.1, 118.8, 115.4, 21.4; IR (KBr) υ: 3469, 3364, 1708, 1605, 1573, 1502, 1456, 1381, 1302, 1194, 1083, 1000, 818, 748 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{33}H_{21}NNaO_2$ ([M+Na]$^{+}$): 486.1465, found: 486.1467.

5-(2-Aminophenyl)-6-(4-methoxyphenyl)indeno[1,2-*a*]fluorene-7,12-dione (2c): yellow solid,



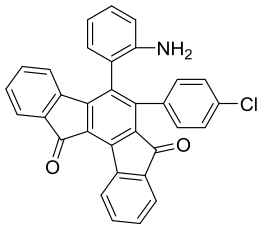
82%, m.p. 267-269 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 9.11 (d, *J* = 8.0 Hz, 1H, ArH), 7.75 (d, *J* = 8.0 Hz, 1H, ArH), 7.65-7.61 (m, 2H, ArH), 7.42 (t, *J* = 7.2 Hz, 1H, ArH), 7.31 (t, *J* = 7.2 Hz, 1H, ArH), 7.26-7.22 (m, 1H, ArH), 7.17-7.13 (m, 2H, ArH), 7.08 (d, *J* = 8.4 Hz, 1H, ArH), 6.86 (d, *J* = 7.2 Hz, 1H, ArH), 6.80-6.67 (m, 4H, ArH), 6.38 (d, *J* = 8.0 Hz, 1H, ArH), 3.78 (s, 3H, OCH_3), 3.56 (s, 2H, NH_2); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ: 192.9, 191.4, 156.3, 147.2, 145.5, 143.7, 143.4, 142.9, 141.6, 135.3, 135.2, 135.1, 135.0, 134.8, 133.4, 130.5, 129.7, 129.4, 129.3, 128.5, 128.1, 127.4, 124.8, 123.9, 123.5, 122.3, 119.8, 118.4, 115.0, 110.0, 55.2; IR (KBr) υ: 3465, 3369, 1707, 1606, 1576, 1511, 1458, 1390, 1293, 1244, 1180, 1086, 1002, 835, 753 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{33}H_{21}NNaO_3$ ([M+Na]$^{+}$): 502.1414, found: 502.1406

5-(2-Aminophenyl)-6-(4-bromophenyl)indeno[1,2-*a*]fluorene-7,12-dione (2d): yellow solid,



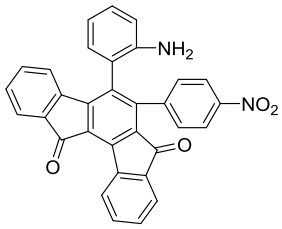
75%, m.p. 297-299 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 9.08 (d, *J* = 8.0 Hz, 1H, ArH), 7.74 (d, *J* = 6.8 Hz, 1H, ArH), 7.65-7.58 (m, 2H, ArH), 7.42-7.28 (m, 4H, ArH), 7.26-7.21 (m, 1H, ArH), 7.18-7.10 (m, 2H, ArH), 7.02 (d, *J* = 7.6 Hz, 1H, ArH), 6.82 (d, *J* = 7.2 Hz, 1H, ArH), 6.73-6.68 (m, 2H, ArH), 6.39 (d, *J* = 6.8 Hz, 1H, ArH), 3.60 (s, 2H, NH_2); ^{13}C{^{1}H} NMR (150 MHz, $CDCl_3$) δ: 192.6, 191.5, 147.5, 147.2, 143.9, 143.3, 143.1, 141.3, 135.2, 135.1, 134.6, 134.4, 133.9, 132.6, 131.1, 130.9, 130.8, 130.7, 130.4, 130.0, 129.7, 129.6, 128.7, 127.5, 124.2, 124.1, 123.7, 123.6, 122.2, 121.5, 120.8, 119.0, 115.5; IR (KBr) υ: 3469, 3372, 3063, 2961, 1709, 1607, 1574, 1503, 1459, 1394, 1306, 1270, 1195, 1095, 1003, 937, 839, 749 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{32}H_{18}BrNNaO_2$ ([M+Na]$^{+}$): 550.0413, found: 550.0428.

5-(2-Aminophenyl)-6-(4-chlorophenyl)indeno[1,2-*a*]fluorene-7,12-dione (2e): yellow solid,



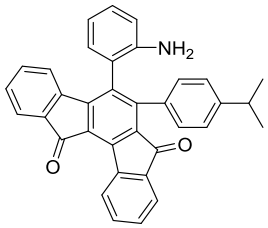
68%, m.p. 282-284 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 9.09 (d, *J* = 7.6 Hz, 1H, ArH), 7.74 (d, *J* = 7.6 Hz, 1H, ArH), 7.66-7.60 (m, 2H, ArH), 7.42 (t, *J* = 7.2 Hz, 1H, ArH), 7.31 (t, *J* = 7.2 Hz, 1H, ArH), 7.26-7.22 (m, 1H, ArH), 7.18-7.14 (m, 3H, ArH), 7.09 (d, *J* = 8.0 Hz, 1H, ArH), 6.82 (d, *J* = 7.2 Hz, 1H, ArH), 6.73-6.67 (m, 2H, ArH), 6.40 (d, *J* = 7.6 Hz, 1H, ArH), 3.60 (s, 2H, NH_2); ^{13}C{^{1}H} NMR (150 MHz, $CDCl_3$) δ: 192.6, 191.5, 147.5, 147.3, 144.0, 143.3, 143.1, 141.3, 135.2, 135.1, 134.6, 133.9, 133.5, 132.6, 130.9, 130.8, 130.4, 130.0, 129.7, 129.3, 128.6, 127.8, 127.6, 127.5, 124.1, 123.7, 121.6, 118.9, 115.5; IR (KBr) υ: 3465, 3362, 3068, 1708, 1604, 1573, 1493, 1456, 1383, 1301, 1195, 1077, 1002, 830, 750 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{32}H_{18}ClNNaO_2$ ([M+Na]$^+$): 506.0918, found: 506.0915.

5-(2-Aminophenyl)-6-(4-nitrophenyl)indeno[1,2-*a*]fluorene-7,12-dione (2f): yellow solid, 68%,



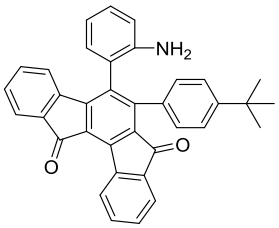
m.p. 253-255 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 9.08 (d, *J* = 7.2 Hz, 1H, ArH), 8.14-8.08 (m, 2H, ArH), 7.75 (d, *J* = 7.2 Hz, 1H, ArH), 7.66 (t, *J* = 7.2 Hz, 1H, ArH), 7.60 (d, *J* = 7.6 Hz, 1H, ArH), 7.46-7.42 (m, 2H, ArH), 7.35-7.31 (m, 2H, ArH), 7.27-7.24 (m, 1H, ArH), 7.14 (t, *J* = 7.6 Hz, 1H, ArH), 6.81 (d, *J* = 7.2 Hz, 1H, ArH), 6.69-6.67 (m, 2H, ArH), 6.45 (d, *J* = 7.2 Hz, 1H, ArH), 3.65 (s, 2H, NH_2); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ: 192.4, 191.3, 147.6, 147.3, 145.9, 143.8, 143.1, 142.8, 142.3, 141.3, 135.4, 135.3, 135.0, 134.9, 133.8, 132.6, 131.0, 130.4, 130.2, 130.1, 129.9, 128.9, 127.6, 124.2, 123.8, 123.6, 122.8, 122.3, 120.9, 119.0, 115.5; IR (KBr) υ: 3468, 3371, 2959, 2318, 1709, 1607, 1574, 1503, 1458, 1396, 1304, 1195, 1087, 1003, 835, 748 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{32}H_{18}N_2NaO_4$ ([M+Na]$^+$): 517.1159, found: 517.1148.

5-(2-Aminophenyl)-6-(4-isopropylphenyl)indeno[1,2-*a*]fluorene-7,12-dione (2g): yellow solid,



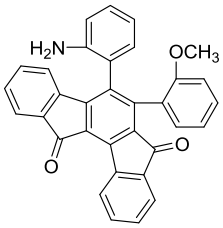
75%, m.p. 281-283 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 9.10 (d, *J* = 7.6 Hz, 1H, ArH), 7.75 (d, *J* = 7.2 Hz, 1H, ArH), 7.66-7.60 (m, 2H, ArH), 7.41 (t, *J* = 7.6 Hz, 1H, ArH), 7.30 (t, *J* = 7.2 Hz, 1H, ArH), 7.23 (t, *J* = 7.2 Hz, 1H, ArH), 7.14-7.06 (m, 5H, ArH), 6.83 (d, *J* = 7.6 Hz, 1H, ArH), 6.71-6.65 (m, 2H, ArH), 6.39 (d, *J* = 7.2 Hz, 1H, ArH), 3.55 (s, 2H, NH_2), 2.89-2.83 (m, 1H, ArH), 1.23 (s, 3H, CH_3), 1.21 (s, 3H, CH_3); ^{13}C{^{1}H} NMR (150 MHz, $CDCl_3$) δ: 192.8, 191.6, 148.9, 148.2, 147.3, 144.0, 143.3, 143.2, 141.3, 135.2, 135.1, 135.0, 134.9, 132.5, 132.2, 130.7, 130.6, 129.8, 129.3, 129.2, 128.2, 127.7, 127.4, 125.4, 125.1, 123.9, 123.6, 123.5, 122.1, 118.7, 115.4, 33.7, 23.9, 23.8; IR (KBr) υ: 3360, 3067, 1708, 1602, 1574, 1517, 1457, 1403, 1344, 1305, 1195, 1090, 1002, 857, 748 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{35}H_{25}NNaO_2$ ($[M+Na]^+$): 514.1778, found: 514.1774.

5-(2-Aminophenyl)-6-(4-(tert-butyl)phenyl)indeno[1,2-*a*]fluorene-7,12-dione (2h): yellow



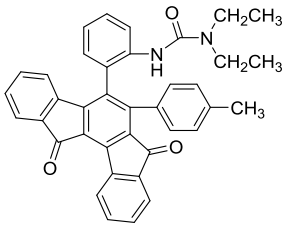
solid, 77%, m.p. 292-294 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 9.12 (d, *J* = 8.0 Hz, 1H, ArH), 7.76 (d, *J* = 7.6 Hz, 1H, ArH), 7.67-7.62 (m, 2H, ArH), 7.42 (t, *J* = 7.2 Hz, 1H, ArH), 7.31 (t, *J* = 7.2 Hz, 1H, ArH), 7.24-7.20 (m, 2H, ArH), 7.12-7.06 (m, 3H, ArH), 6.82 (d, *J* = 7.2 Hz, 1H, ArH), 6.69-6.65 (m, 2H, ArH), 6.41 (d, *J* = 7.6 Hz, 1H, ArH), 3.55 (s, 2H, NH_2), 1.28 (s, 9H, CH_3); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ: 192.8, 191.7, 150.5, 148.9, 147.2, 143.9, 143.4, 143.3, 141.4, 135.3, 135.0, 135.0, 134.9, 132.5, 131.8, 130.7, 130.5, 129.8, 129.3, 129.1, 128.3, 127.4, 124.2, 123.9, 123.6, 123.6, 122.1, 118.7, 115.3, 109.9, 34.5, 31.2; IR (KBr) υ: 3467, 3371, 1706, 1607, 1573, 1526, 1454, 1360, 1304, 1228, 1191, 1084, 1001, 810, 748 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{36}H_{27}NNaO_2$ ($[M+Na]^+$): 528.1934, found: 528.1921.

5-(2-Aminophenyl)-6-(2-methoxyphenyl)indeno[1,2-*a*]fluorene-7,12-dione (2i): yellow solid,



65%, m.p. 283-285 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ: *A*-isomer: 9.09 (d, *J* = 8.0 Hz, 1H, ArH), 7.73 (d, *J* = 7.6 Hz, 1H, ArH), 7.64-7.58 (m, 2H, ArH), 7.40 (t, *J* = 7.2 Hz, 1H, ArH), 7.29-7.19 (m, 3H, ArH), 7.12-7.07 (m, 1H, ArH), 6.97-6.92 (m, 2H, ArH), 6.88-6.79 (m, 2H, ArH), 6.72 (t, *J* = 7.2 Hz, 1H, ArH), 6.65 (d, *J* = 8.0 Hz, 1H, ArH), 6.33 (d, *J* = 7.6 Hz, 1H, ArH), 3.65 (s, 3H, OCH_3); *B*-isomer: 9.07 (d, *J* = 8.0 Hz, 1H, ArH), 6.45 (d, *J* = 7.6 Hz, 1H, ArH), 3.69 (s, 3H, OCH_3); ratio of *A/B* iosmer = 5:1; $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ: 192.9, 192.8, 191.5, 191.3, 156.4, 156.3, 147.6, 147.1, 145.6, 144.7, 144.4, 143.8, 143.5, 143.3, 142.9, 142.8, 141.7, 141.6, 135.4, 135.34, 135.31, 135.1, 135.0, 134.9, 134.8, 134.7, 133.4, 133.1, 130.9, 130.6, 130.5, 130.4, 129.6, 129.5, 129.4, 129.2, 128.6, 128.4, 128.1, 127.4, 127.3, 127.2, 124.8, 124.3, 123.9, 123.7, 123.5, 123.3, 122.3, 122.1, 120.0, 119.8, 118.3, 118.2, 115.6, 115.5, 115.0, 114.9, 110.1, 110.0, 109.9, 55.4, 55.3; IR (KBr) υ: 3466, 3365, 1706, 1605, 1575, 1512, 1455, 1390, 1294, 1246, 1180, 1085, 1000, 833, 754 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{33}H_{21}NNaO_3$ ($[M+Na]^+$): 502.1414, found: 502.1419.

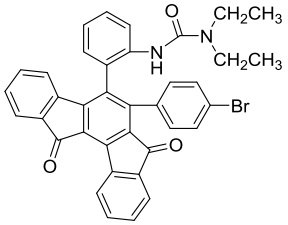
3. 2. General procedure for the preparation of indeno[1,2-*a*]fluorene-7,12-diones 3a, 3b: A mixture of 1,3-indanedione (2.2 mmol) and 2-arylideneoxindolin-2-one (1.0 mmol) in acetonitrile in the presence of triethylamine was refluxed for 24 hours. The solvent was subjected to silicon column chromatography with a mixture of light petroleum and ethyl acetate (V/V = 6:1) to give pure product **2** and **3** for analysis.



3-(2-(7,12-Dioxo-6-(*p*-tolyl)-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)-1,1-diethylurea (3a): yellow solid, 55%, m.p. 278-280 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 9.14 (d, *J* = 8.0 Hz, 1H, ArH), 8.14 (d,

J = 8.4 Hz, 1H, ArH), 7.77 (d, *J* = 7.2 Hz, 1H, ArH), 7.70-7.64 (m, 2H, ArH), 7.46 (t, *J* = 7.6 Hz, 1H, ArH), 7.35-7.32 (m, 2H, ArH), 7.25-7.23 (m, 1H, ArH), 7.08-7.02 (m, 3H, ArH), 6.97-6.96 (m, 2H, ArH), 6.87 (d, *J* = 8.0 Hz, 1H, ArH), 6.31 (d, *J* = 7.6 Hz, 1H, ArH), 6.22 (s, 1H, NH), 3.12-2.98 (m, 4H, CH_2), 2.31 (s, 3H, CH_3), 0.87 (t, *J* = 7.2 Hz, 6H, CH_3); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ: 192.4, 191.3, 153.7, 148.6, 147.3, 143.7, 142.5, 141.0, 137.9, 137.3, 135.5, 135.2, 135.1, 135.0, 133.6, 132.6, 131.1, 131.0, 130.2, 129.9, 129.4, 129.3, 128.5, 128.2, 128.0, 127.6, 127.4, 125.2, 124.1, 123.9, 123.7, 122.6, 120.3, 41.6, 21.3, 13.5; IR (KBr) υ: 3699, 3451, 3300, 3060, 2961, 2922, 1945, 1715, 1703, 1673, 1602, 1578, 1522, 1452, 1383, 1299, 1247, 1220, 1187, 1158, 1083, 1046, 1002, 935, 891, 846, 817, 756, 712 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{38}H_{30}N_2NaO_3$ ($[M+Na]^+$): 585.2149, found: 585.2161.

3-(2-(6-(4-Bromophenyl)-7,12-dioxo-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)-1,1-

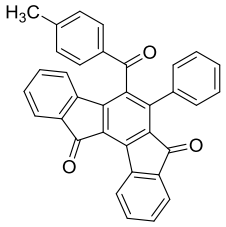


diethylurea (3b): yellow solid, 53%, m.p. 272-274 °C; ^1H NMR (400 MHz, $CDCl_3$) δ: 9.14 (d, *J* = 7.6 Hz, 1H, ArH), 8.16 (d, *J* = 8.4 Hz, 1H, ArH), 7.79 (d, *J* = 8.0 Hz, 1H, ArH), 7.71-7.65 (m, 2H, ArH), 7.48 (t, *J* = 7.2 Hz, 1H, ArH), 7.42-7.33 (m, 4H, ArH), 7.29-7.26 (m, 1H, ArH), 7.05 (d, *J* = 8.0 Hz, 1H, ArH), 6.97 (t, *J* = 6.8 Hz, 1H, ArH), 6.91 (d, *J* = 6.8 Hz, 1H, ArH), 6.82 (d, *J* = 8.0 Hz, 1H, ArH), 6.36 (d, *J* = 7.2 Hz, 1H, ArH), 6.21 (s, 1H, NH), 3.10-2.98 (m, 4H, CH_2), 0.86 (t, *J* = 7.2 Hz, 6H, CH_3); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ: 192.2, 191.1, 153.6, 147.4, 146.9, 143.6, 142.2, 141.0, 137.3, 135.6, 135.3, 135.1, 134.9, 133.2, 132.6, 131.2, 131.1, 131.0, 130.6, 130.4, 129.7, 129.6, 129.1, 128.3, 127.7, 124.6, 124.2, 123.8, 123.8, 122.8, 122.5, 120.3, 41.6, 13.5; IR (KBr) υ: 3726, 3451, 3068, 2963, 2927, 1944, 1713, 1675, 1602, 1579, 1522, 1486, 1451, 1396, 1299, 1255, 1191, 1159, 1077, 1048, 1001, 935, 843, 822, 755, 712 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for

$C_{37}H_{28}BrN_2O_3$ ([M+H]$^+$): 627.1278, found: 627.1273.

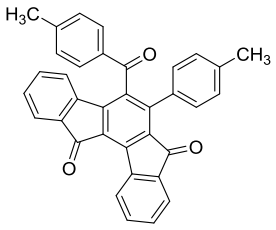
4. General procedure for the preparation of indeno[1,2-*a*]fluorene-7,12-diones 4a-4p: A mixture of 1,3-indanedione (2.2 mmol) and chalcone (1.0 mmol) in ethanol in the presence of triethylamine was refluxed for 24 hours. The solvent was removed by rotatory evaporation at reduced pressure, the residue was subjected to silicon column chromatography with a mixture of light petroleum, methylene dichloride and ethyl acetate (V/V/V = 6:3:1) to give pure product for analysis.

5-(4-Methylbenzoyl)-6-phenylindeno[1,2-*a*]fluorene-7,12-dione (4a): yellow solid, 52%, m.p.



317-319 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 9.14 (d, *J* = 7.2 Hz, 1H, ArH), 7.80 (d, *J* = 6.8 Hz, 1H, ArH), 7.70-7.63 (m, 4H, ArH), 7.46 (t, *J* = 7.2 Hz, 1H, ArH), 7.38-7.18 (m, 6H, ArH), 7.13-7.09 (m, 3H, ArH), 7.03 (d, *J* = 7.6 Hz, 1H, ArH), 2.34 (s, 3H, CH_3); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ: 196.7, 191.9, 191.1, 145.3, 145.2, 144.7, 144.0, 141.5, 141.2, 135.9, 135.3, 135.19, 135.16, 135.0, 134.2, 133.8, 131.8, 131.0, 130.3, 129.5, 129.4, 129.2, 129.0, 128.3, 128.0, 127.9, 127.7, 127.1, 124.4, 123.8, 123.7, 21.8; IR (KBr) υ: 3059, 1709, 1662, 1601, 1460, 1376, 1315, 1245, 1198, 1083, 1001, 911, 845, 792, 744 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{34}H_{21}O_3$ ([M+H]$^+$): 477.1485, found: 477.1502.

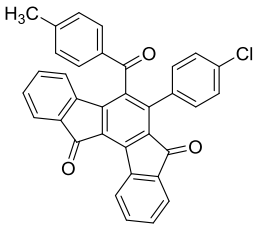
5-(4-Methylbenzoyl)-6-(*p*-tolyl)indeno[1,2-*a*]fluorene-7,12-dione (4b): yellow solid, 44%, m.p.



301-303 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 9.13 (d, *J* = 7.6 Hz, 1H, ArH), 7.79 (d, *J* = 6.8 Hz, 1H, ArH), 7.69-7.63 (m, 4H, ArH), 7.46 (t, *J* = 7.2 Hz, 1H, ArH), 7.37-7.29 (m, 2H, ArH), 7.18-7.13 (m, 5H, ArH), 6.92 (s, 2H, ArH), 2.35 (s, 3H, CH_3), 2.28 (s, 3H, CH_3); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ: 196.7, 192.0, 191.2, 145.3, 145.2, 145.0, 144.0, 141.5, 141.1, 138.1, 136.0, 135.3, 135.2, 135.1, 135.0, 134.2,

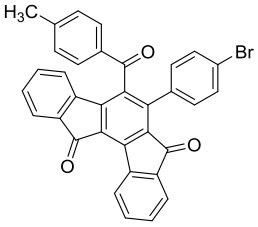
131.9, 131.0, 130.8, 130.2, 129.4, 129.1, 128.8, 128.7, 128.0, 127.8, 127.6, 124.3, 123.8, 123.7, 21.8, 21.3; IR (KBr) υ:3021, 1708, 1665, 1602, 1514, 1461, 1316, 1243, 1200, 1164, 1002, 827, 745 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{35}H_{22}NaO_3$ ($[M+Na]^+$): 513.1461, found: 513.1473.

6-(4-Chlorophenyl)-5-(4-methylbenzoyl)indeno[1,2-*a*]fluorene-7,12-dione (4c): yellow solid,



58%, m.p. 295-297 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 9.12 (d, *J* = 7.6 Hz, 1H, ArH), 7.78 (d, *J* = 6.8 Hz, 1H, ArH), 7.70-7.63 (m, 4H, ArH), 7.46 (t, *J* = 7.2 Hz, 1H, ArH), 7.38-7.30 (m, 3H, ArH), 7.24-7.22 (m, 1H, ArH), 7.16-7.14 (m, 3H, ArH), 7.09 (d, *J* = 8.4 Hz, 1H, ArH), 6.97 (d, *J* = 7.6 Hz, 1H, ArH), 2.37 (s, 3H, CH_3); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ: 196.4, 191.7, 191.1, 145.6, 145.4, 143.9, 143.2, 141.3, 141.0, 135.7, 135.3, 135.1, 135.0, 134.5, 134.0, 132.2, 131.8, 131.1, 130.7, 130.5, 130.4, 129.6, 129.4, 128.2, 128.1, 127.7, 127.5, 124.4, 123.8, 123.7, 21.8; IR (KBr) υ: 3068, 1709, 1665, 1602, 1491, 1462, 1402, 1315, 1243, 1199, 1166, 1087, 1002, 912, 830, 784, 750 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{34}H_{19}ClNaO_3$ ($[M+Na]^+$): 533.0915, found: 533.0926.

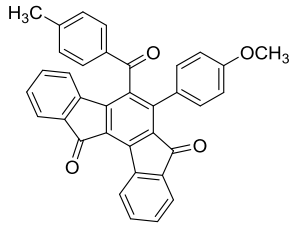
6-(4-Bromophenyl)-5-(4-methylbenzoyl)indeno[1,2-*a*]fluorene-7,12-dione (4d): yellow solid,



58%, m.p. 292-294 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 9.12 (d, *J* = 7.6 Hz, 1H, ArH), 7.79 (d, *J* = 6.8 Hz, 1H, ArH), 7.70-7.63 (m, 4H, ArH), 7.48-7.44 (m, 2H, ArH), 7.38-7.30 (m, 2H, ArH), 7.25-7.23 (m, 1H, ArH), 7.17-7.15 (m, 4H, ArH), 6.91 (d, *J* = 8.4 Hz, 1H, ArH), 2.37 (s, 3H, CH_3); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ: 196.4, 191.7, 191.0, 145.6, 145.4, 143.9, 143.2, 141.3, 141.1, 135.6, 135.3, 135.1, 135.0, 134.0, 132.7, 131.8, 131.2, 131.1, 131.0, 130.6, 130.5, 130.4, 129.6, 129.4, 128.2, 127.7, 124.4, 123.8, 123.7, 122.9, 21.8; IR (KBr) υ: 3060, 1710, 1665, 1602, 1573, 1462, 1315, 1242, 1196, 1079, 1002, 911, 828, 782, 750 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{34}H_{19}BrNaO_3$ ($[M+Na]^+$):

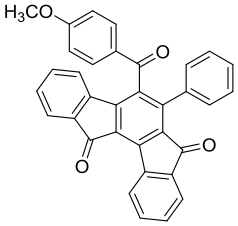
577.0410, found: 577.0416.

6-(4-Methoxyphenyl)-5-(4-methylbenzoyl)indeno[1,2-*a*]fluorene-7,12-dione (4e): yellow solid,



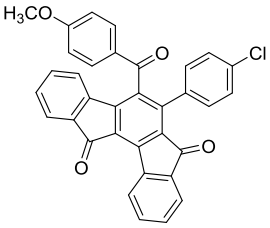
50%, m.p. 291-293 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 9.13 (d, *J* = 8.0 Hz, 1H, ArH), 7.79 (d, *J* = 6.8 Hz, 1H, ArH), 7.69-7.63 (m, 4H, ArH), 7.46 (t, *J* = 7.2 Hz, 1H, ArH), 7.37-7.30 (m, 2H, ArH), 7.23-7.19 (m, 2H, ArH), 7.12 (d, *J* = 7.6 Hz, 2H, ArH), 7.01 (d, *J* = 7.6 Hz, 1H, ArH), 6.85 (d, *J* = 6.8 Hz, 1H, ArH), 6.66 (d, *J* = 7.2 Hz, 1H, ArH), 3.76 (s, 3H, OCH_3), 2.34 (s, 3H, CH_3); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ: 197.0, 191.9, 191.3, 159.5, 145.3, 145.2, 144.7, 144.1, 141.5, 141.1, 136.1, 135.3, 135.2, 135.1, 135.0, 134.1, 131.7, 131.0, 130.7, 130.2, 129.5, 129.4, 127.8, 127.6, 125.9, 124.3, 123.8, 123.7, 113.2, 113.0, 112.9, 55.0, 21.8; IR (KBr) υ: 3063, 1711, 1665, 1603, 1575, 1512, 1461, 1285, 1245, 1176, 1095, 1002, 828, 782, 748 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{35}H_{22}NaO_4$ ([M+Na]$^{+}$): 529.1410, found: 529.1414.

5-(4-Methoxybenzoyl)-6-phenylindeno[1,2-*a*]fluorene-7,12-dione (4f): yellow solid, 51%, m.p.



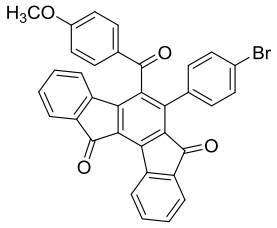
313-315 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 9.14 (d, *J* = 7.6 Hz, 1H, ArH), 7.80 (d, *J* = 6.4 Hz, 1H, ArH), 7.73 (d, *J* = 8.0 Hz, 2H, ArH), 7.70-7.64 (m, 2H, ArH), 7.46 (t, *J* = 7.6 Hz, 1H, ArH), 7.38-7.21 (m, 6H, ArH), 7.13 (t, *J* = 7.6 Hz, 1H, ArH), 7.05 (d, *J* = 7.2 Hz, 1H, ArH), 6.80 (t, *J* = 8.0 Hz, 2H, ArH), 3.82 (s, 3H, OCH_3); ^{13}C{^{1}H} NMR (150 MHz, $CDCl_3$) δ: 195.4, 192.0, 191.2, 164.3, 145.3, 144.8, 144.0, 141.6, 141.2, 136.0, 135.3, 135.2, 135.1, 133.9, 131.9, 131.8, 131.1, 130.3, 129.9, 129.2, 129.0, 128.4, 128.1, 128.0, 127.7, 127.2, 124.4, 123.9, 123.8, 114.0, 105.0, 55.5; IR (KBr) υ: 3070, 1709, 1657, 1594, 1506, 1460, 1319, 1250, 1190, 1159, 1004, 849, 803, 746 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{34}H_{20}NaO_4$ ([M+Na]$^{+}$): 515.1254, found: 515.1246.

6-(4-Chlorophenyl)-5-(4-methoxybenzoyl)indeno[1,2-*a*]fluorene-7,12-dione (4g): yellow solid,



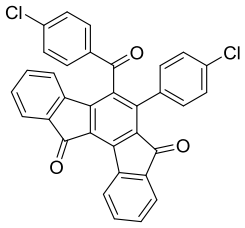
66%, m.p. 335-337 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 9.13 (d, *J* = 7.6 Hz, 1H, ArH), 7.80 (d, *J* = 7.2 Hz, 1H, ArH), 7.74-7.64 (m, 4H, ArH), 7.47 (t, *J* = 7.2 Hz, 1H, ArH), 7.39-7.31 (m, 3H, ArH), 7.25-7.19 (m, 2H, ArH), 7.11 (d, *J* = 8.4 Hz, 1H, ArH), 6.99 (d, *J* = 7.6 Hz, 1H, ArH), 6.83 (d, *J* = 8.4 Hz, 2H, ArH), 3.84 (s, 3H, OCH_3); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ: 195.1, 191.8, 191.1, 164.4, 145.4, 143.9, 143.2, 141.4, 141.1, 135.8, 135.3, 135.2, 135.15, 135.12, 134.5, 132.2, 131.8, 131.7, 131.1, 130.6, 130.4, 130.3, 129.6, 128.2, 127.7, 127.5, 124.4, 123.9, 123.8, 114.1, 55.5; IR (KBr) υ:3073, 1709, 1661, 1592, 1498, 1460, 1317, 1248, 1192, 1157, 1086, 1004, 913, 838, 747 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{34}H_{19}ClNaO_4$ ([M+Na]$^{+}$): 549.0864, found: 549.0868.

6-(4-Bromophenyl)-5-(4-methoxybenzoyl)indeno[1,2-*a*]fluorene-7,12-dione (4h): yellow solid,



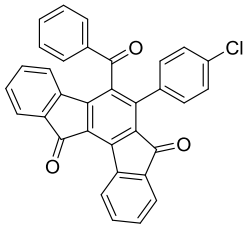
50%, m.p. 337-339 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 9.13 (d, *J* = 7.2 Hz, 1H, ArH), 7.81-7.64 (m, 6H, ArH), 7.49-7.47 (m, 2H, ArH), 7.39-7.32 (m, 2H, ArH), 7.20-7.17 (m, 2H, ArH), 6.93 (d, *J* = 7.6 Hz, 1H, ArH), 6.83 (d, *J* = 8.0 Hz, 2H, ArH), 3.84 (s, 3H, OCH_3); ^{13}C{^{1}H} NMR (150 MHz, $CDCl_3$) δ: 195.1, 191.9, 191.1, 164.5, 145.4, 143.9, 143.3, 141.5, 141.2, 135.8, 135.3, 135.3, 135.2, 132.8, 131.9, 131.8, 131.3, 131.2, 131.0, 130.6, 130.5, 130.4, 129.7, 128.3, 127.8, 124.5, 123.9, 123.8, 122.9, 114.2, 55.5; IR (KBr) υ: 3072, 1917, 1708, 1661, 1592, 1460, 1316, 1247, 1157, 1066, 1001, 913, 836, 746 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{34}H_{19}BrNaO_4$ ([M+Na]$^{+}$): 593.0359, found: 593.0338.

5-(4-Chlorobenzoyl)-6-(4-chlorophenyl)indeno[1,2-*a*]fluorene-7,12-dione (4i): yellow solid,



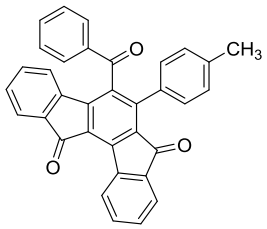
70%, m.p. 309-311 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 9.13 (d, *J* = 7.6 Hz, 1H, ArH), 7.81 (d, *J* = 7.2 Hz, 1H, ArH), 7.69-7.64 (m, 4H, ArH), 7.47 (t, *J* = 7.2 Hz, 1H, ArH), 7.41-7.32 (m, 5H, ArH), 7.20 (d, *J* = 7.6 Hz, 1H, ArH), 7.14-7.12 (m, 2H, ArH), 6.97 (d, *J* = 8.4 Hz, 1H, ArH); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ: 195.8, 191.6, 190.9, 145.5, 144.2, 143.0, 141.2, 141.1, 141.0, 135.4, 135.2, 135.2, 135.1, 134.9, 134.82, 134.81, 132.0, 131.9, 131.3, 130.6, 130.5, 130.4, 129.3, 128.4, 128.2, 127.8, 127.7, 124.6, 123.9, 123.6; IR (KBr) υ: 3088, 1710, 1668, 1577, 1488, 1397, 1316, 1242, 1202, 1088, 1001, 912, 834, 751, 717 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{33}H_{16}Cl_2NaO_3$ ([M+Na]$^{+}$): 553.0369, found: 553.0336.

5-Benzoyl-6-(4-chlorophenyl)indeno[1,2-*a*]fluorene-7,12-dione (4j): yellow solid, 58%, m.p.



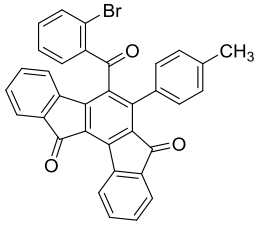
293-295 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 9.13 (d, *J* = 7.6 Hz, 1H, ArH), 7.81 (d, *J* = 7.2 Hz, 1H, ArH), 7.74-7.63 (m, 4H, ArH), 7.53 (t, *J* = 7.2 Hz, 1H, ArH), 7.47 (t, *J* = 7.2 Hz, 1H, ArH), 7.40-7.31 m, 5H, ArH), 7.23-7.18 (m, 2H, ArH), 7.06 (d, *J* = 8.0 Hz, 1H, ArH), 6.95 (d, *J* = 7.6 Hz, 1H, ArH); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ: 197.1, 191.7, 191.0, 145.5, 144.0, 143.2, 141.3, 141.1, 136.4, 135.5, 135.3, 135.1, 135.0, 134.5, 134.3, 132.1, 131.8, 131.2, 130.6, 130.5, 129.2, 128.8, 128.3, 128.2, 127.8, 127.5, 124.5, 123.84, 123.81; IR (KBr) υ: 3059, 1709, 1669, 1574, 1491, 1458, 1377, 1316, 1239, 1200, 1088, 1001, 847, 750 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{34}H_{17}ClNaO_3$ ([M+Na]$^{+}$): 519.0758, found: 519.0767.

5-Benzoyl-6-(*p*-tolyl)indeno[1,2-*a*]fluorene-7,12-dione (4k): yellow solid, 68%, m.p. 304-306 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 9.14 (d, *J* = 7.2 Hz, 1H, ArH), 7.80 (d, *J* = 6.8 Hz, 1H, ArH), 7.74



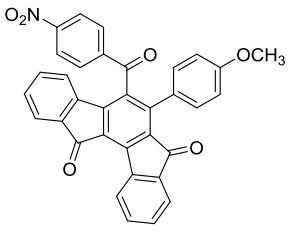
(d, *J* = 7.2 Hz, 1H, ArH), 7.70-7.63 (m, 2H, ArH), 7.52-7.44 (m, 2H, ArH), 7.38-7.32 (m, 4H, ArH), 7.20-7.15 (m, 3H, ArH), 6.90 (s, 2H, ArH), 2.27 (s, 3H, CH_3); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ: 197.4, 191.9, 191.2, 145.4, 145.0, 144.2, 141.5, 141.1, 138.2, 136.6, 135.8, 135.3, 135.2, 135.1, 135.0, 134.0, 131.9, 131.0, 130.7, 130.3, 129.2, 129.1, 129.0, 128.9, 128.8, 128.7, 128.6, 128.0, 127.9, 127.7, 124.4, 123.8, 123.7, 21.3; IR (KBr) υ: 3060, 1710, 1659, 1572, 1512, 1455, 1316, 1246, 1192, 1089, 1000, 848, 813, 750 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{34}H_{20}NaO_3$ ($[M+Na]^+$): 499.1305, found: 499.1305.

5-(2-Bromobenzoyl)-6-(*p*-tolyl)indeno[1,2-*a*]fluorene-7,12-dione (4l): yellow solid, 41%, m.p.



290-292°C; ^1H NMR (400 MHz, $CDCl_3$) δ: 9.13 (d, *J* = 7.6 Hz, 1H, ArH), 7.82 (d, *J* = 7.2 Hz, 1H, ArH), 7.66 (t, *J* = 7.2 Hz, 1H, ArH), 7.61 (d, *J* = 7.2 Hz, 1H, ArH), 7.46-7.42 (m, 5H, ArH), 7.31 (d, *J* = 7.6 Hz, 1H, ArH), 7.18-7.09 (m, 2H, ArH), 6.95-6.91 (m, 4H, ArH), 2.26 (s, 3H, CH_3); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ: 196.8, 192.0, 191.1, 147.0, 144.6, 144.4, 141.7, 141.1, 138.1, 137.7, 136.4, 135.4, 135.2, 135.1, 135.0, 134.3, 133.0, 132.2, 131.7, 131.1, 130.9, 130.5, 128.7, 128.6, 128.5, 128.3, 127.8, 126.9, 124.3, 124.1, 123.7, 121.3, 21.2; IR (KBr) υ: 3068, 1711, 1676, 1603, 1574, 1520, 1461, 1345, 1314, 1242, 1177, 1098, 1002, 837, 749 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{34}H_{19}BrNaO_3$ ($[M+Na]^+$): 577.0410, found: 577.0402.

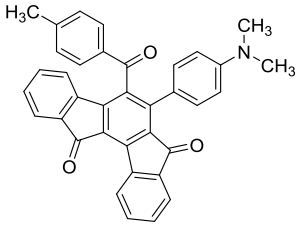
6-(4-Methoxyphenyl)-5-(4-nitrobenzoyl)indeno[1,2-*a*]fluorene-7,12-dione (4m): yellow solid,



56%, m.p. 316-318 °C; ^1H NMR (400 MHz, $CDCl_3$) δ: 9.13 (d, *J* = 7.6 Hz, 1H, ArH), 8.13 (d, *J* = 8.0 Hz, 1H, ArH), 7.81 (d, *J* = 7.2 Hz, 1H, ArH), 7.69-7.64 (m, 2H, ArH), 7.47 (t, *J* = 7.2 Hz, 1H, ArH), 7.41-7.33

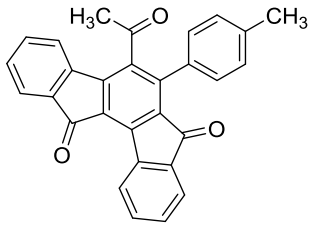
(m, 2H, ArH), 7.15 (d, *J* = 7.2 Hz, 1H, ArH), 7.10-7.00 (m, 2H, ArH), 6.79-6.64 (m, 2H, ArH), 3.74 (s, 3H, OCH_3); $^{13}C\{^1H\}$ NMR (150 MHz, $CDCl_3$) δ: 263985623798.3, 196.5, 191.5, 191.0, 160.0, 150.5, 145.8, 144.9, 144.4, 141.1, 141.0, 141.0, 135.3, 135.2, 135.1, 134.5, 131.8, 131.4, 130.8, 129.9, 128.0, 127.9, 125.5, 124.7, 123.9, 123.8, 123.3, 113.3, 55.2; IR (KBr) υ: 3063, 1844, 1708, 1572, 1461, 1427, 1315, 1276, 1231, 1198, 1089, 1031, 998, 910, 846, 755, 712 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{34}H_{19}NNaO_6$ ($[M+Na]^+$): 560.1105, found: 560.1096.

6-(4-(Dimethylamino)phenyl)-5-(4-methylbenzoyl)indeno[1,2-*a*]fluorene-7,12-dione (4n): red



solid, 52%, m.p. 310-312 °C; ^1H NMR (400 MHz, $CDCl_3$) δ: 9.14 (d, *J* = 8.0 Hz, 1H, ArH), 7.78 (d, *J* = 6.8 Hz, 1H, ArH), 7.67-7.65 (m, 4H, ArH), 7.46 (t, *J* = 7.2 Hz, 1H, ArH), 7.36-7.30 (m, 2H, ArH), 7.22 (d, *J* = 7.2 Hz, 1H, ArH), 7.11 (d, *J* = 7.6 Hz, 1H, ArH), 6.55 (brs, 2H, ArH), 2.92 (s, 6H, CH_3), 2.33 (s, 3H, CH_3); $^{13}C\{^1H\}$ NMR (150 MHz, $CDCl_3$) δ: 197.4, 192.1, 191.4, 150.4, 146.0, 145.2, 144.9, 144.5, 141.6, 141.2, 136.3, 135.5, 135.4, 135.0, 134.9, 134.3, 131.4, 130.9, 130.6, 130.1, 129.5, 129.4, 127.6, 127.2, 124.3, 123.8, 123.6, 121.2, 111.0, 40.1, 21.8; IR (KBr) υ: 3063, 1708, 1666, 1605, 1571, 1527, 1466, 1368, 1320, 1241, 1195, 1160, 1083, 1001, 946, 842, 746 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{36}H_{26}NO_3$ ($[M+H]^+$): 520.1907, found: 520.1900.

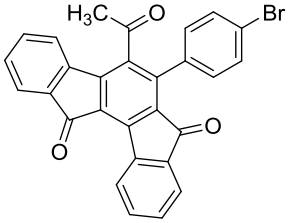
5-Acetyl-6-(*p*-tolyl)indeno[1,2-*a*]fluorene-7,12-dione (4o): yellow solid, 66%, m.p. 318-320 °C;



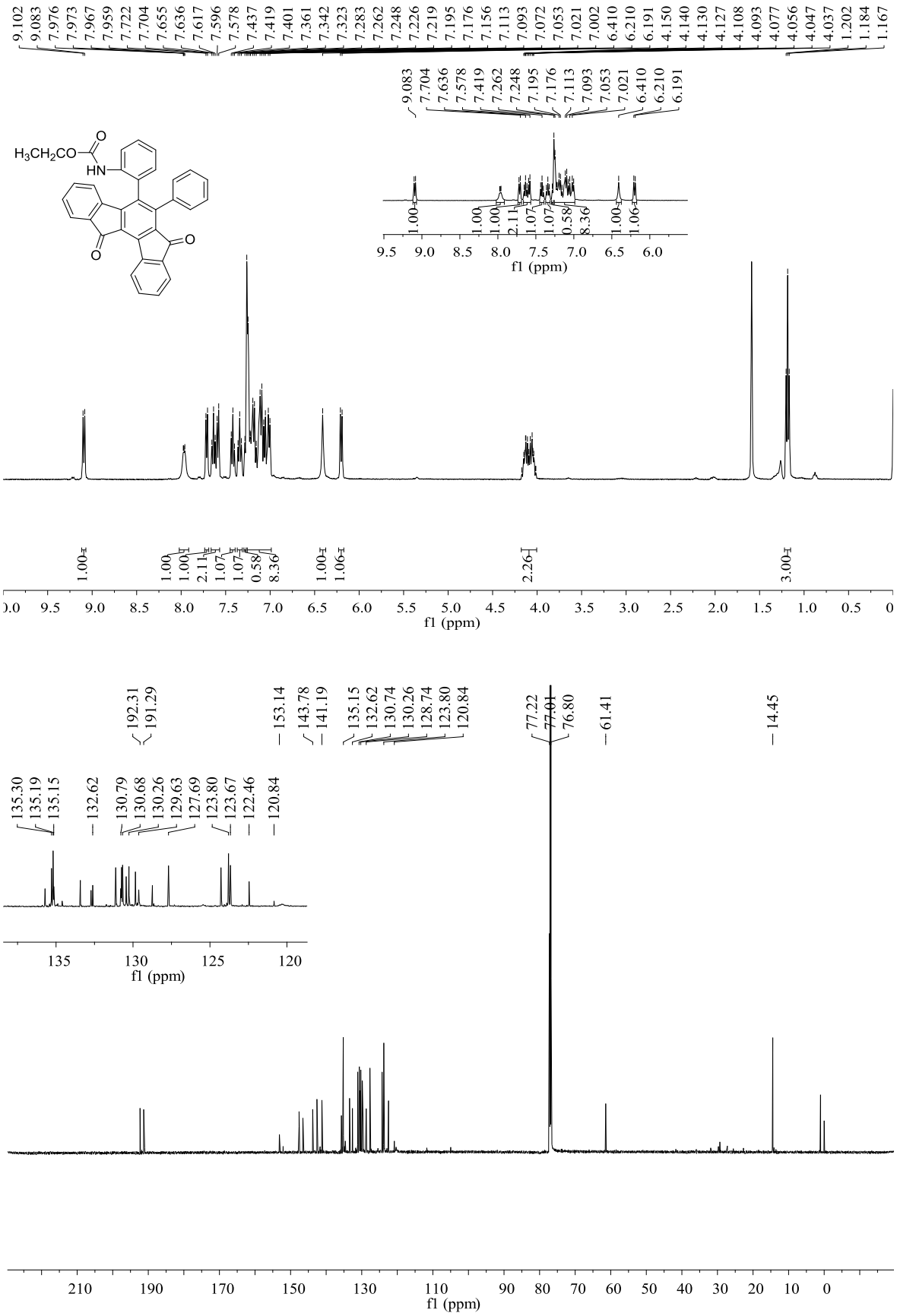
^1H NMR (400 MHz, $CDCl_3$) δ: 9.08 (d, *J* = 7.2 Hz, 1H, ArH), 7.80 (d, *J* = 7.2 Hz, 1H, ArH), 7.66-7.61 (m, 2H, ArH), 7.49 (t, *J* = 7.2 Hz, 1H, ArH), 7.44-7.41 (m, 3H, ArH), 7.30-7.23 (m, 4H, ArH), 2.45 (s, 3H, CH_3), 2.09 (s, 3H, CH_3); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ: 205.3, 191.7, 191.1, 143.9, 143.6, 143.3, 141.4, 141.0, 139.0, 138.3, 135.3, 135.2, 135.1, 131.6, 131.0, 130.8, 130.5, 129.1, 128.9,

128.0, 127.7, 124.5, 123.7, 123.0, 109.9, 32.1, 21.4; IR (KBr) υ: 3067, 1707, 1574, 1513, 1461, 1358, 1219, 1187, 1117, 993, 820, 754, 712 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{29}H_{18}NaO_3$ ($[M+Na]^+$): 437.1148, found: 437.1135.

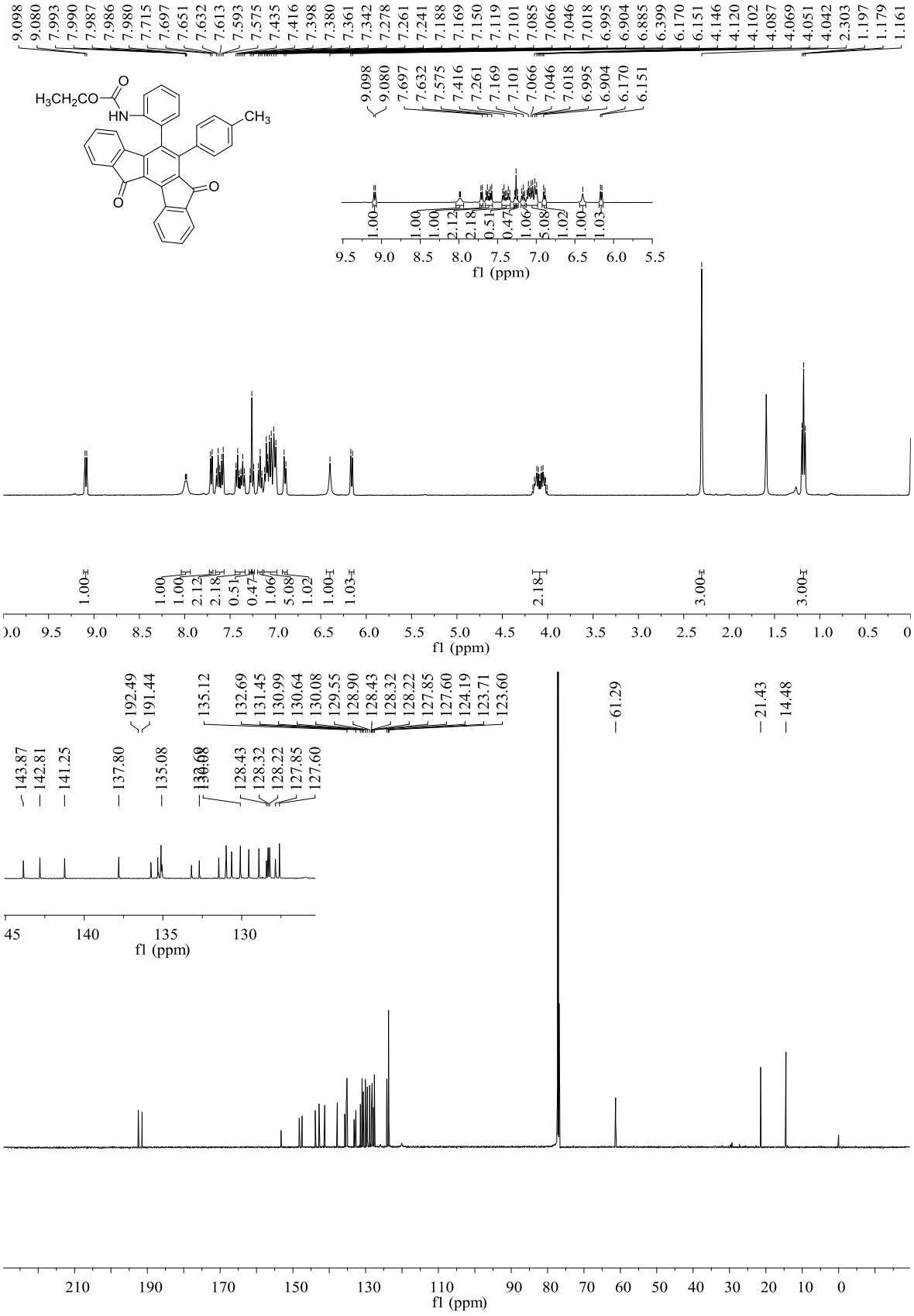
5-Acetyl-6-(4-bromophenyl)indeno[1,2-*a*]fluorene-7,12-dione (4p): yellow solid, 64%, m.p. 317-319°C; ^1H NMR (400 MHz, $CDCl_3$) δ: 9.11 (d, *J* = 6.8 Hz, 1H, ArH), 7.84 (d, *J* = 6.8 Hz, 1H, ArH), 7.70-7.61 (m, 4H, ArH), 7.54 (t, *J* = 7.2 Hz, 1H, ArH), 7.49-7.42 (m, 3H, ArH), 7.23 (d, *J* = 8.0 Hz, 2H, ArH), 2.14 (s, 3H, CH_3); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ: 204.9, 191.4, 190.9, 143.8, 143.7, 141.4, 141.1, 140.9, 137.8, 135.3, 135.2, 135.1, 135.0, 132.6, 131.6, 131.5, 131.1, 130.9, 130.6, 128.3, 127.7, 124.6, 123.7, 123.6, 123.0, 109.9, 32.3; IR (KBr) υ: 1707, 1601, 1575, 1461, 1358, 1219, 1187, 1119, 1082, 999, 834, 755, 713 cm^{-1}; MS (*m*/*z*): HRMS (ESI-TOF) Calcd. for $C_{28}H_{15}BrNaO_3$ ($[M+Na]^+$): 501.0097, found: 501.0096.



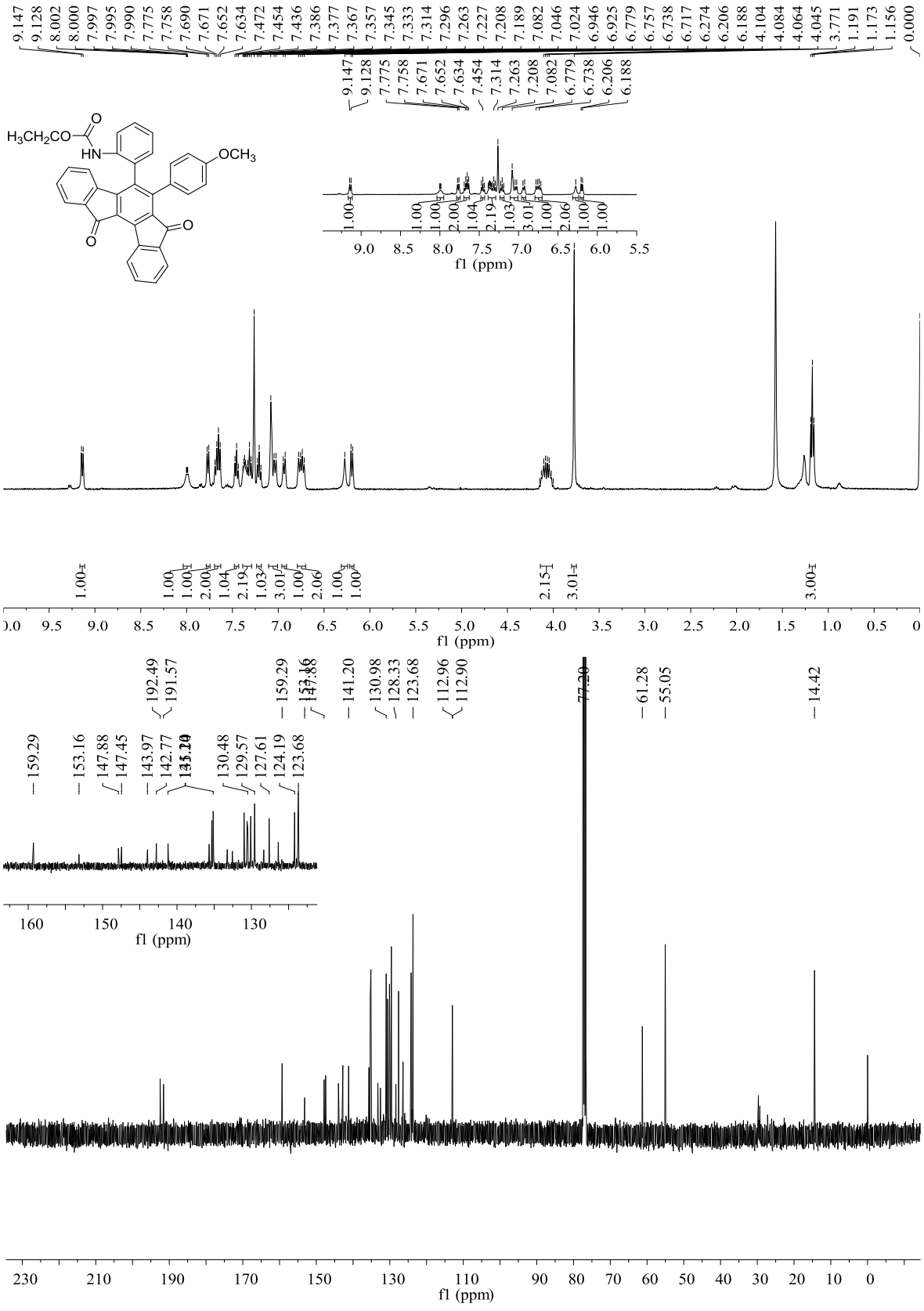
Ethyl (2-(7,12-dioxo-6-phenyl-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)carbamate (1a):



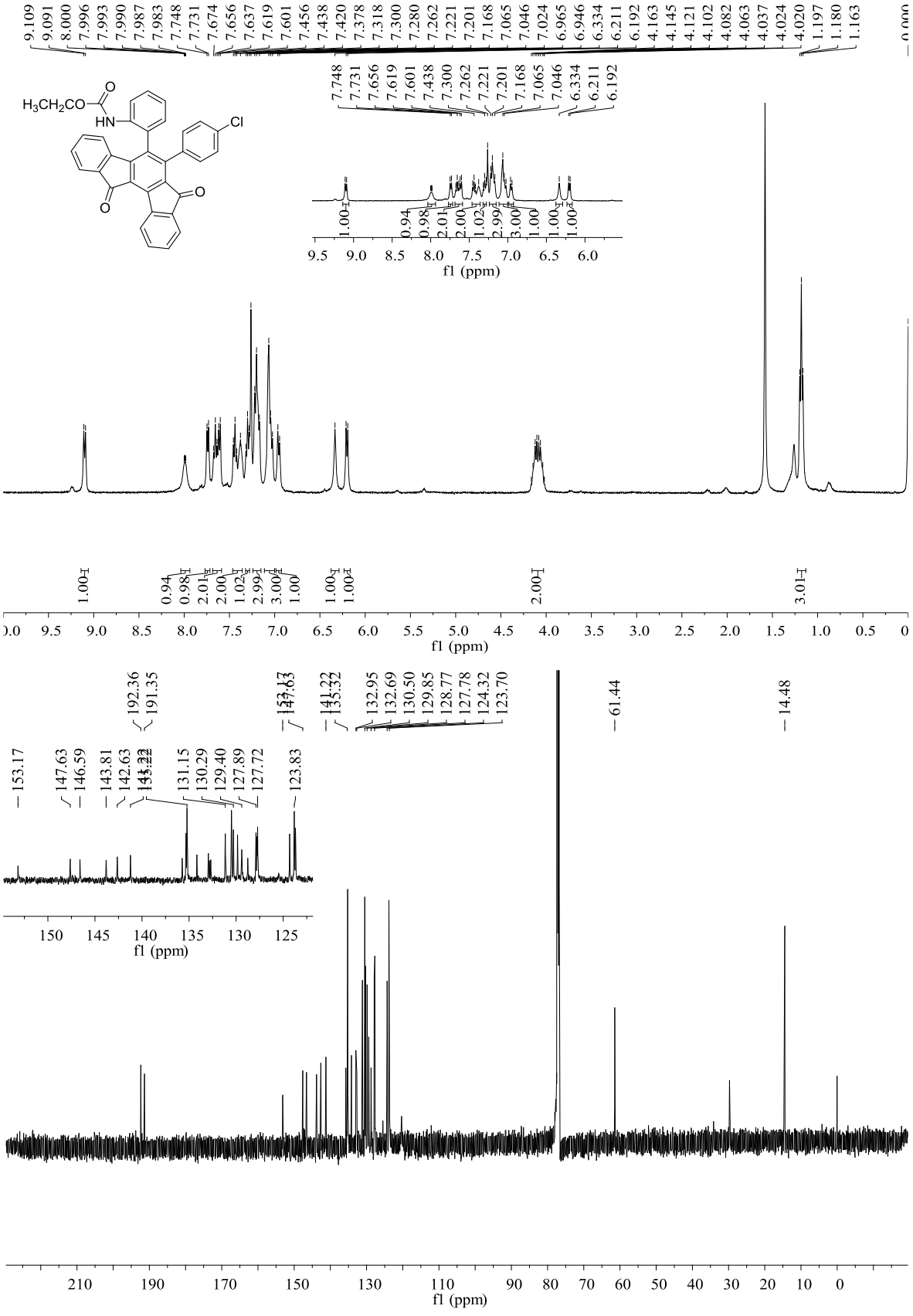
Ethyl (2-(7,12-dioxo-6-(*p*-tolyl)-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)carbamate (1b):



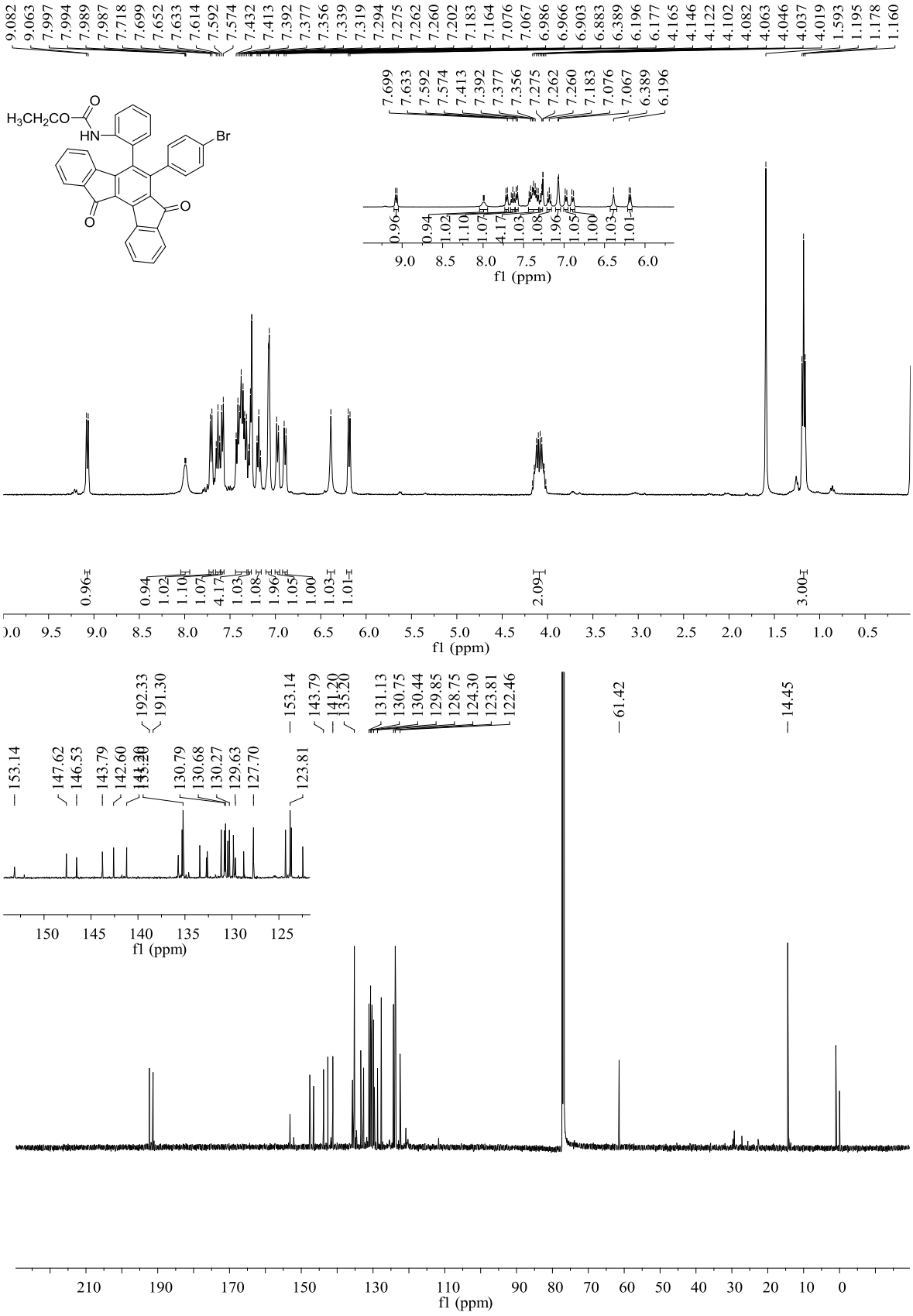
Ethyl (2-(6-(4-methoxyphenyl)-7,12-dioxo-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)carbamate (1c):



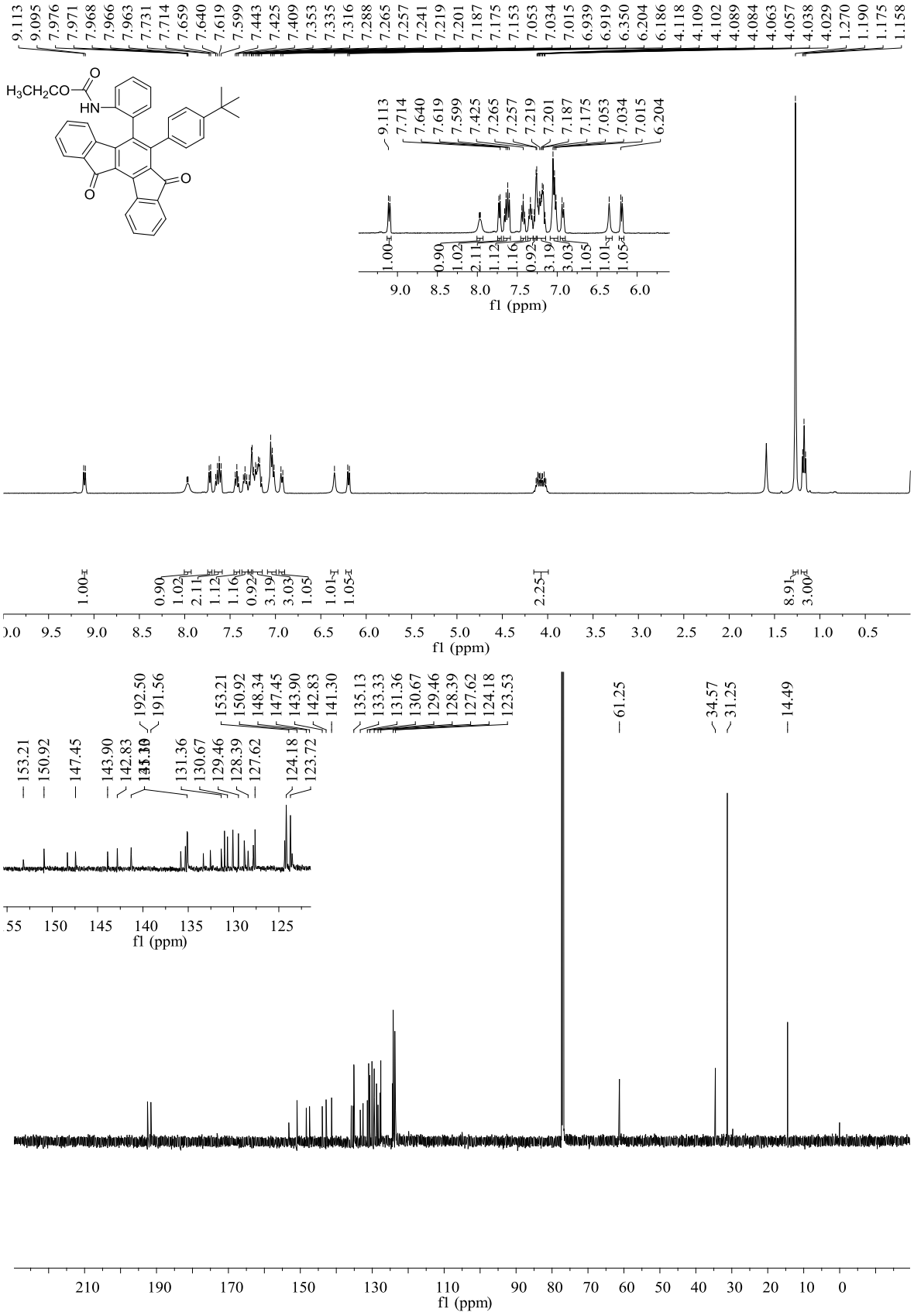
Ethyl (2-(6-(4-chlorophenyl)-7,12-dioxo-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)carbamate (1d):



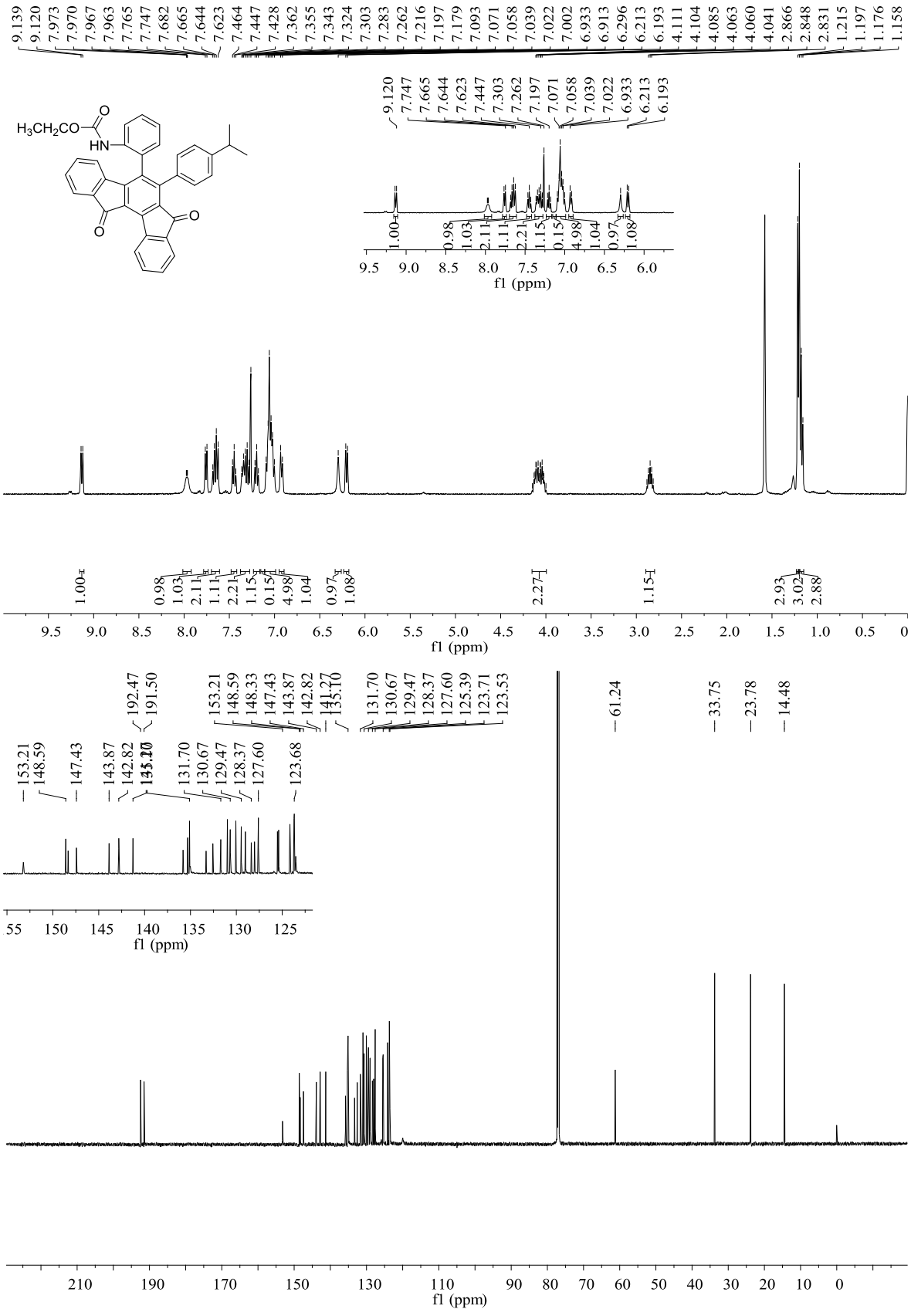
Ethyl (2-(6-(4-bromophenyl)-7,12-dioxo-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)carbamate (1e):



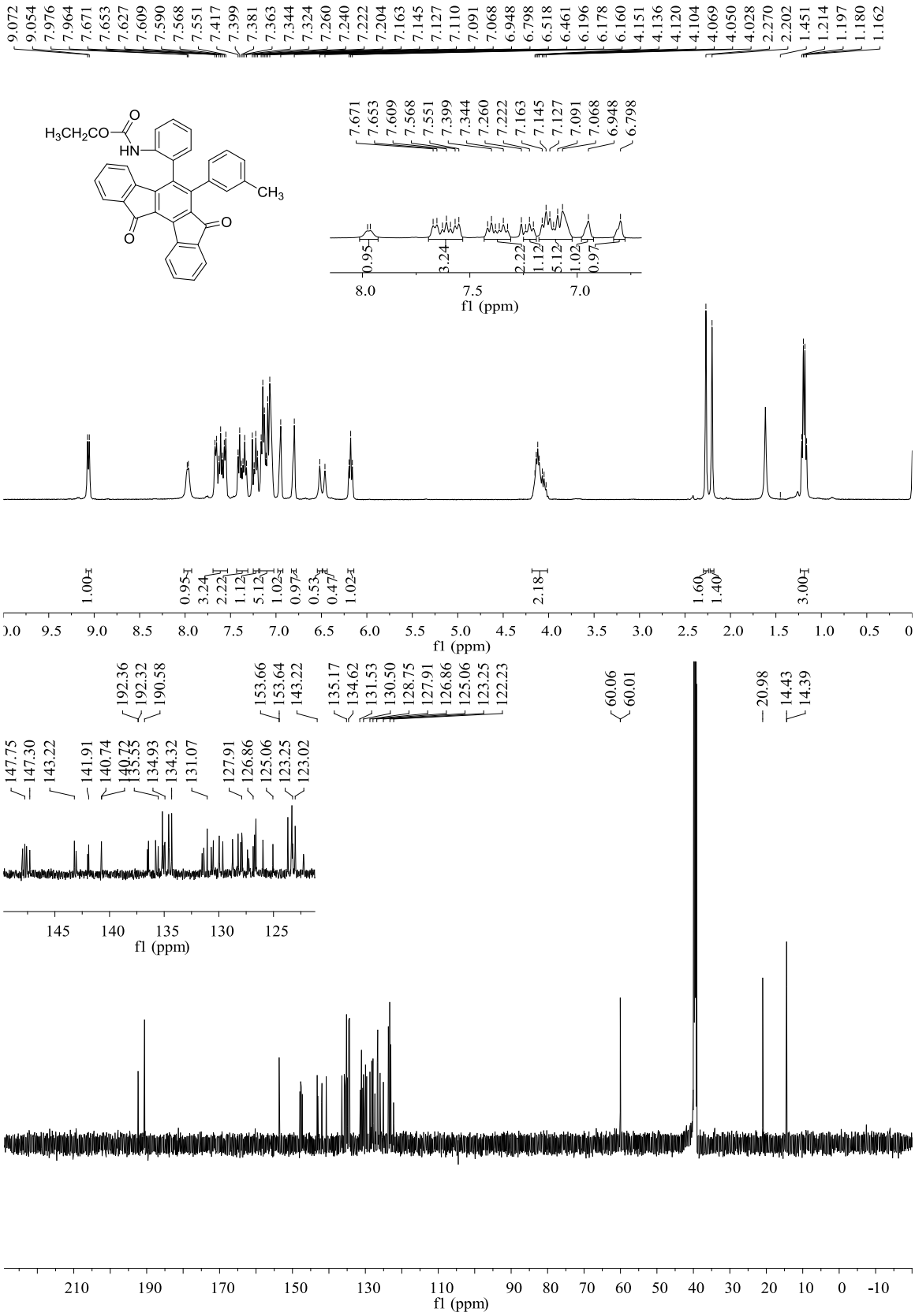
Ethyl (2-(6-(4-(tert-butyl)phenyl)-7,12-dioxo-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)carbamate (1f):



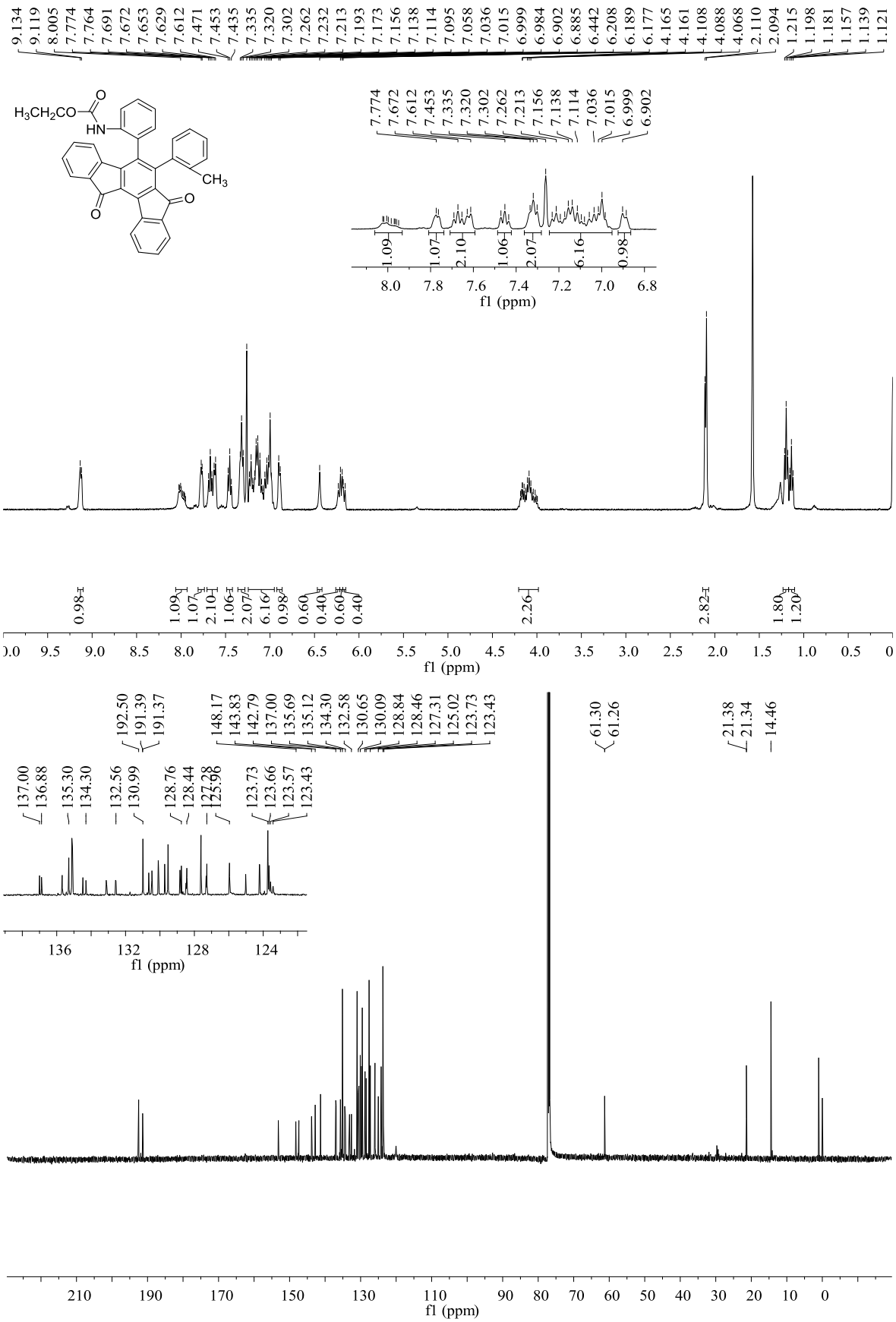
Ethyl (2-(6-(4-isopropylphenyl)-7,12-dioxo-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)carbamate (1g):



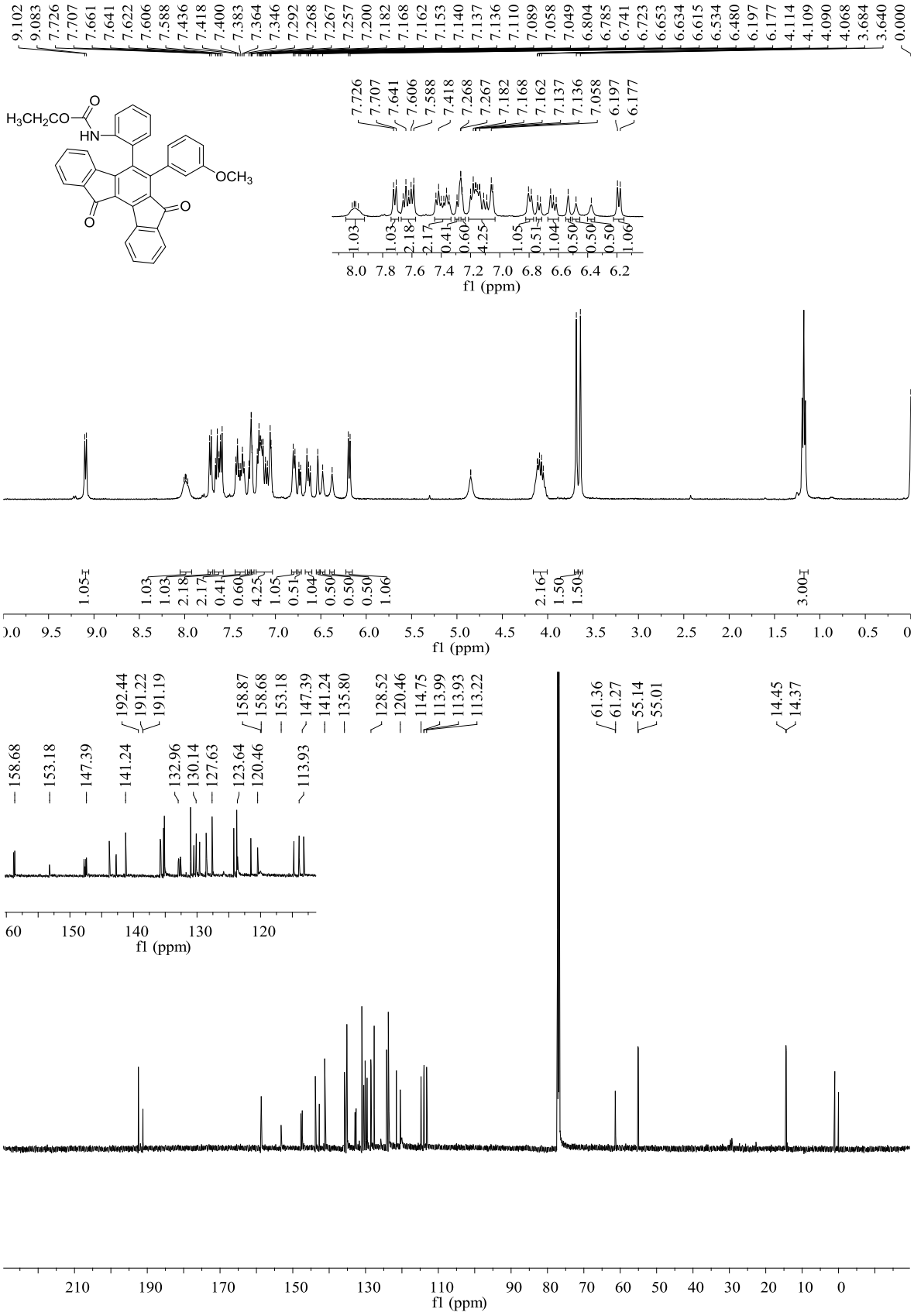
Ethyl (2-(7,12-dioxo-6-(*m*-tolyl)-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)carbamate (1h):



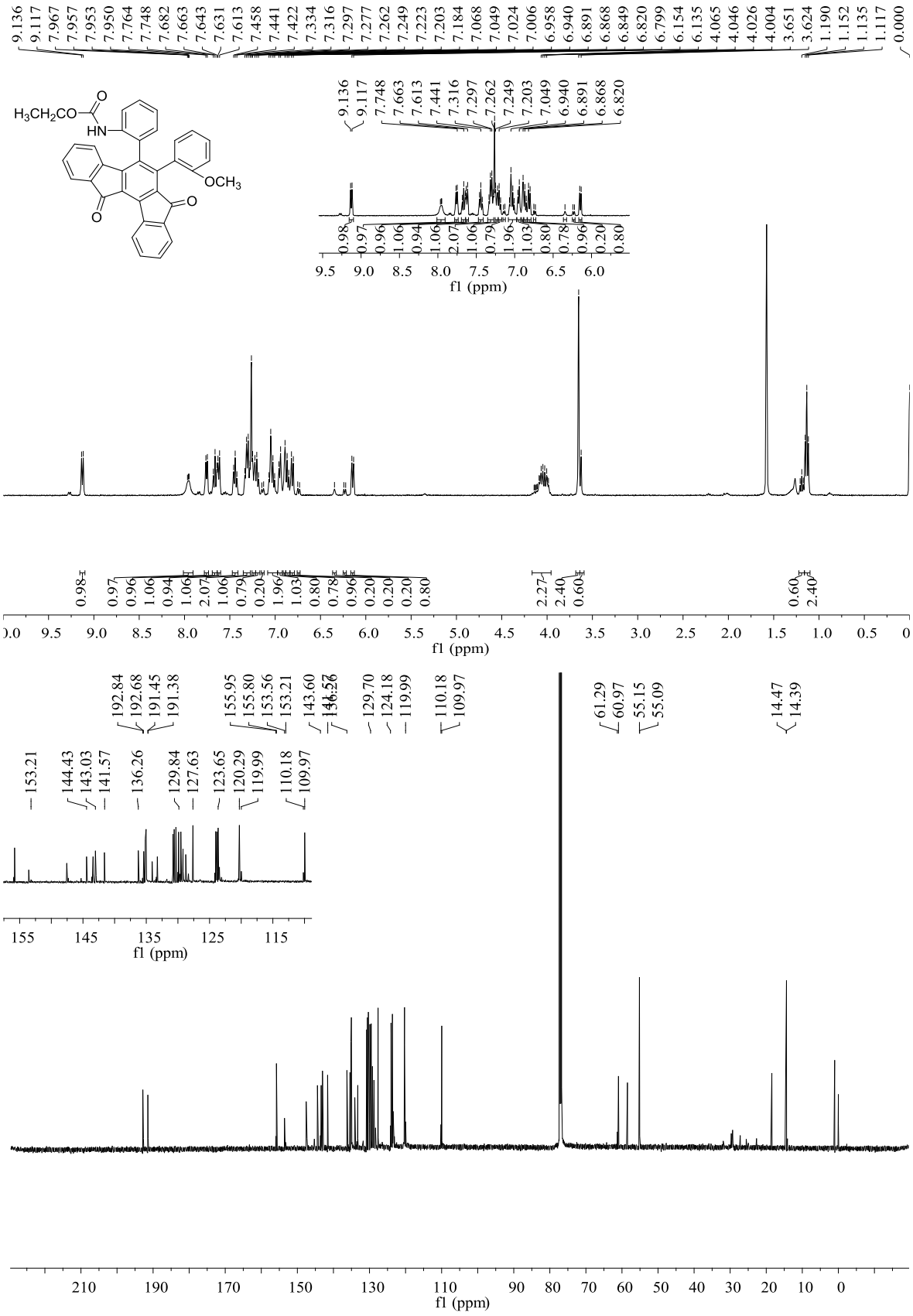
Ethyl (2-(7,12-dioxo-6-(*o*-tolyl)-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)carbamate (1i):



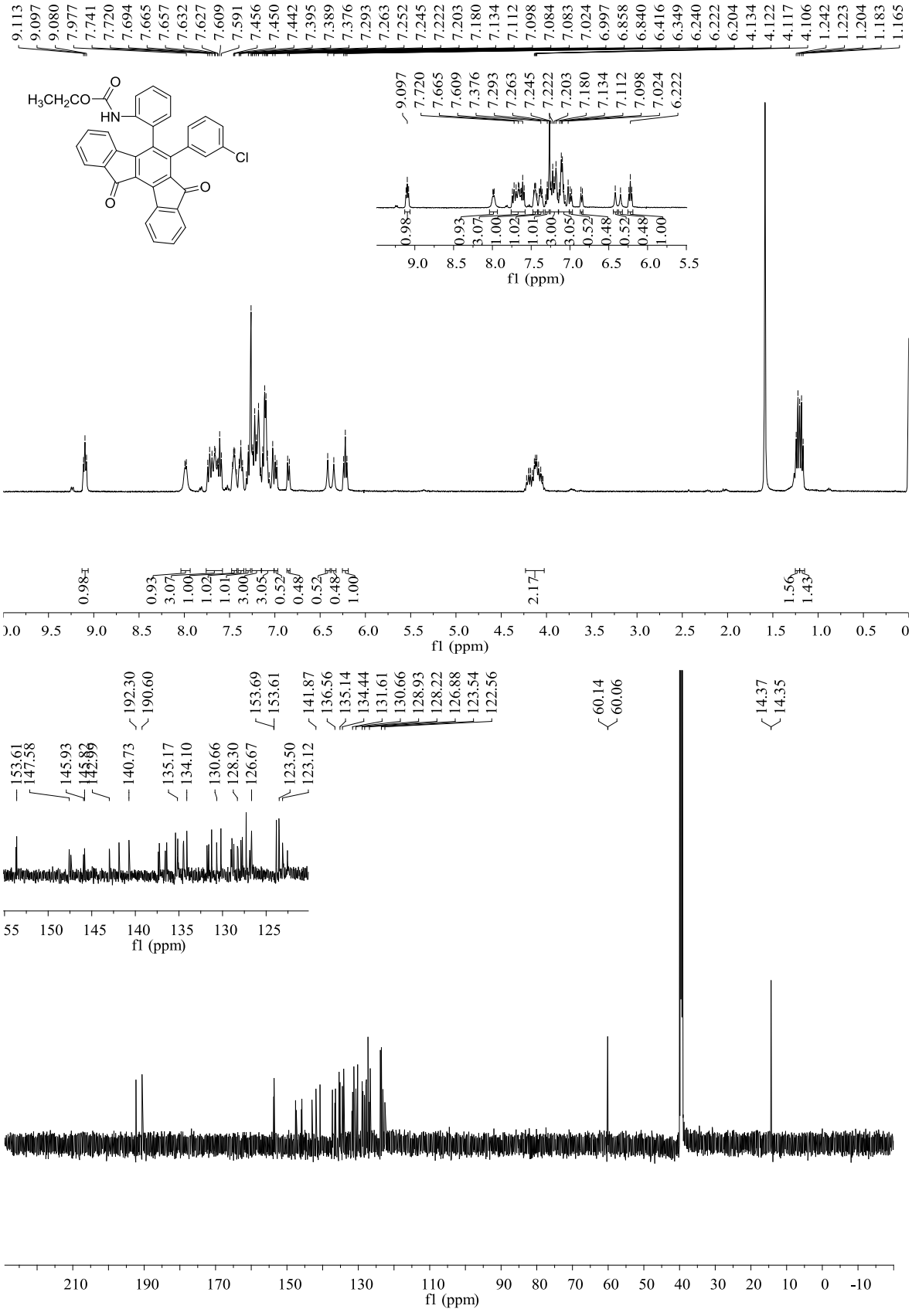
Ethyl (2-(6-(3-methoxyphenyl)-7,12-dioxo-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)carbamate (1j):



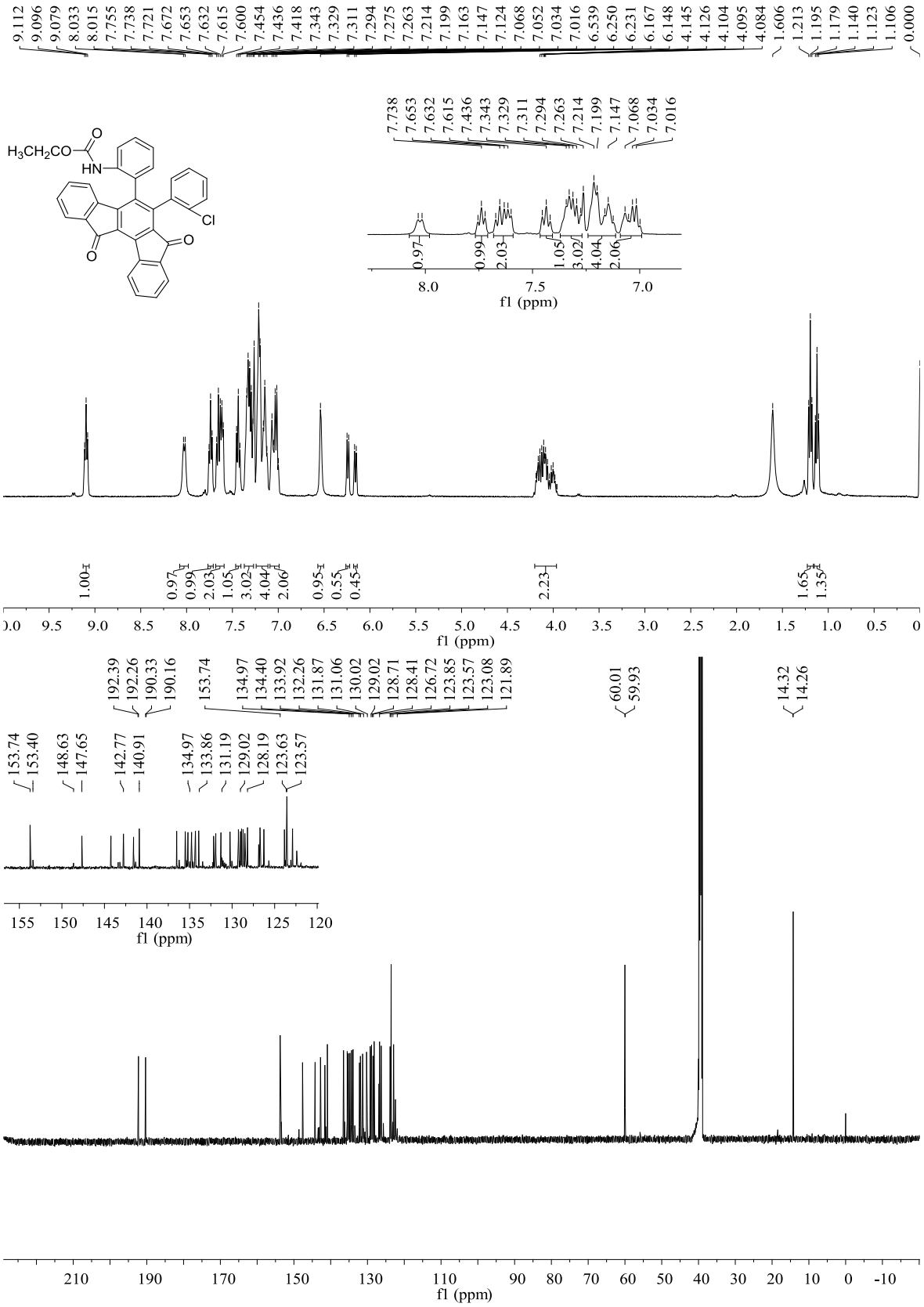
Ethyl (2-(6-(2-methoxyphenyl)-7,12-dioxo-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)carbamate (1k):



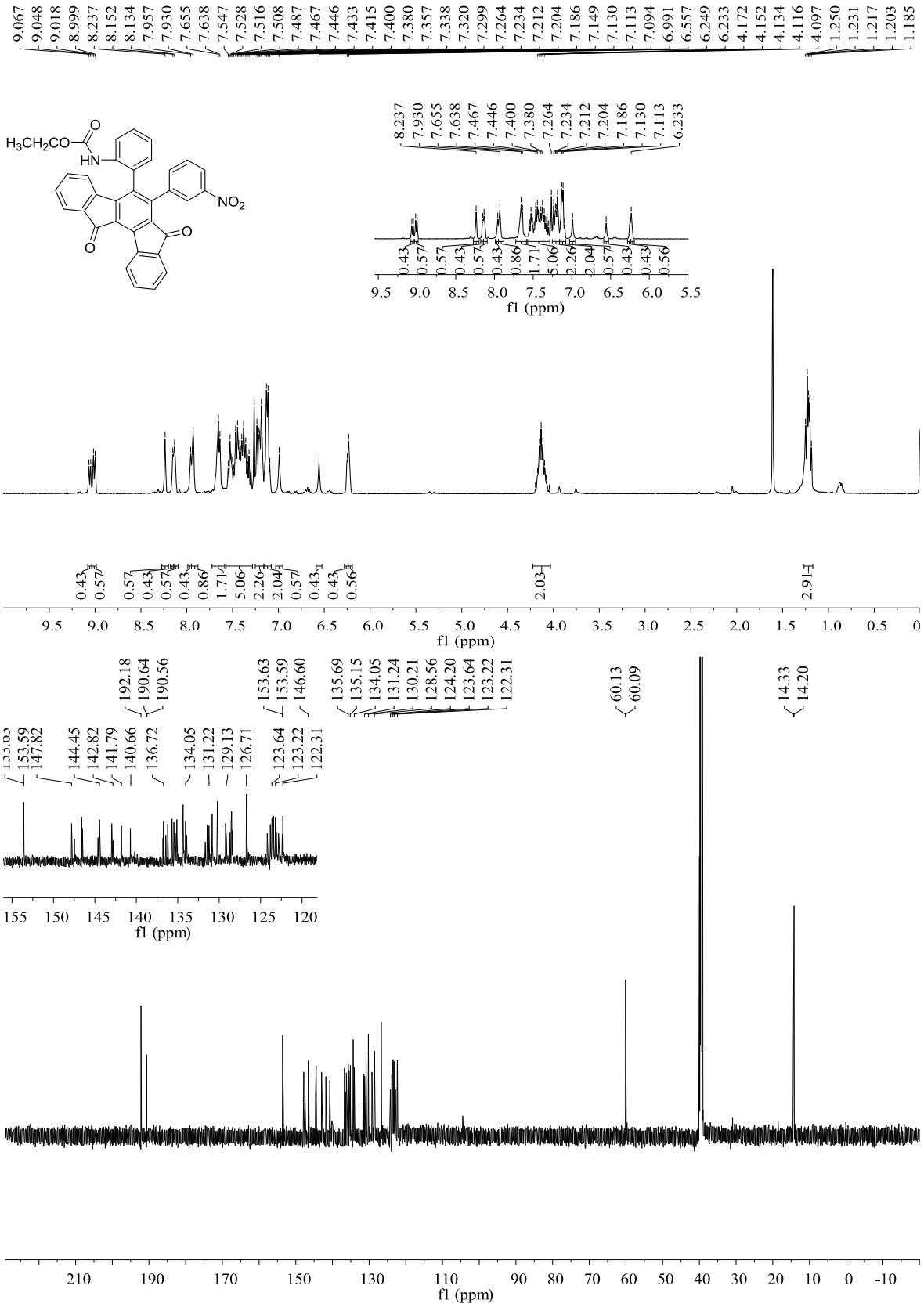
Ethyl (2-(6-(3-chlorophenyl)-7,12-dioxo-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)carbamate (1l):



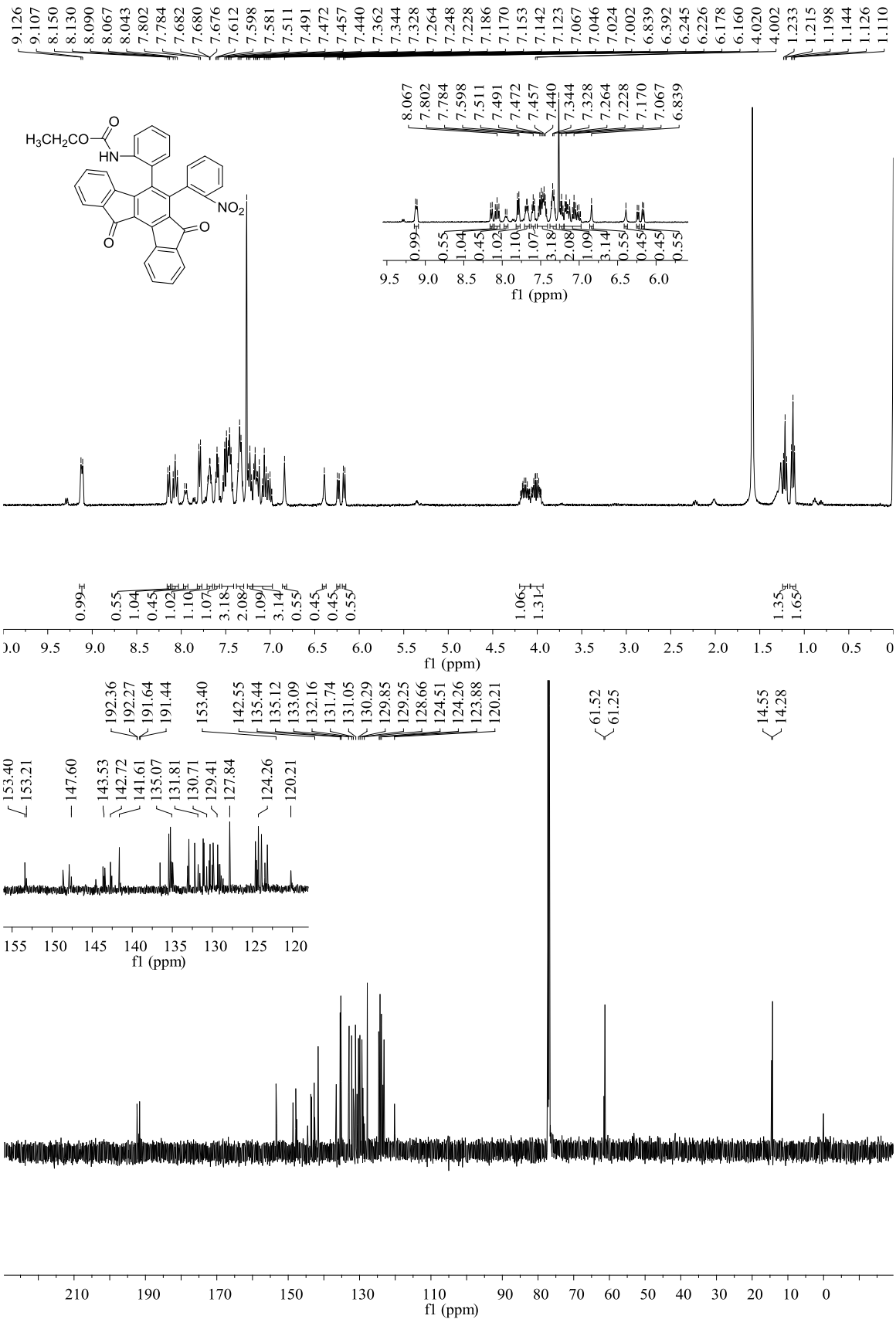
Ethyl (2-(6-(2-chlorophenyl)-7,12-dioxo-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)carbamate (1m):



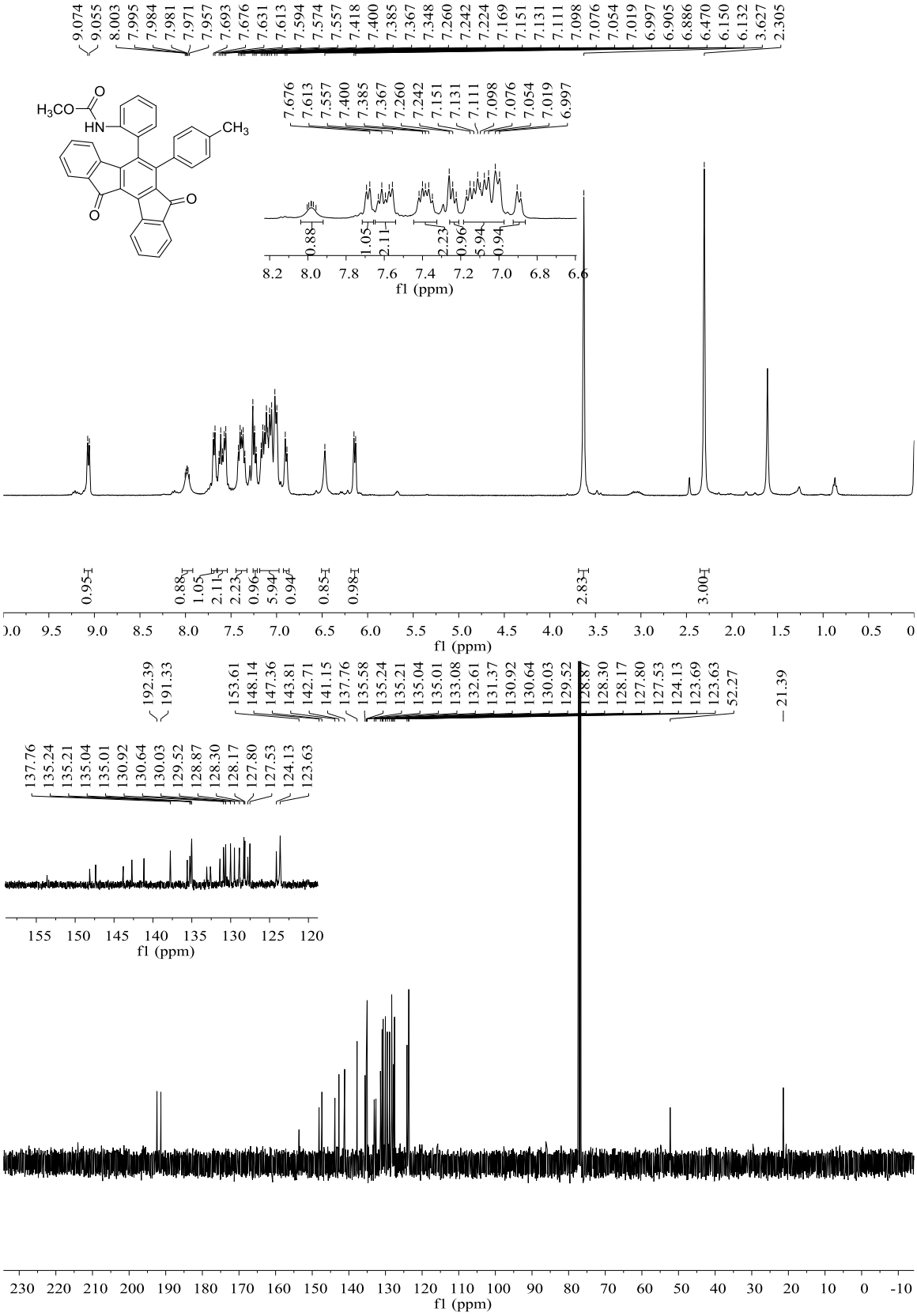
Ethyl (2-(6-(3-nitrophenyl)-7,12-dioxo-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)carbamate (1n):



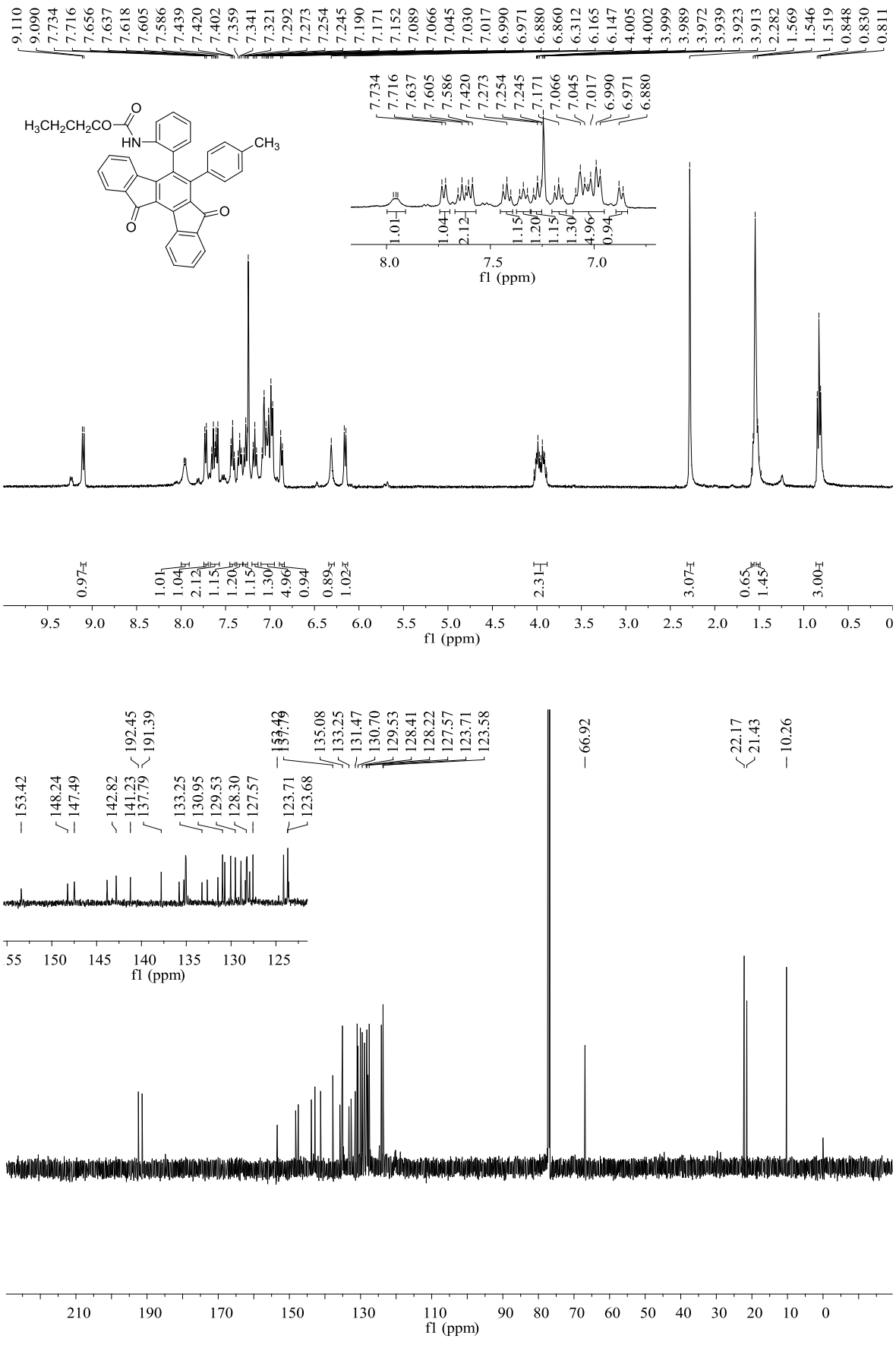
Ethyl (2-(6-(2-nitrophenyl)-7,12-dioxo-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)carbamate (1o):



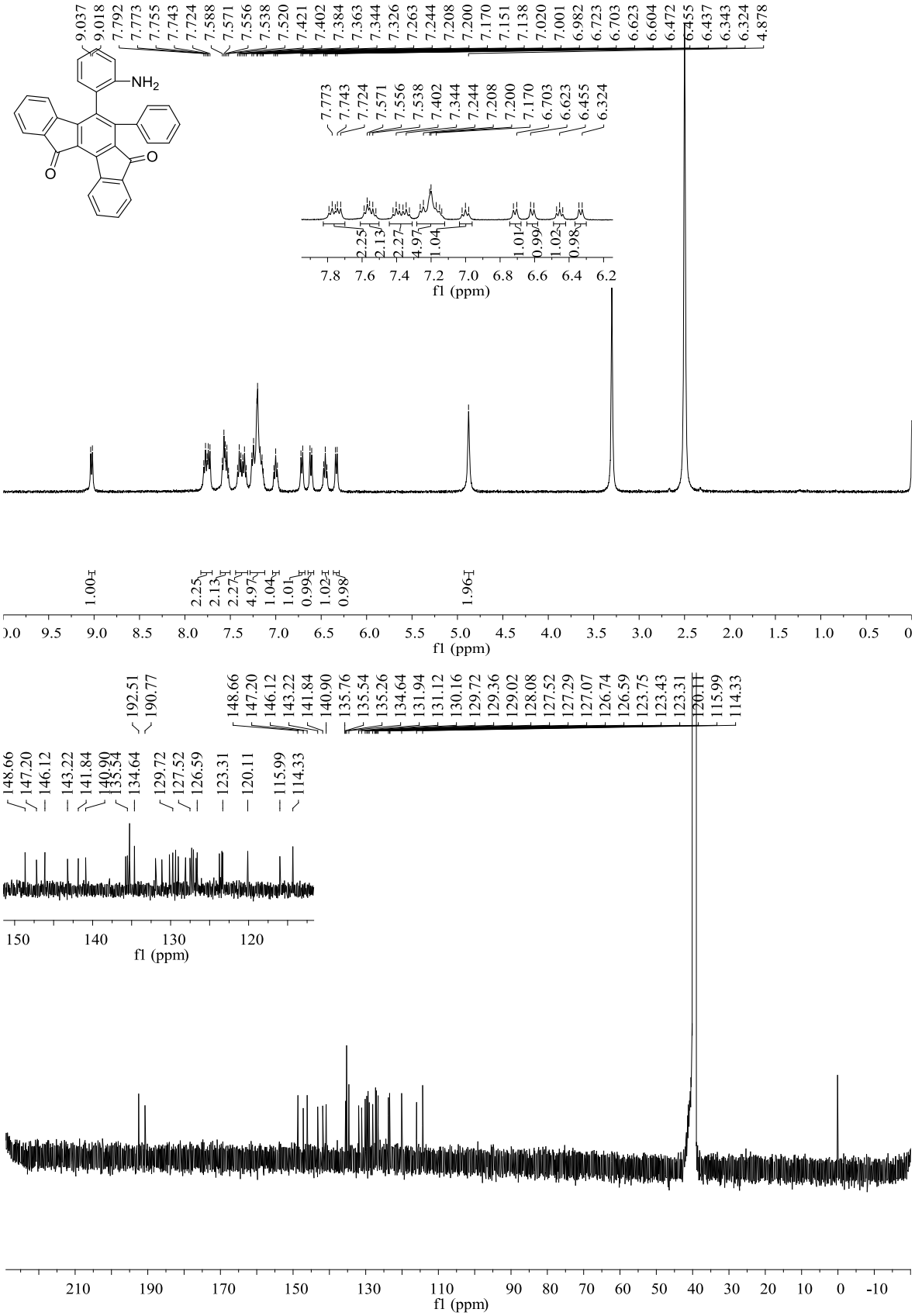
Methyl (2-(7,12-dioxo-6-(*p*-tolyl)-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)carbamate (1p):



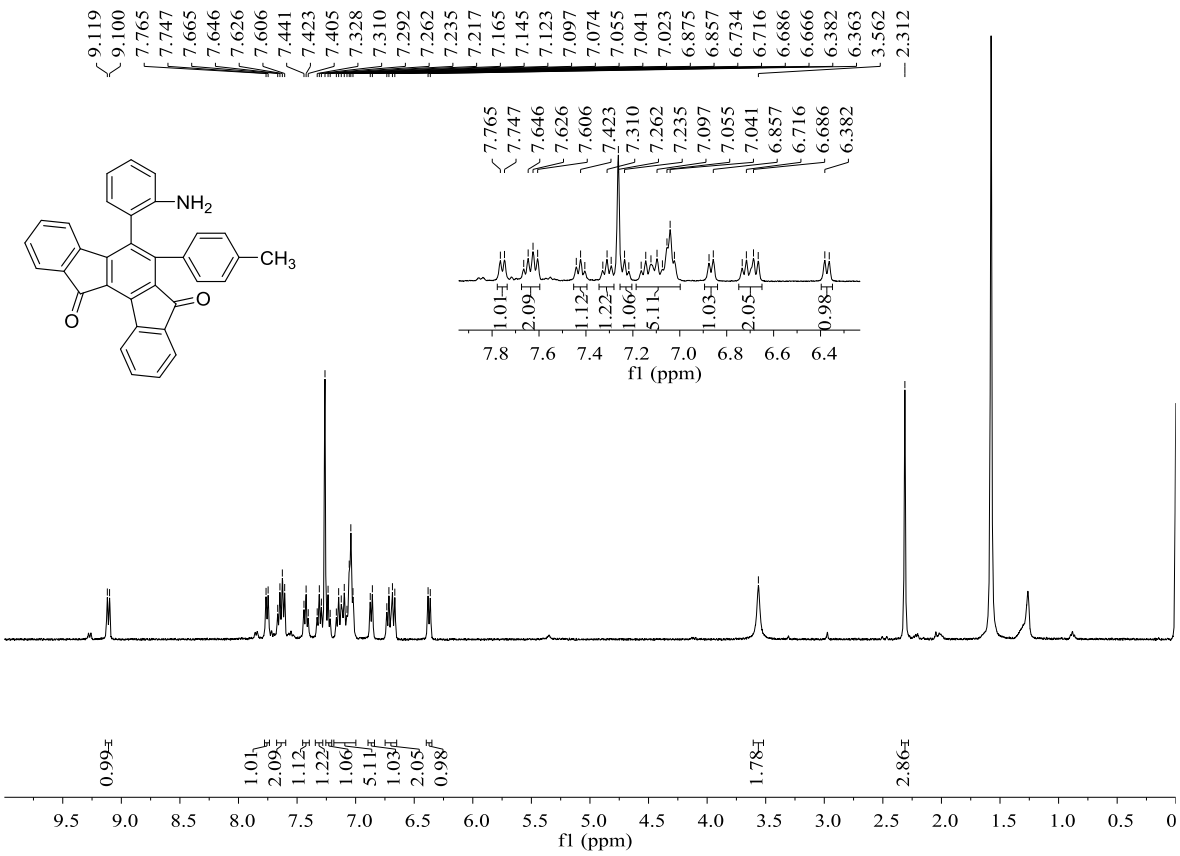
Butyl (2-(7,12-dioxo-6-(*p*-tolyl)-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)carbamate (1q):

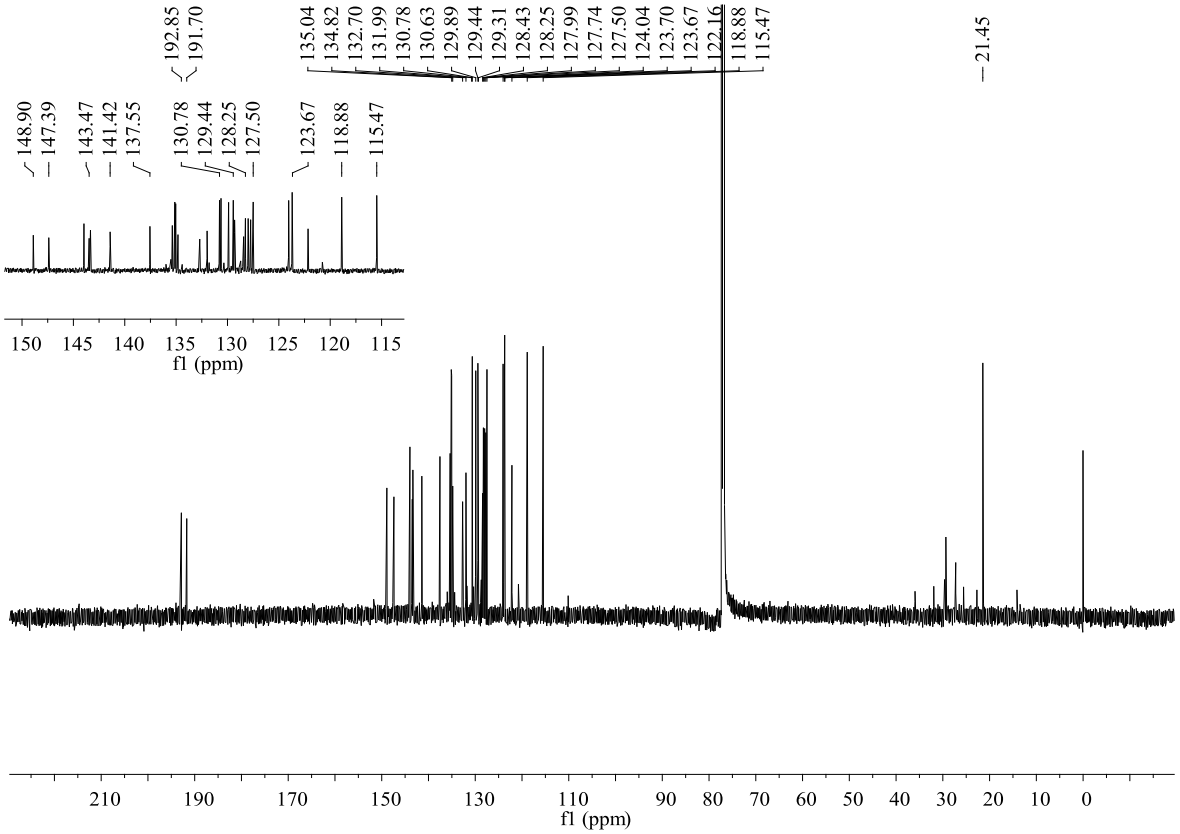


5-(2-Aminophenyl)-6-phenylindeno[1,2-*a*]fluorene-7,12-dione (2a):

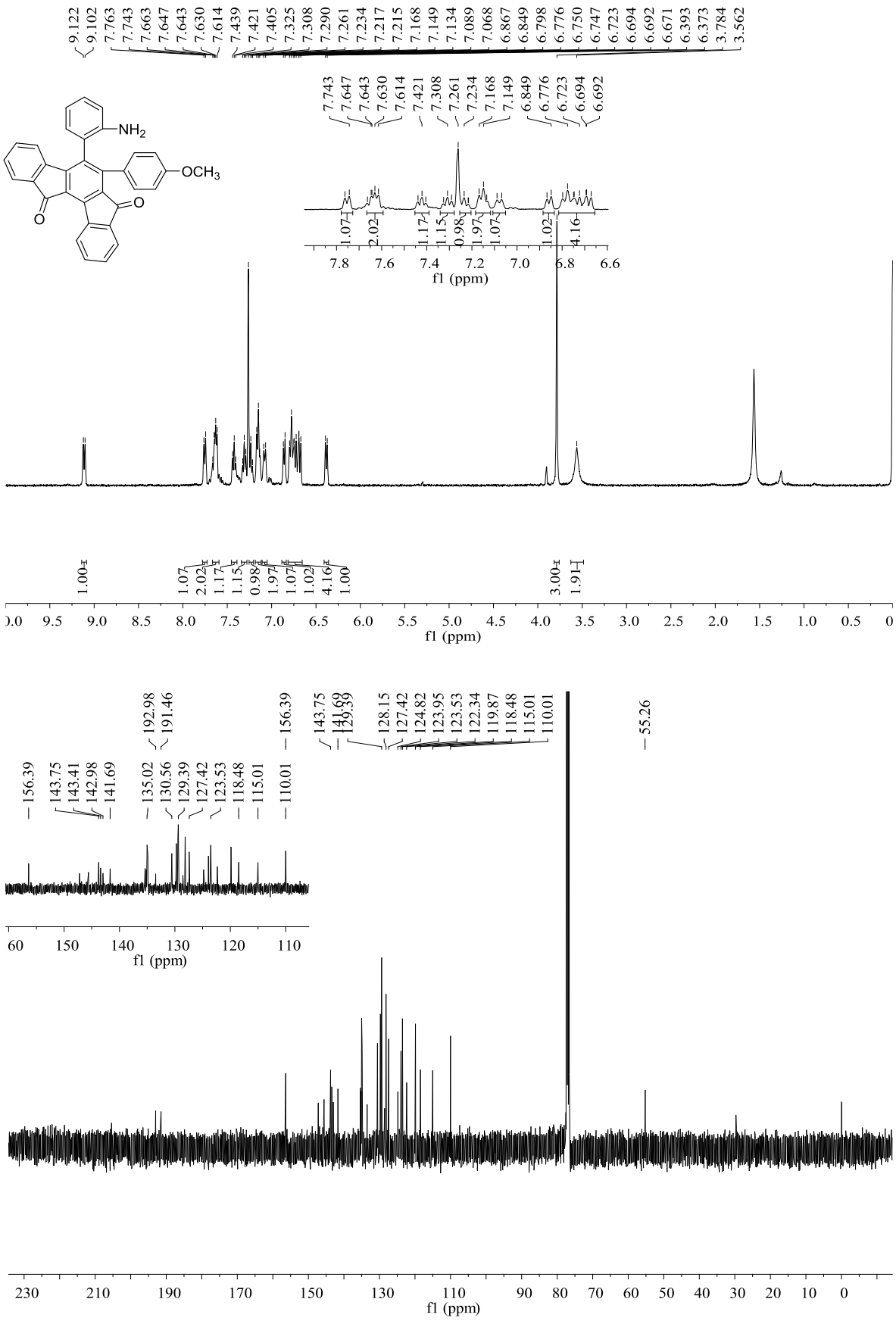


5-(2-Aminophenyl)-6-(*p*-tolyl)indeno[1,2-*a*]fluorene-7,12-dione (2b):

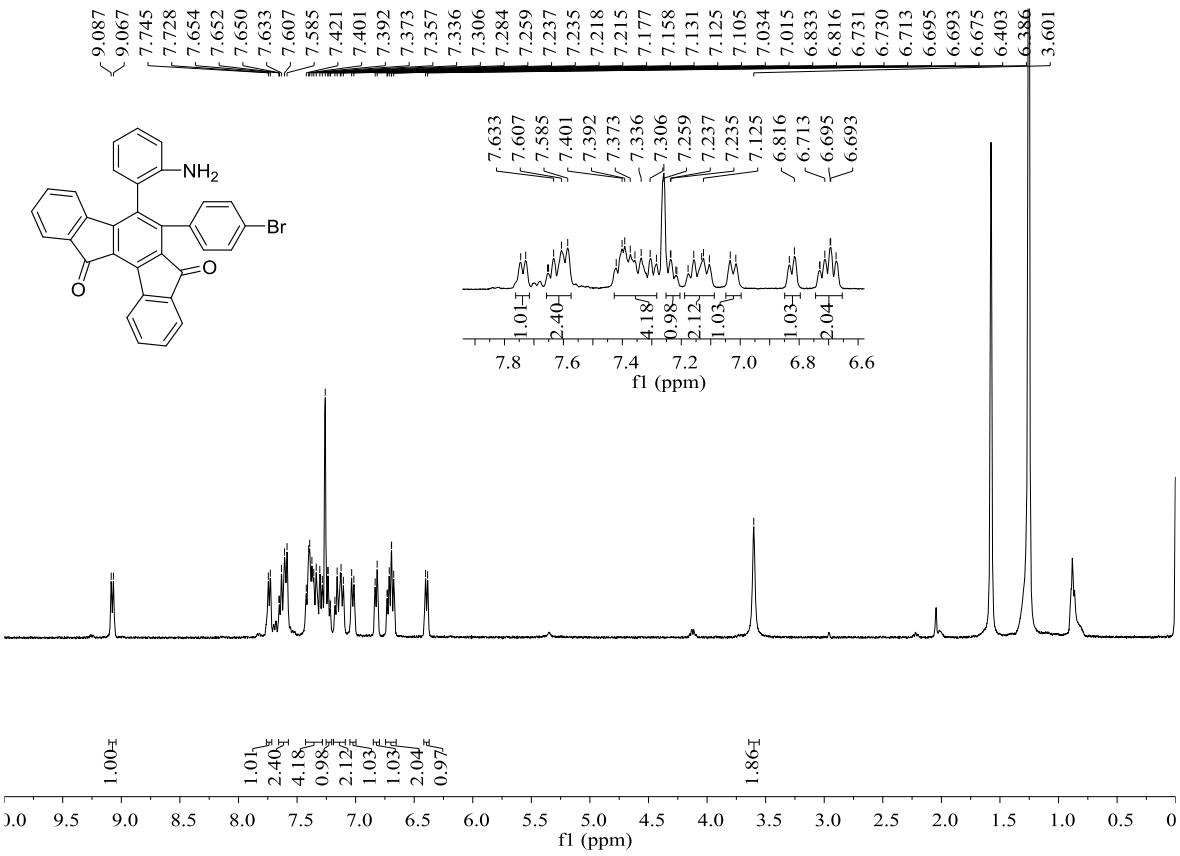


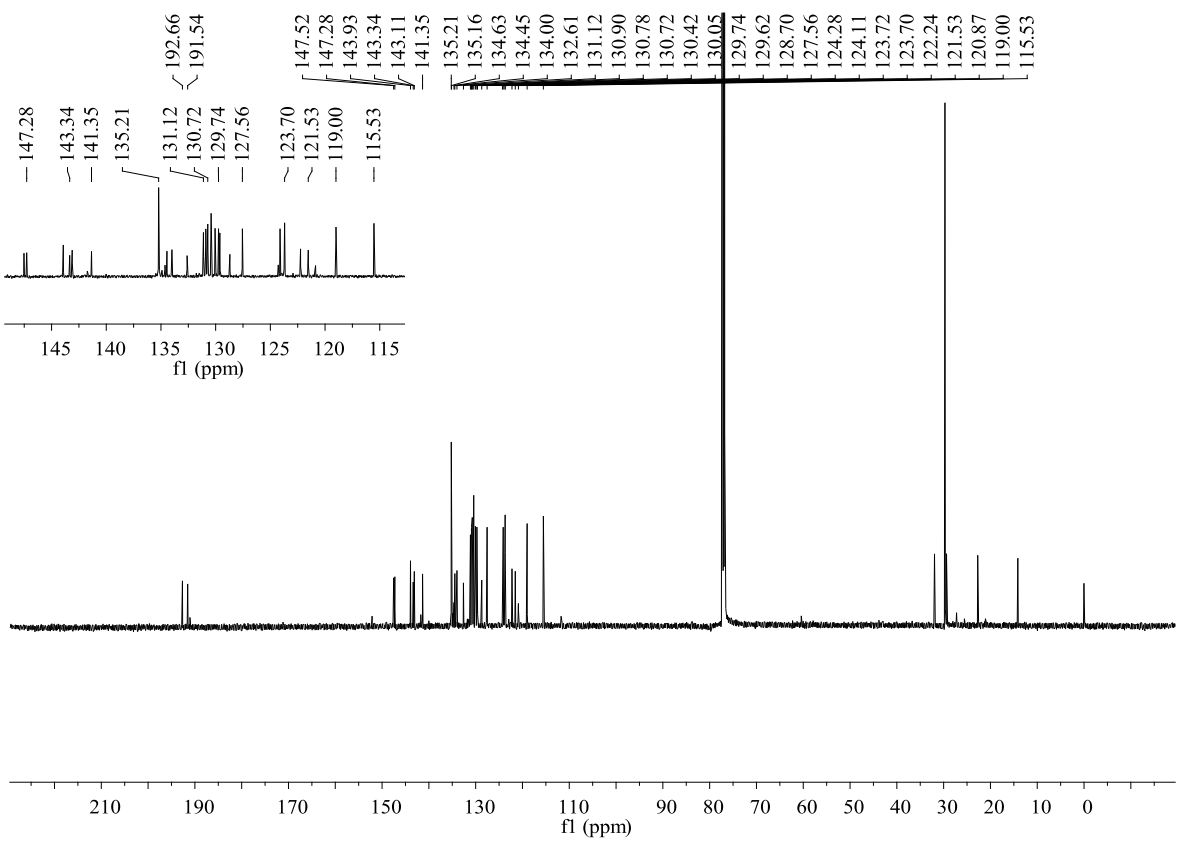


5-(2-Aminophenyl)-6-(4-methoxyphenyl)indeno[1,2-*a*]fluorene-7,12-dione (2c):

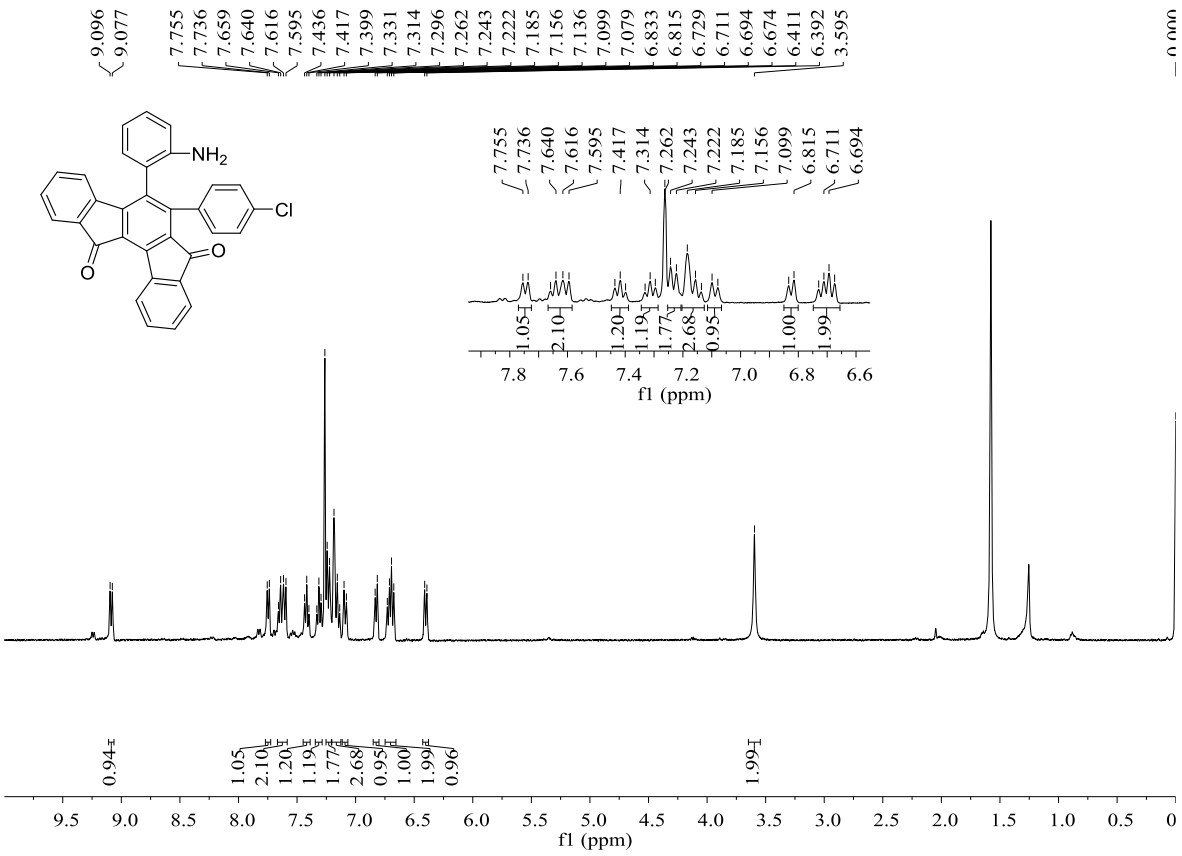


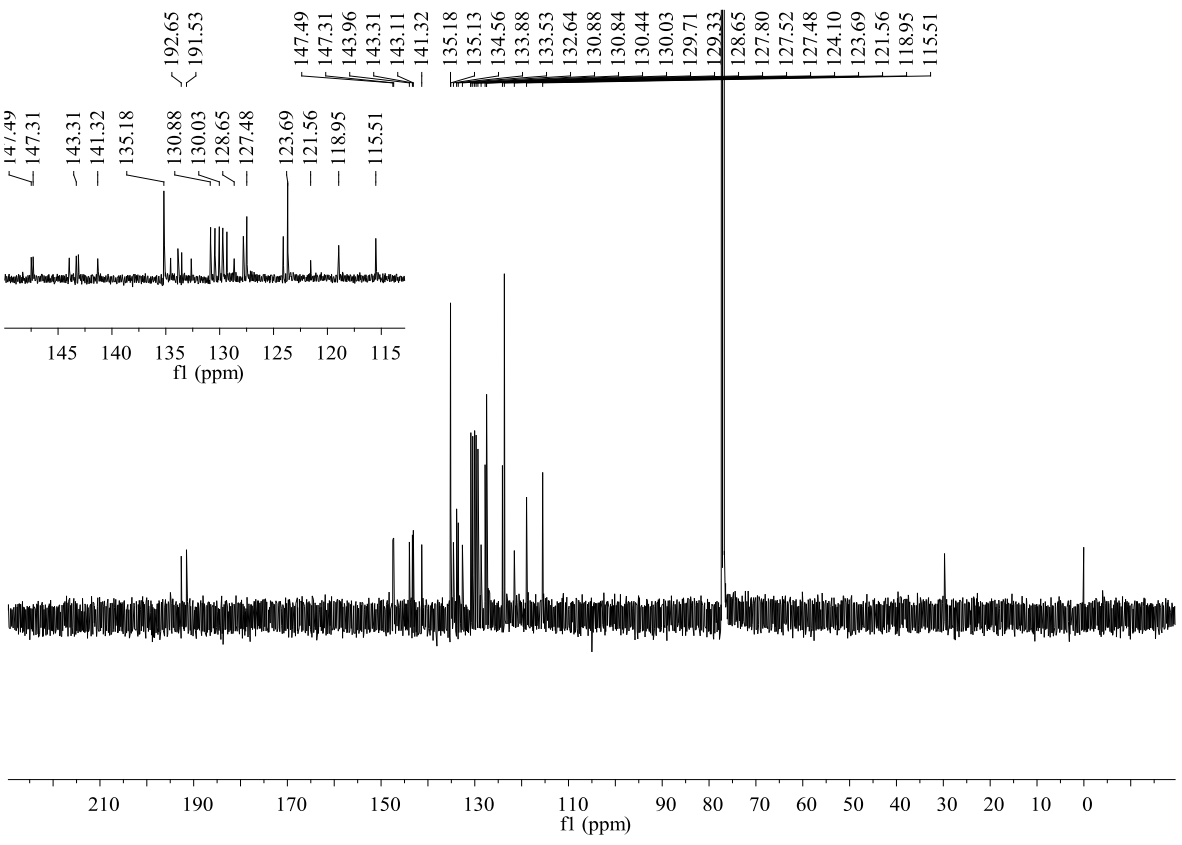
5-(2-Aminophenyl)-6-(4-bromophenyl)indeno[1,2-*a*]fluorene-7,12-dione (2d):



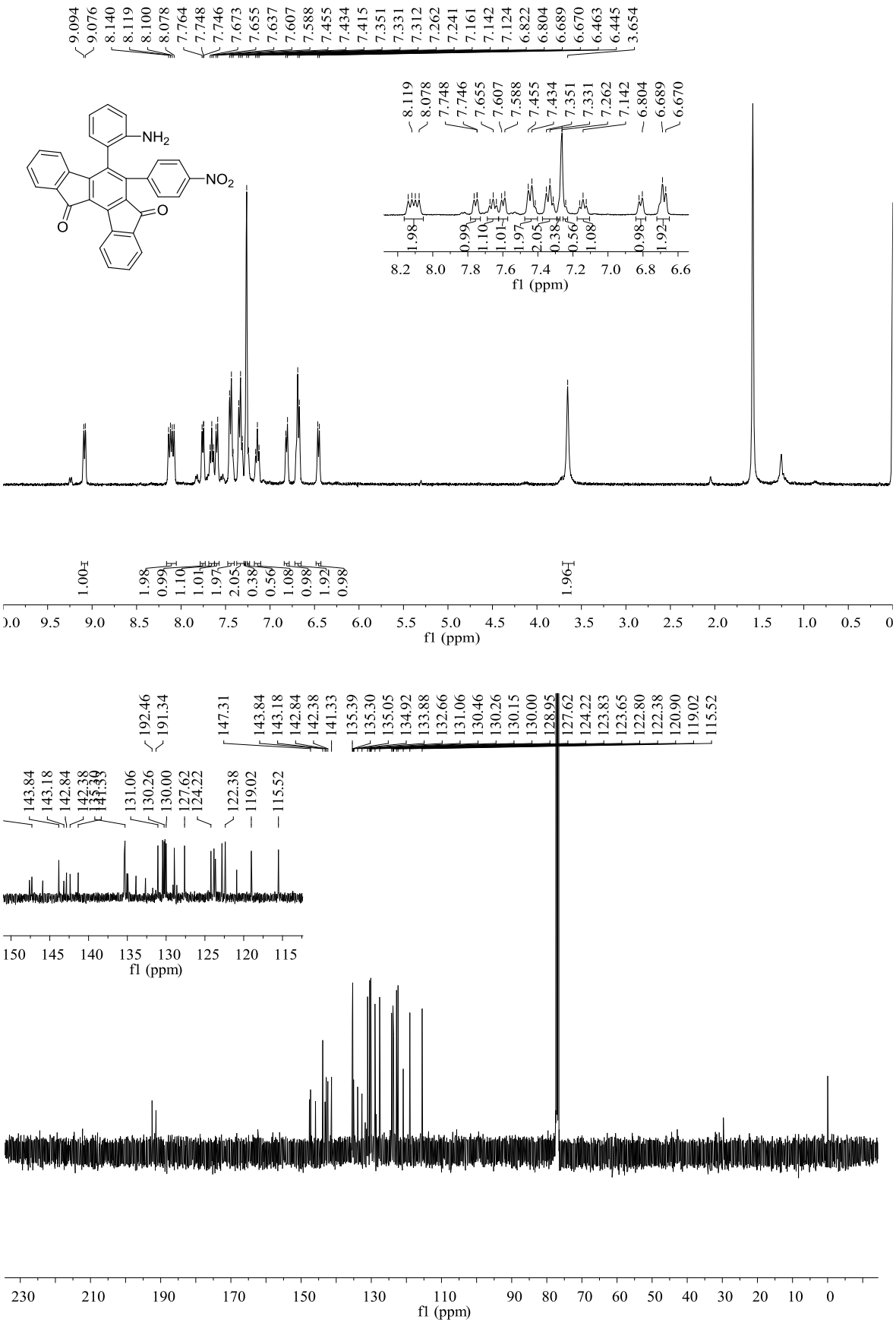


5-(2-Aminophenyl)-6-(4-chlorophenyl)indeno[1,2-*a*]fluorene-7,12-dione (2e):

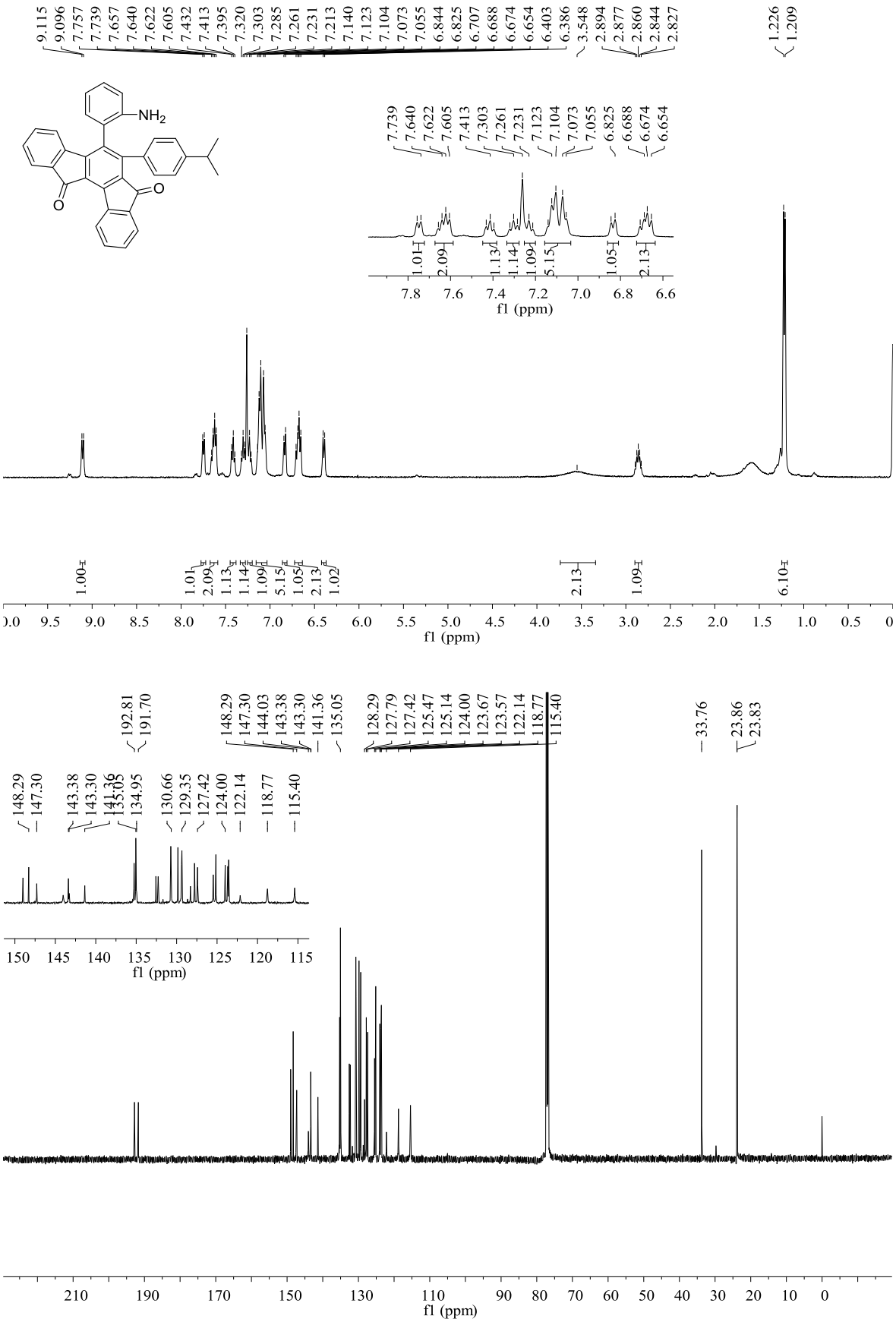




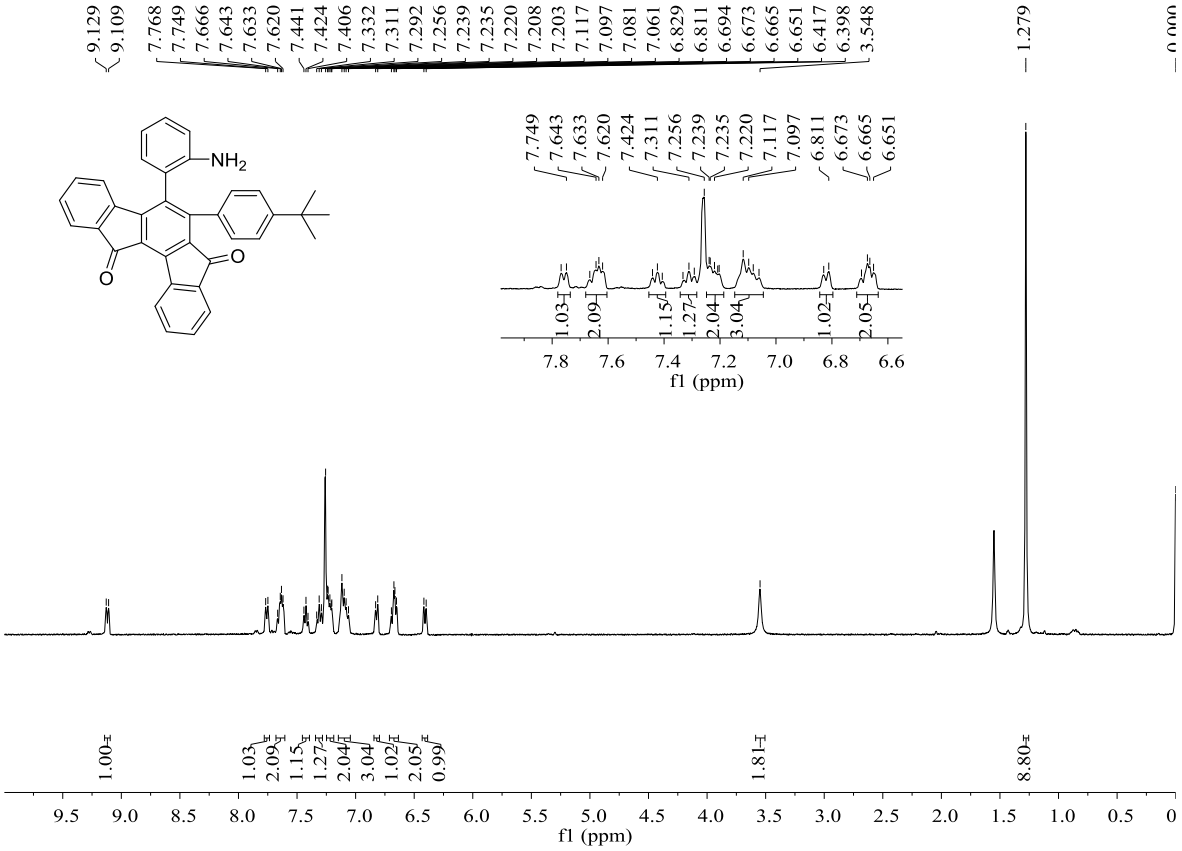
5-(2-Aminophenyl)-6-(4-nitrophenyl)indeno[1,2-*a*]fluorene-7,12-dione (2f):

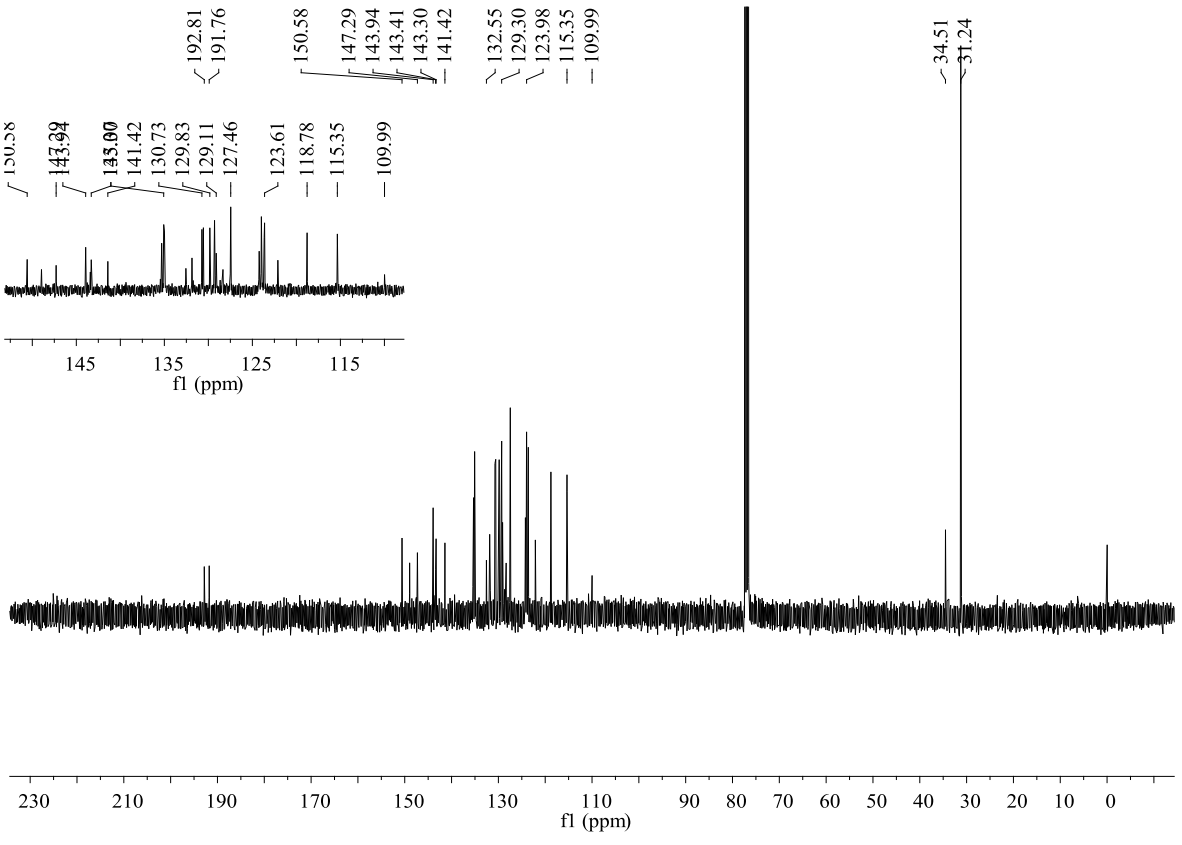


5-(2-Aminophenyl)-6-(4-isopropylphenyl)indeno[1,2-*a*]fluorene-7,12-dione (2g):

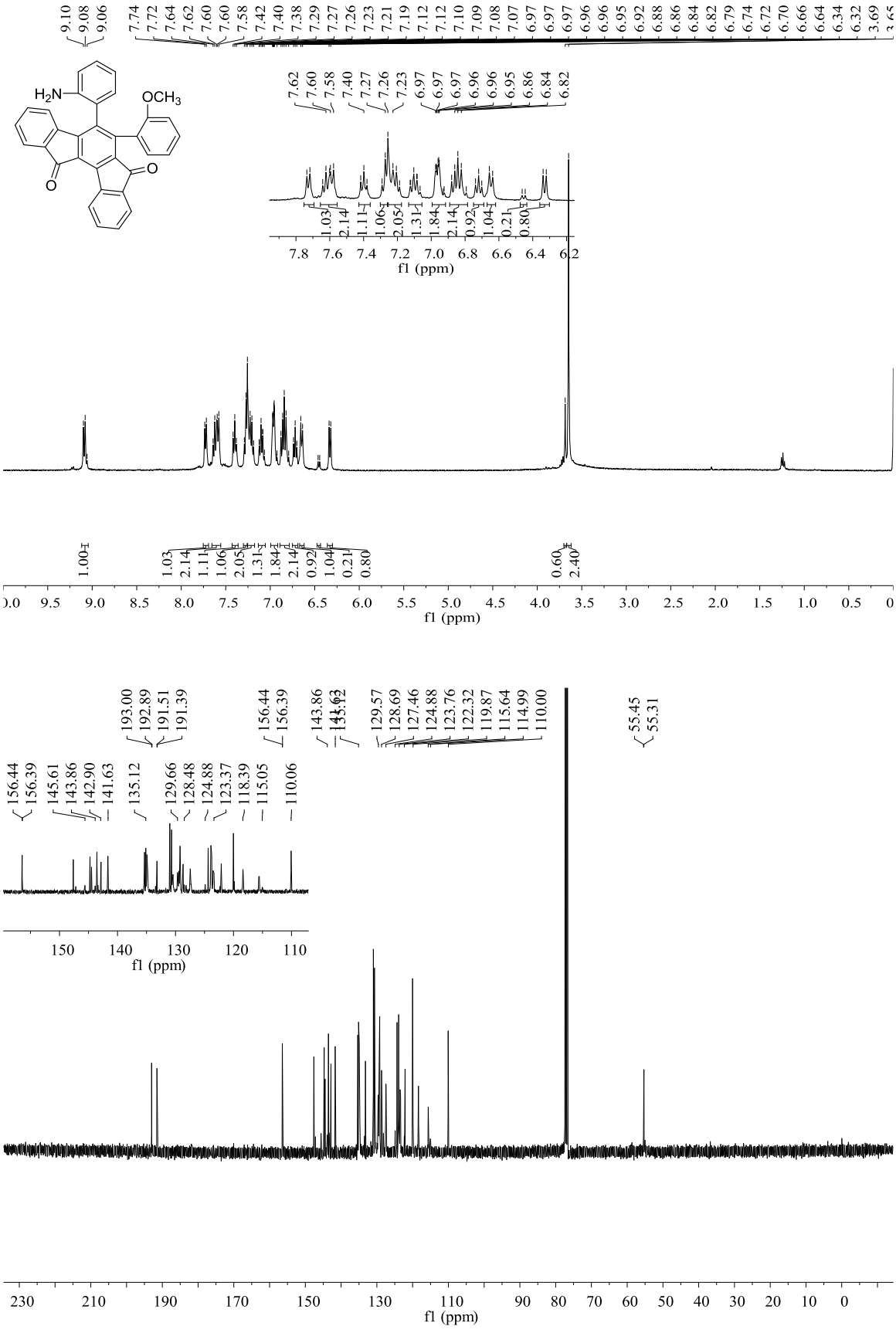


5-(2-Aminophenyl)-6-(4-(tert-butyl)phenyl)indeno[1,2-*a*]fluorene-7,12-dione (2h):

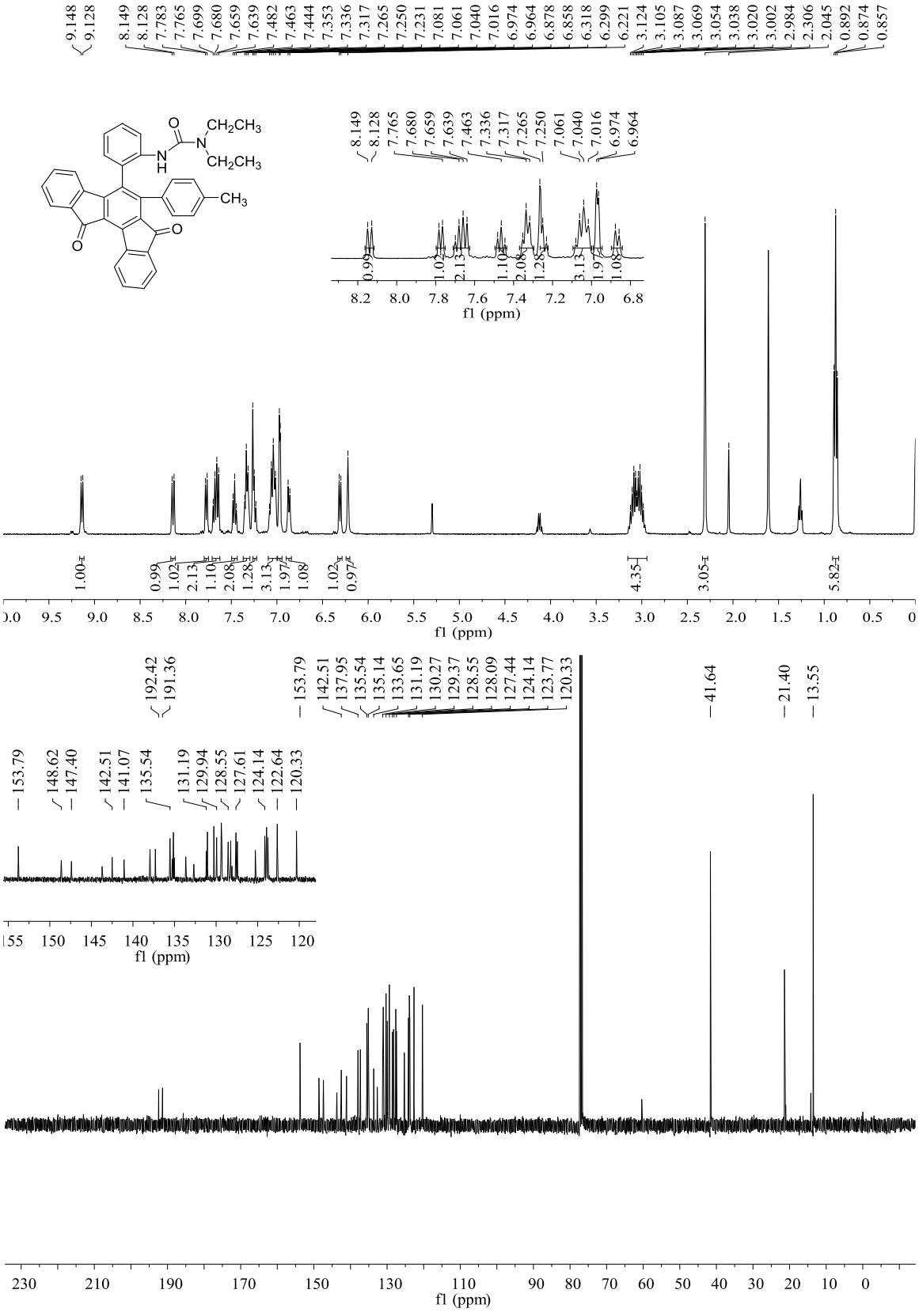




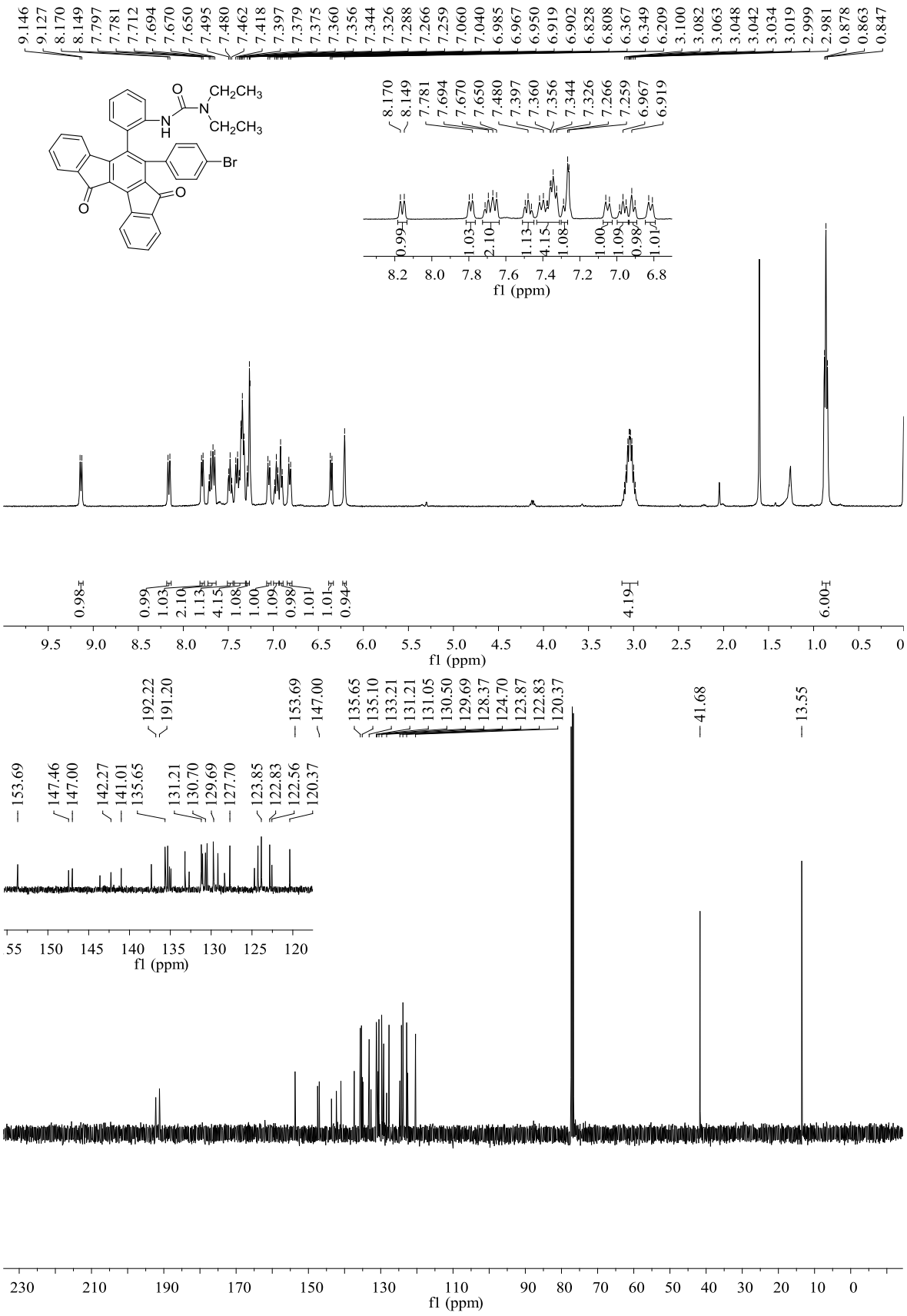
5-(2-Aminophenyl)-6-(2-methoxyphenyl)indeno[1,2-*a*]fluorene-7,12-dione (2i):



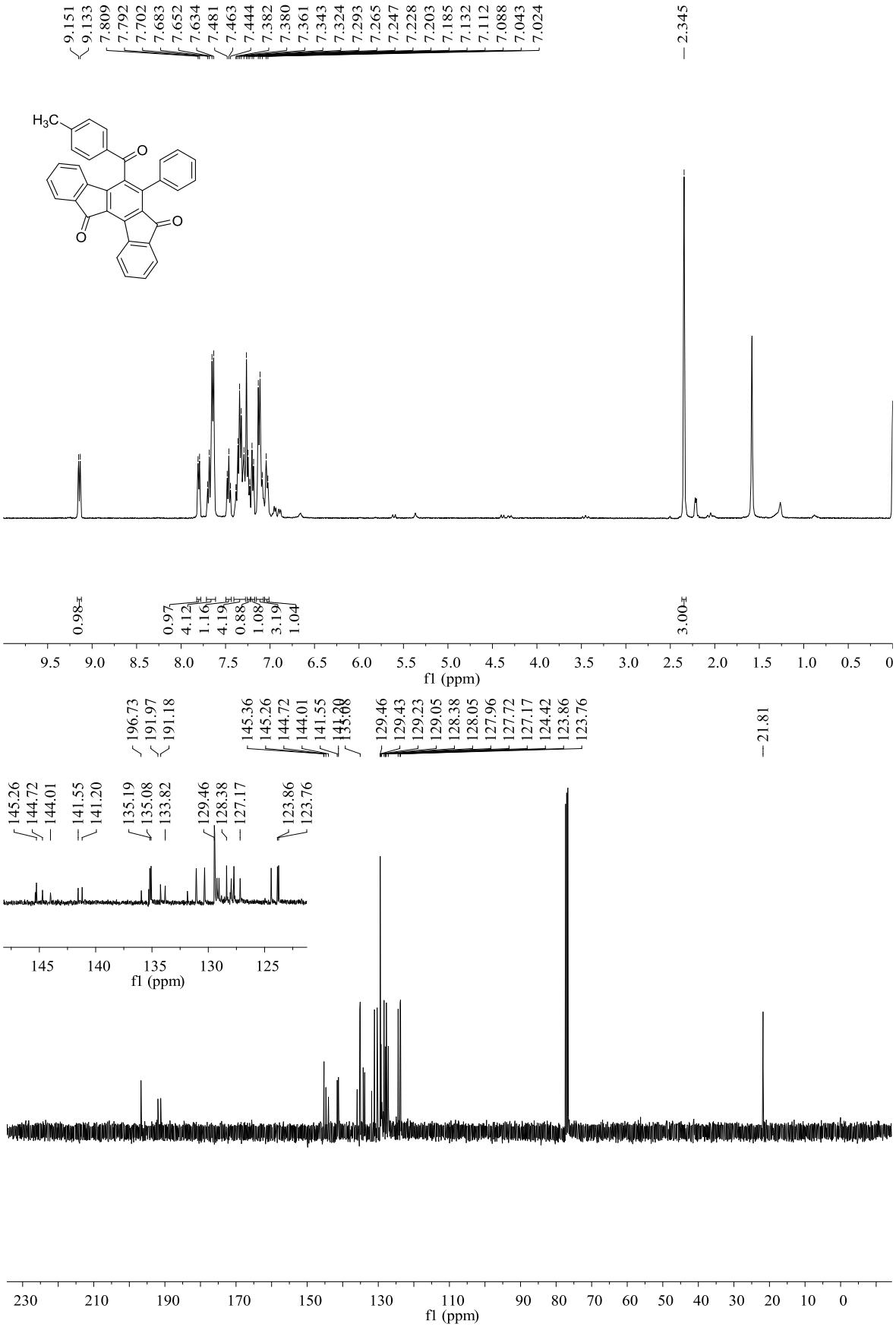
3-(2-(7,12-Dioxo-6-(*p*-tolyl)-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)-1,1-diethylurea (3a):



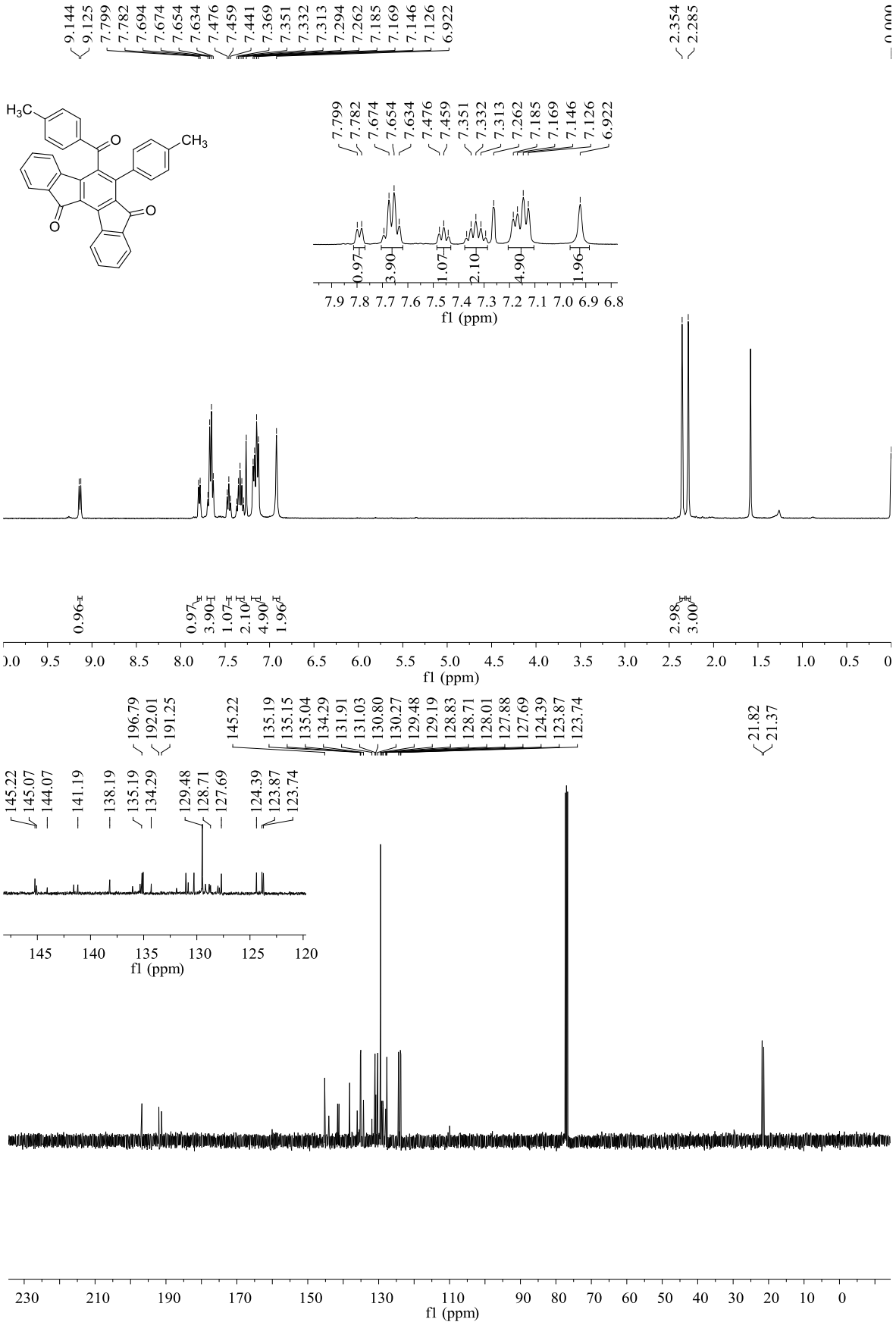
3-(2-(6-(4-Bromophenyl)-7,12-dioxo-7,12-dihydroindeno[1,2-*a*]fluoren-5-yl)phenyl)-1,1-diethylurea (3b):



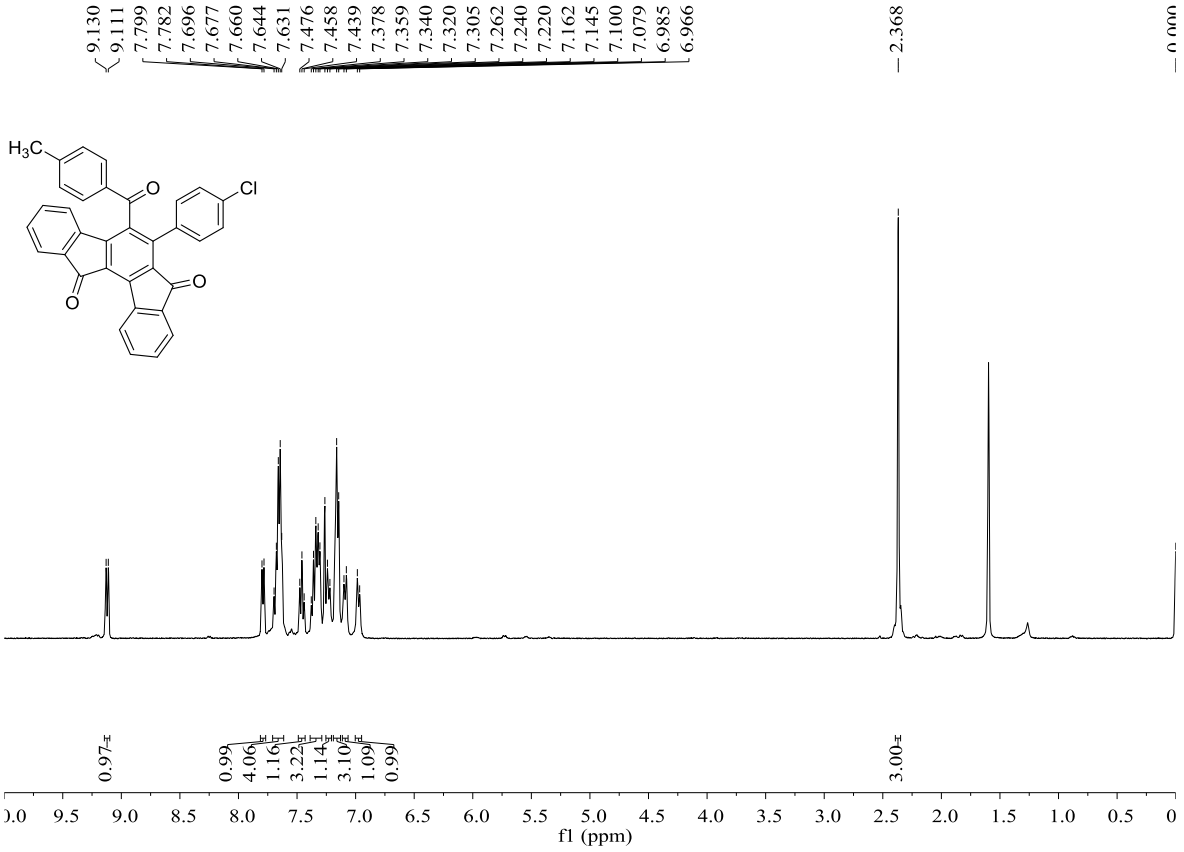
5-(4-Methylbenzoyl)-6-phenylindeno[1,2-*a*]fluorene-7,12-dione (4a):

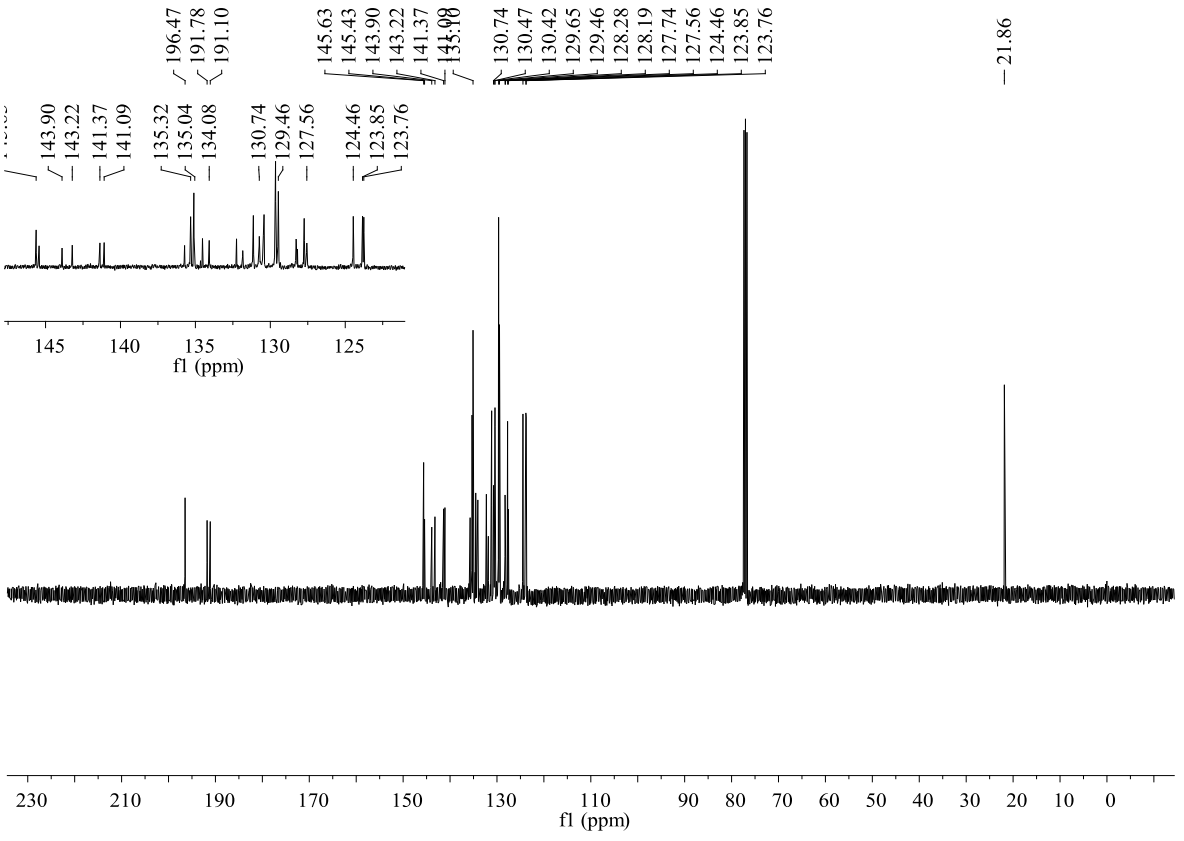


5-(4-Methylbenzoyl)-6-(*p*-tolyl)indeno[1,2-*a*]fluorene-7,12-dione (4b):

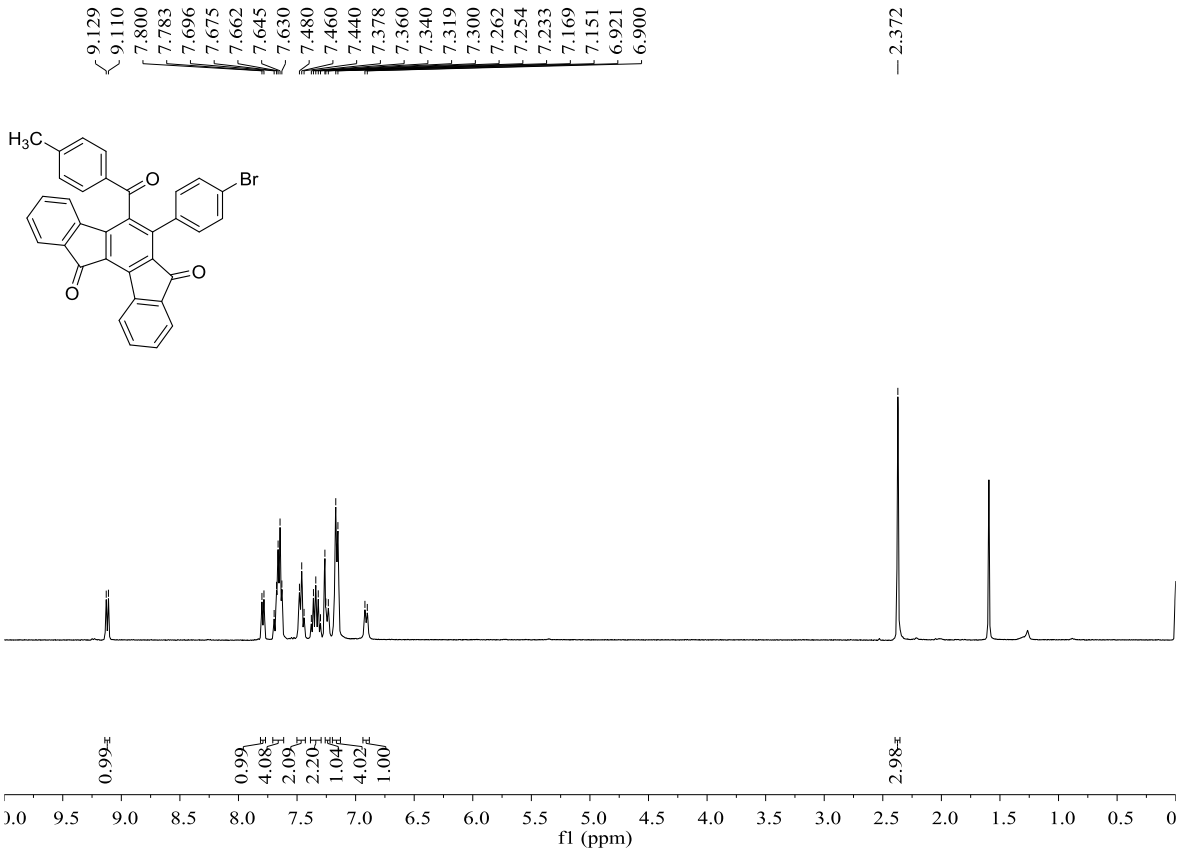


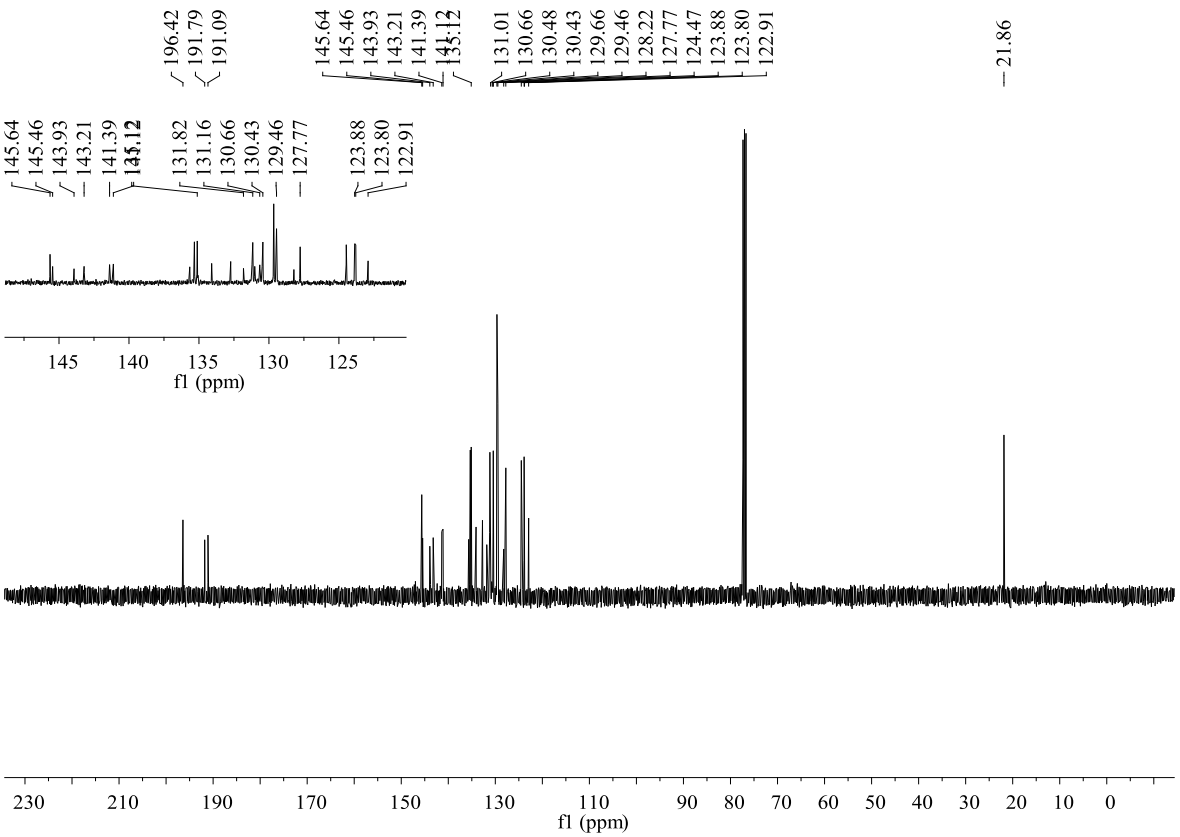
6-(4-Chlorophenyl)-5-(4-methylbenzoyl)indeno[1,2-*a*]fluorene-7,12-dione (4c):



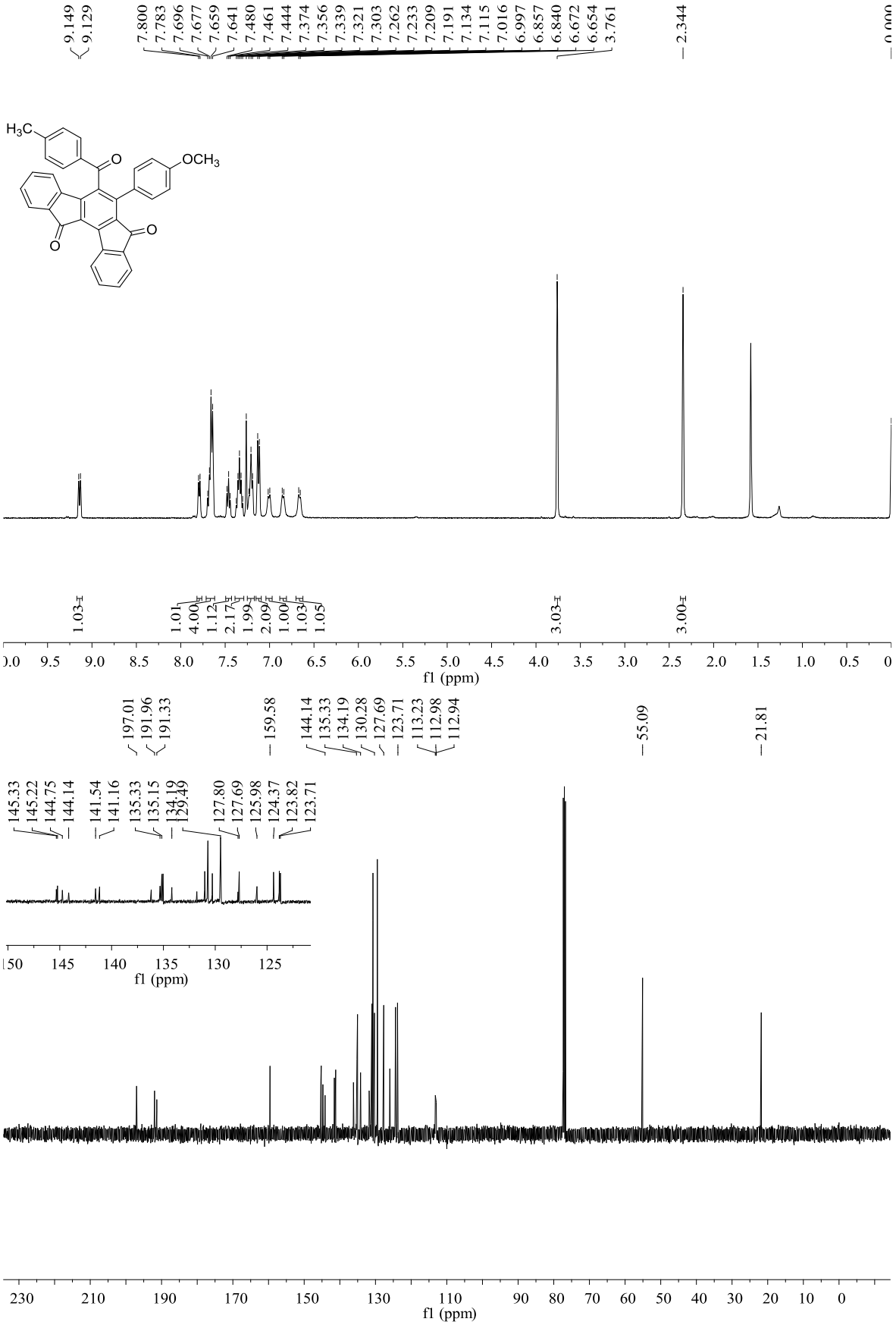


6-(4-Bromophenyl)-5-(4-methylbenzoyl)indeno[1,2-*a*]fluorene-7,12-dione (4d):

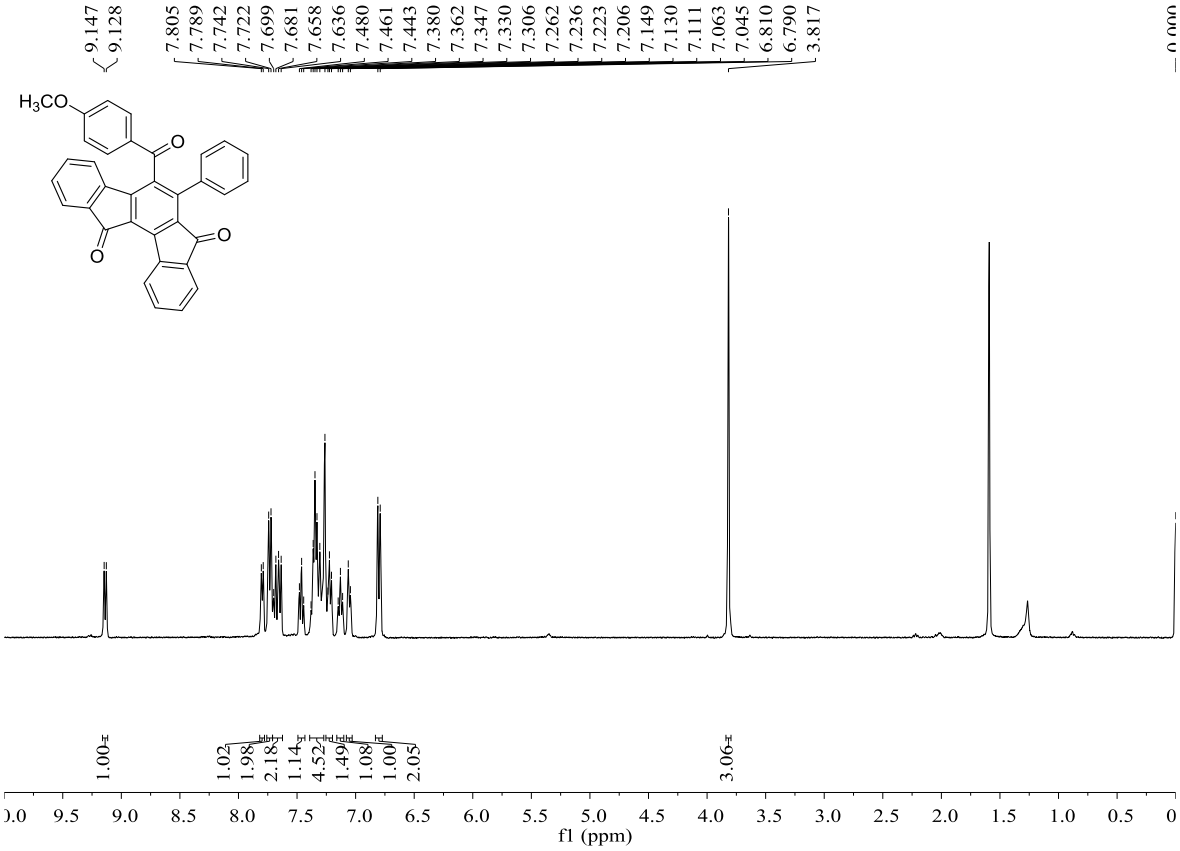


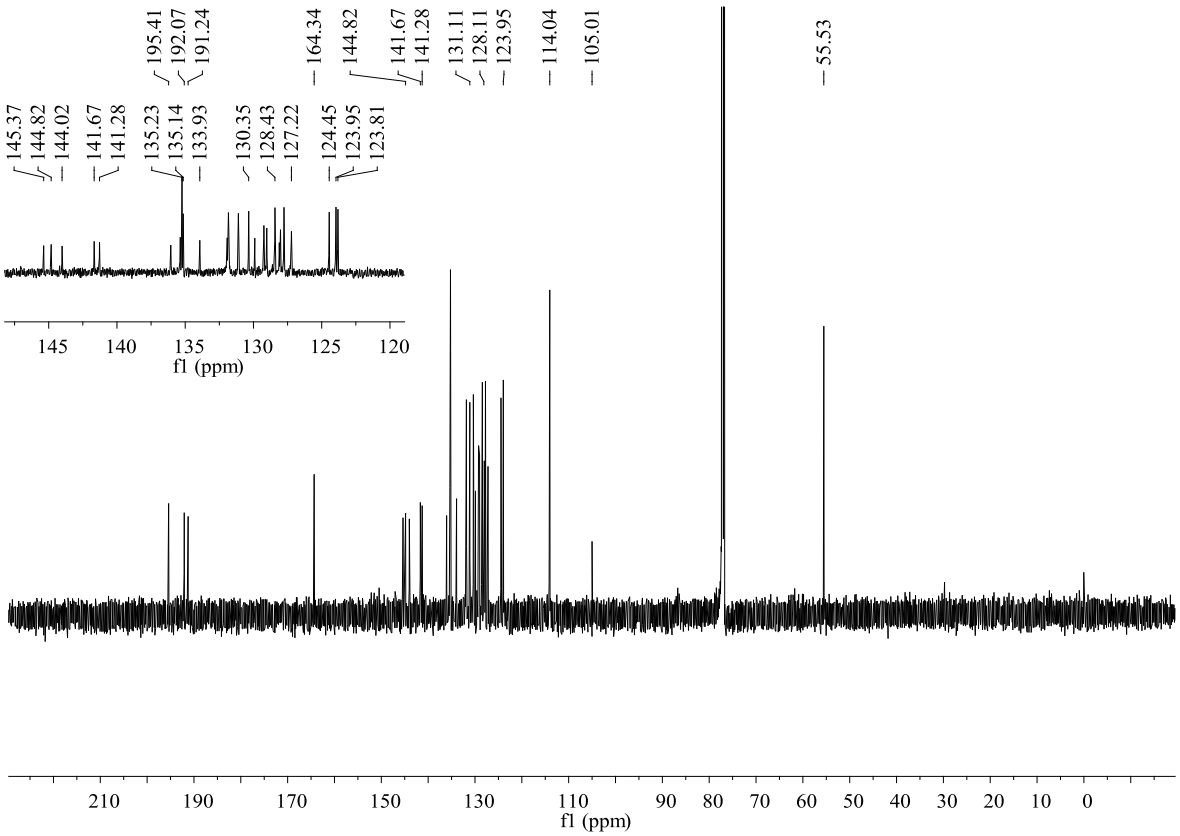


6-(4-Methoxyphenyl)-5-(4-methylbenzoyl)indeno[1,2-*a*]fluorene-7,12-dione (4e):

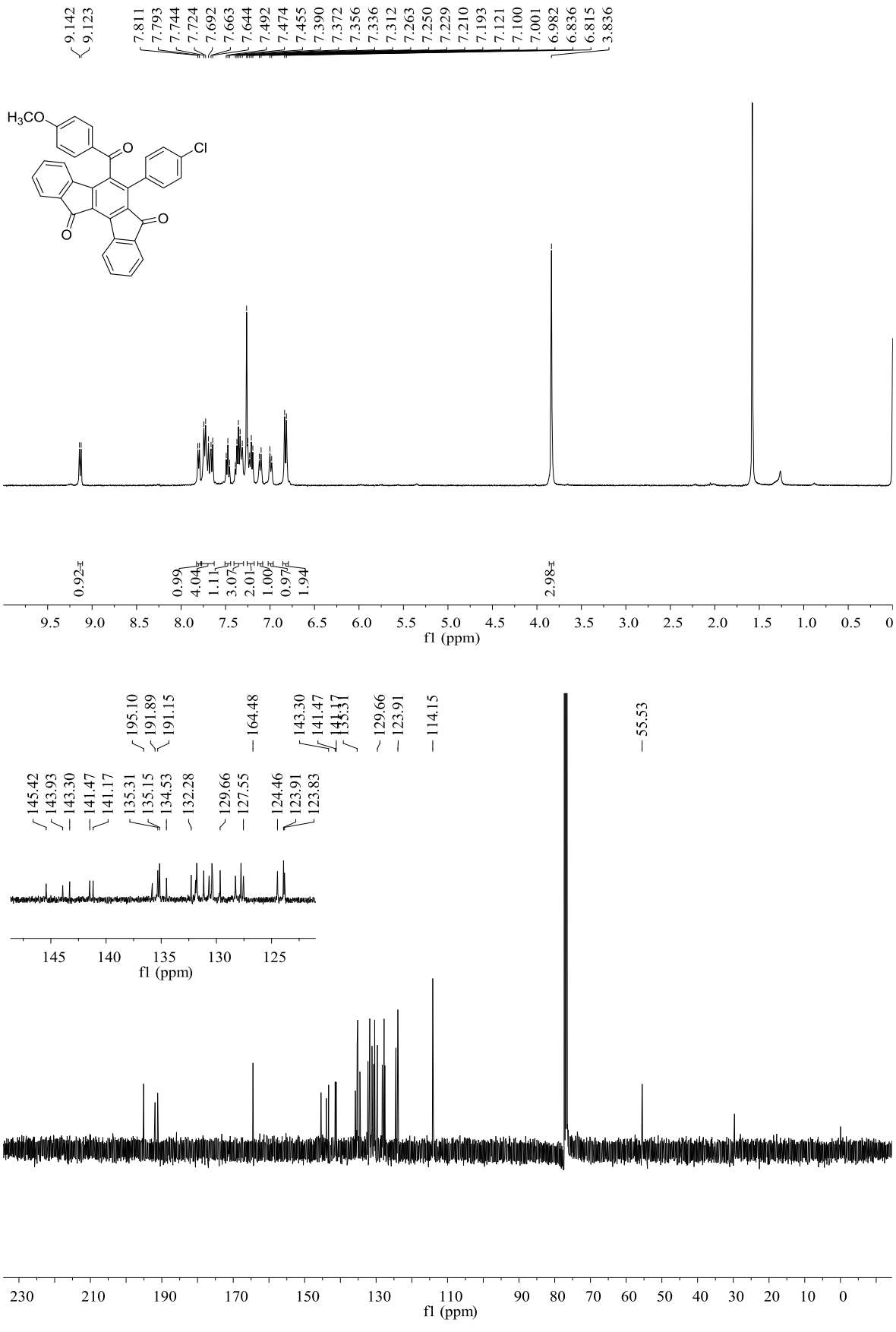


5-(4-Methoxybenzoyl)-6-phenylindeno[1,2-*a*]fluorene-7,12-dione (4f):

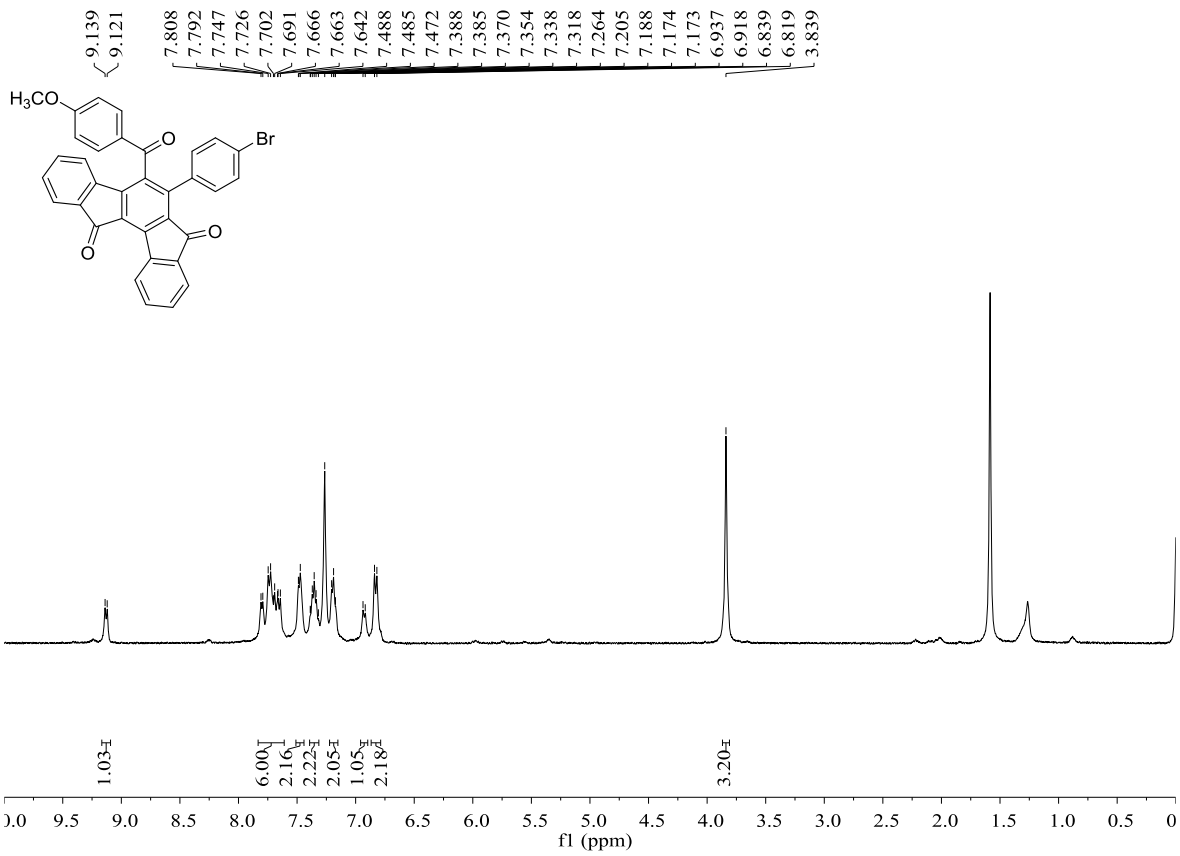


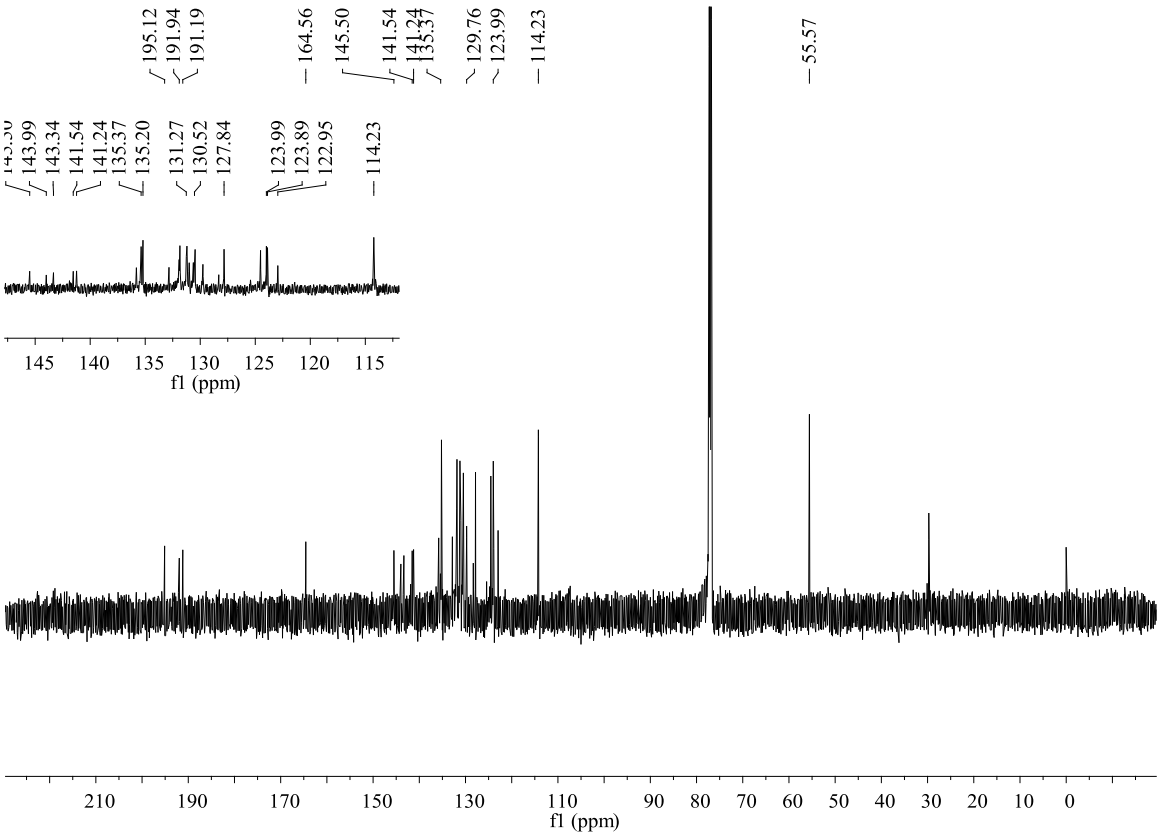


6-(4-Chlorophenyl)-5-(4-methoxybenzoyl)indeno[1,2-*a*]fluorene-7,12-dione (4g):

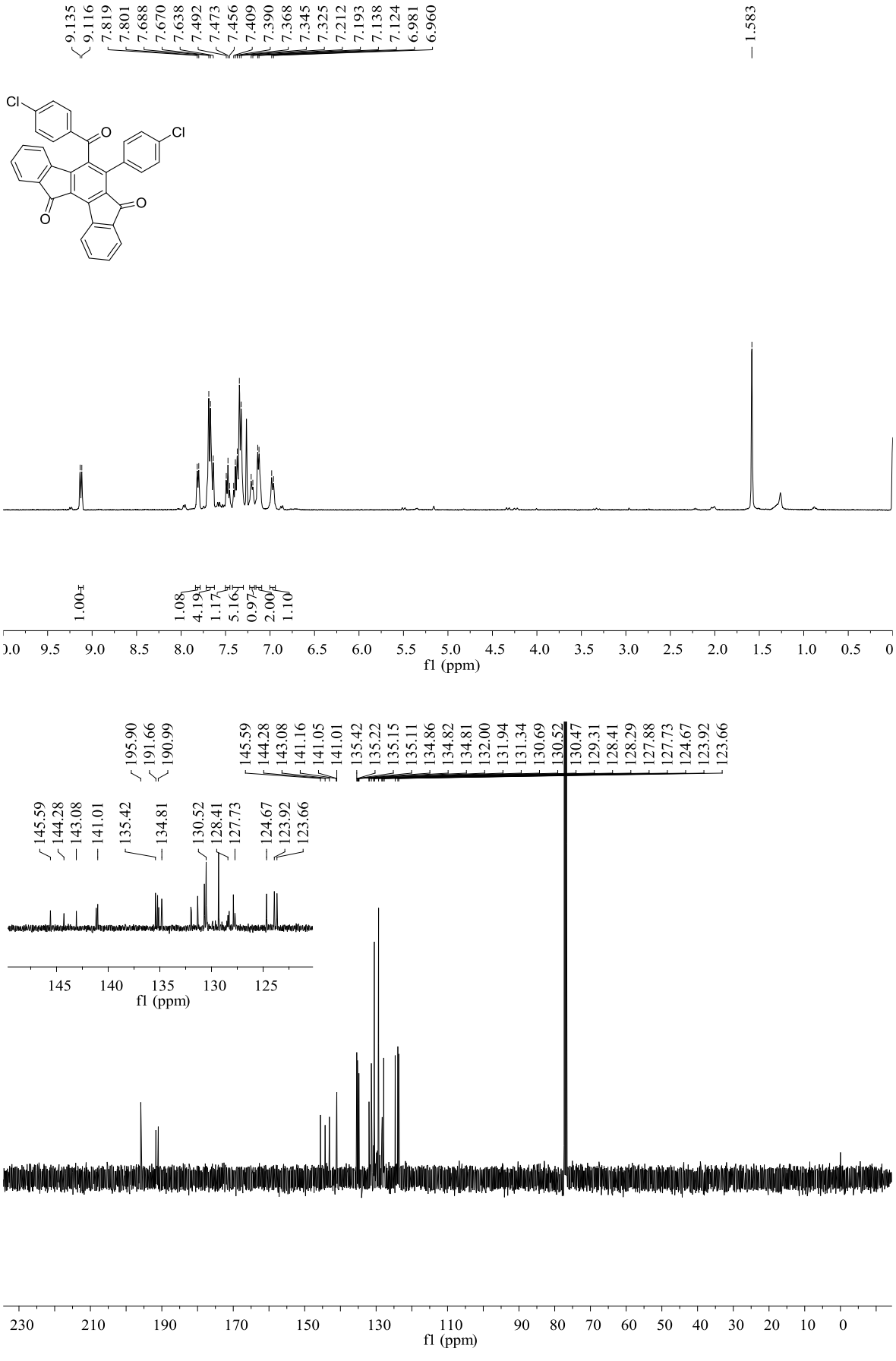


6-(4-Bromophenyl)-5-(4-methoxybenzoyl)indeno[1,2-*a*]fluorene-7,12-dione (4h):

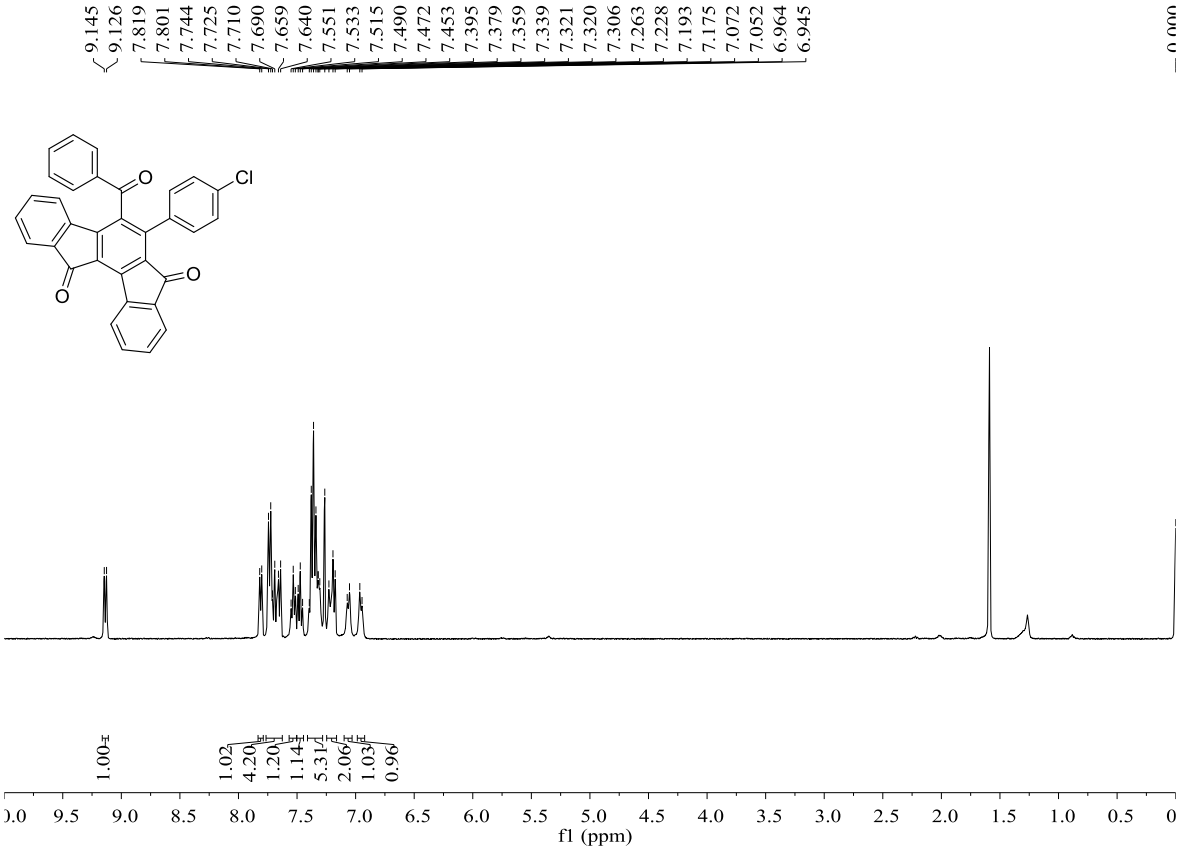


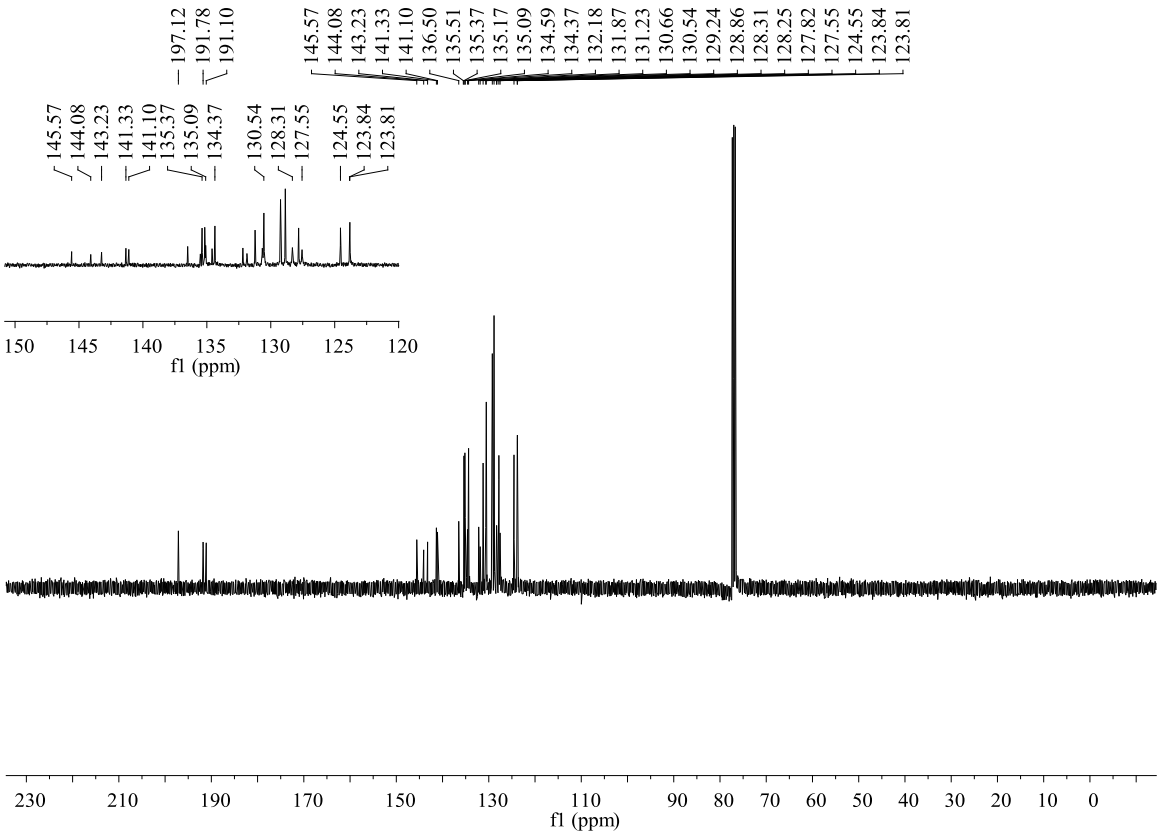


5-(4-Chlorobenzoyl)-6-(4-chlorophenyl)indeno[1,2-*a*]fluorene-7,12-dione (4i):

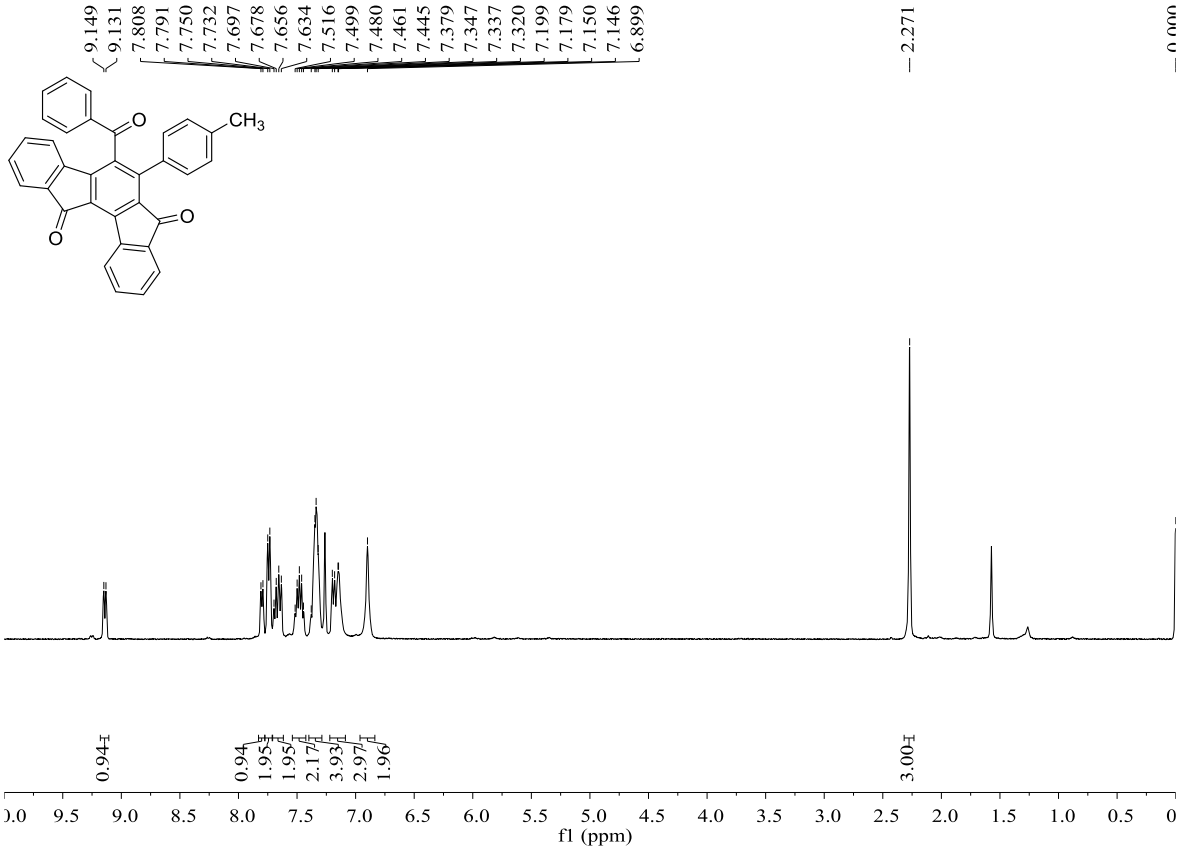


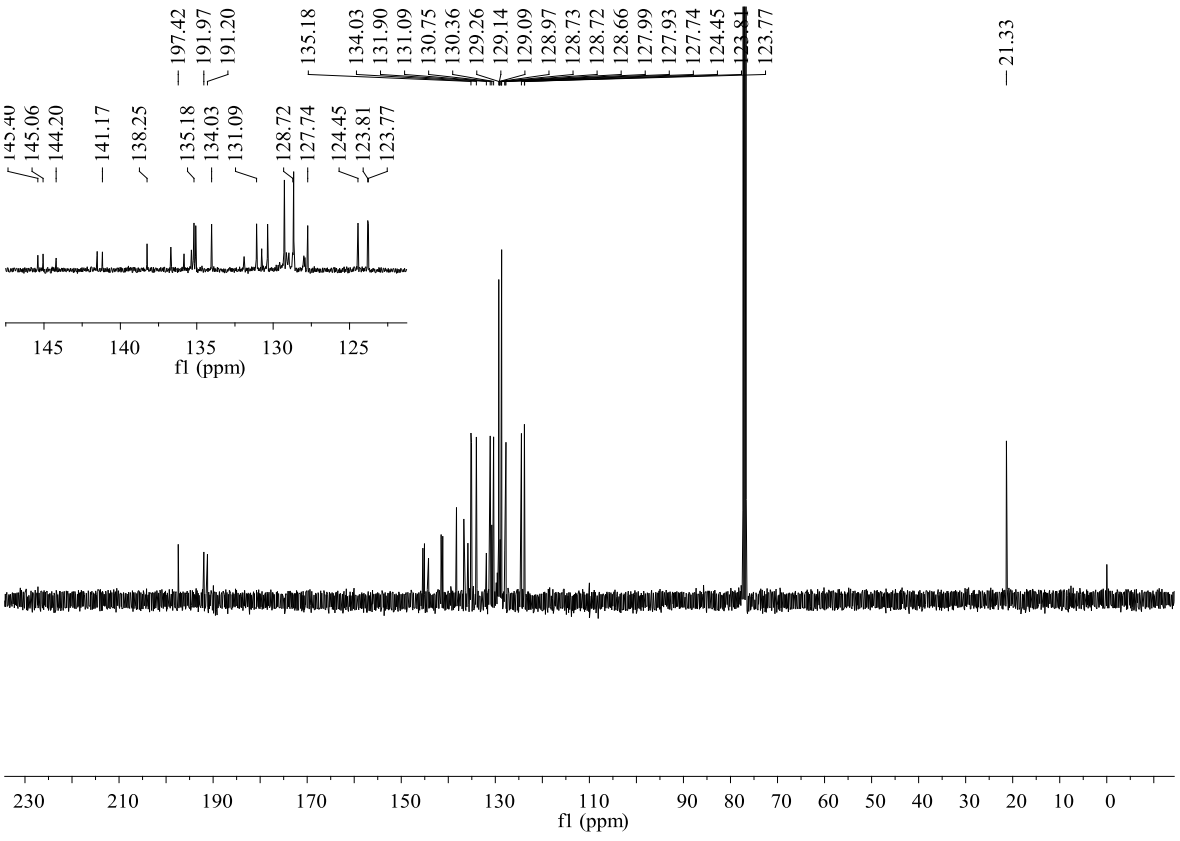
5-Benzoyl-6-(4-chlorophenyl)indeno[1,2-*a*]fluorene-7,12-dione (4j):



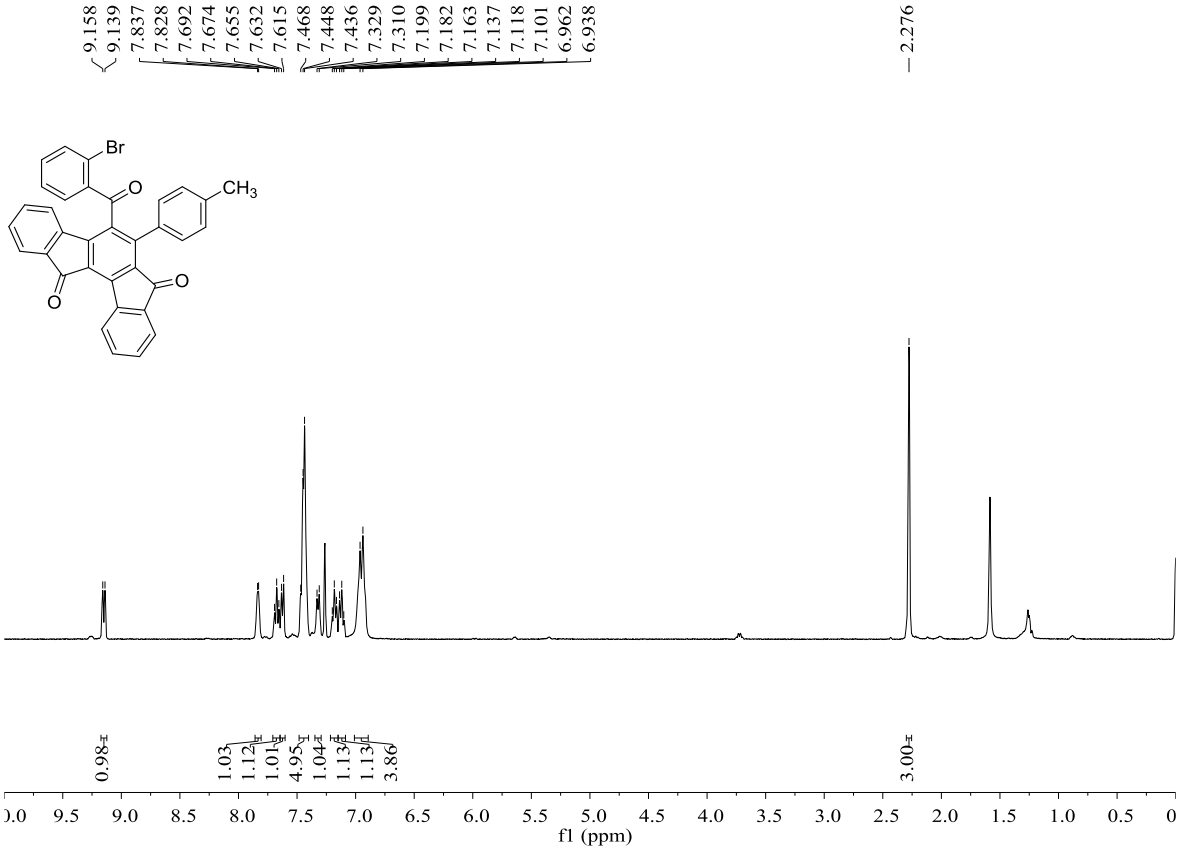


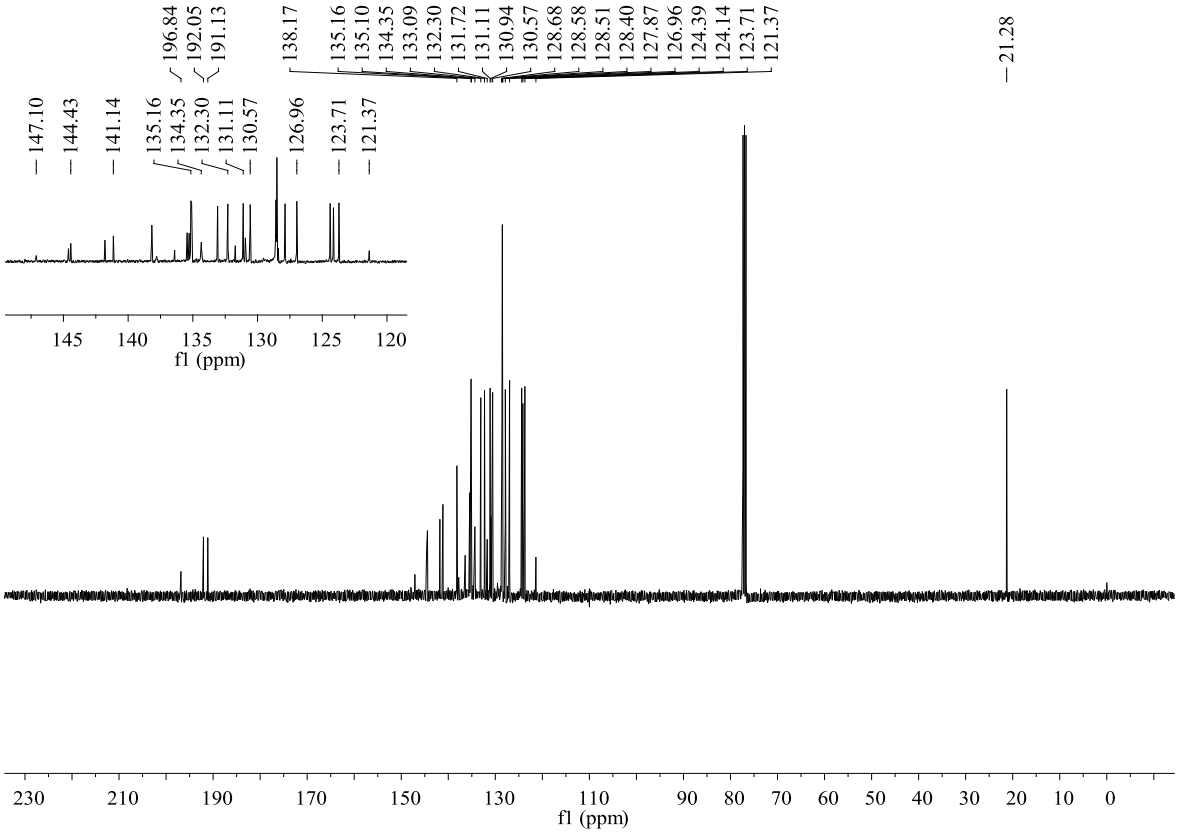
5-Benzoyl-6-(p-tolyl)indeno[1,2-*a*]fluorene-7,12-dione (4k):



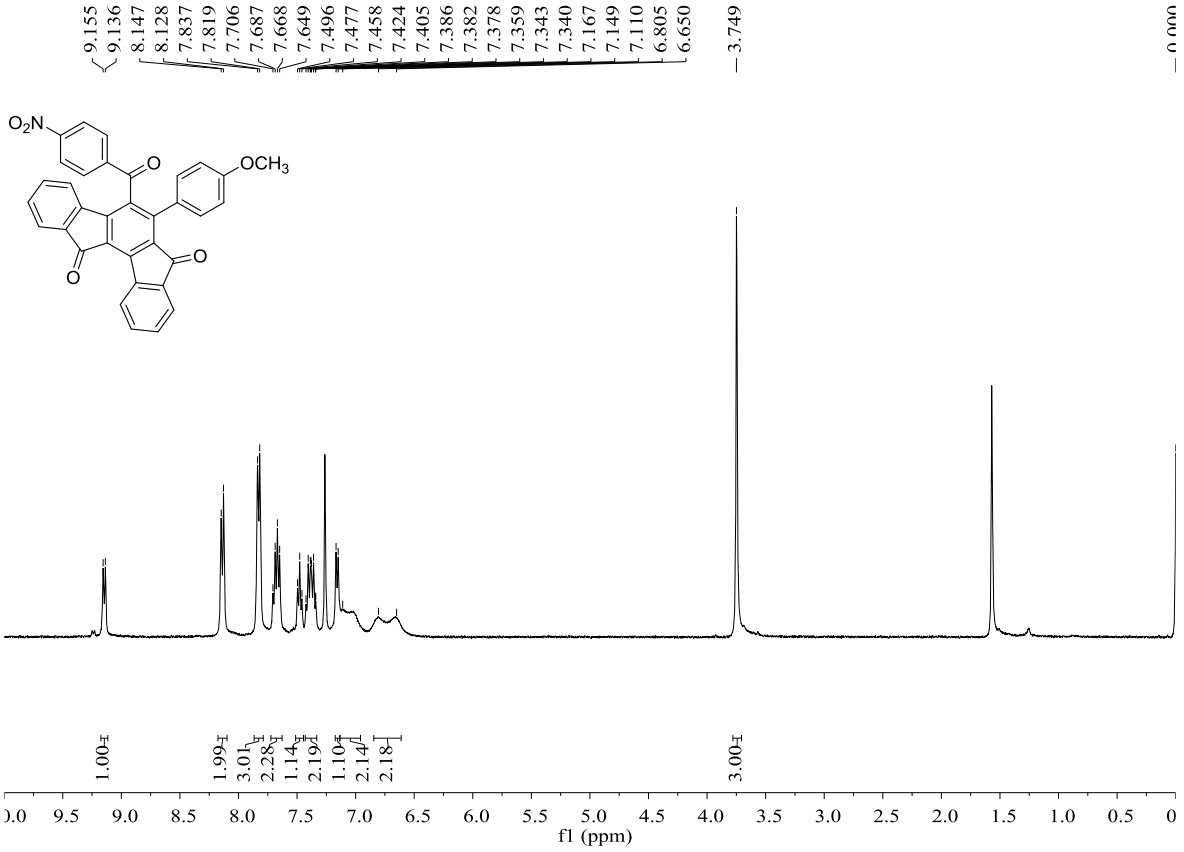


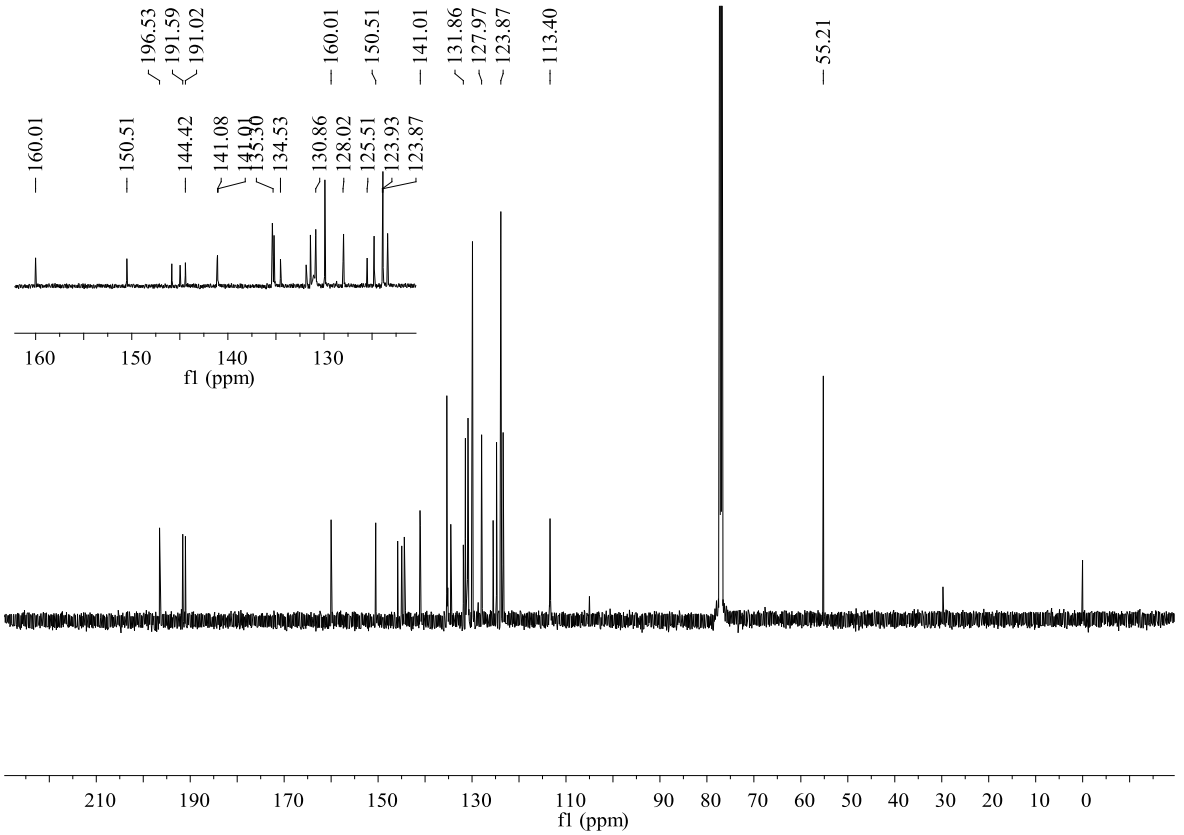
5-(2-Bromobenzoyl)-6-(*p*-tolyl)indeno[1,2-*a*]fluorene-7,12-dione (4l):



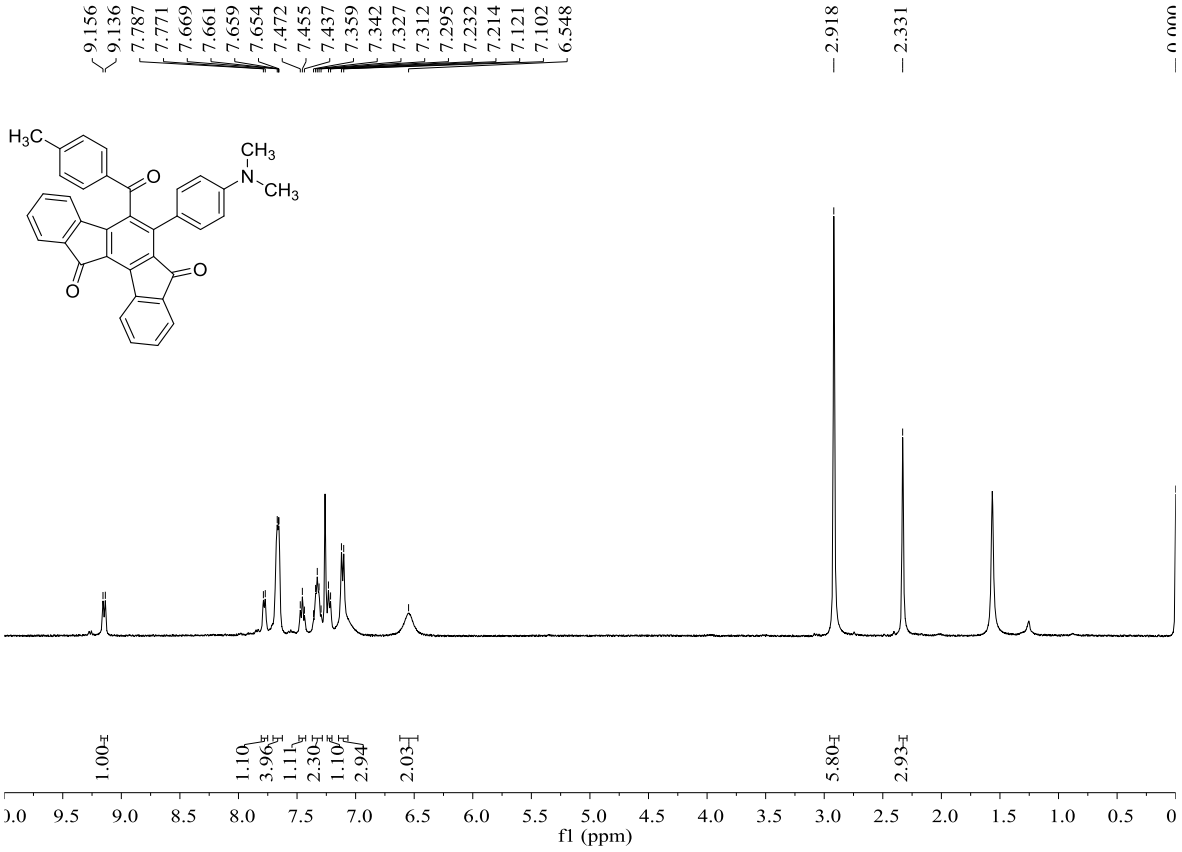


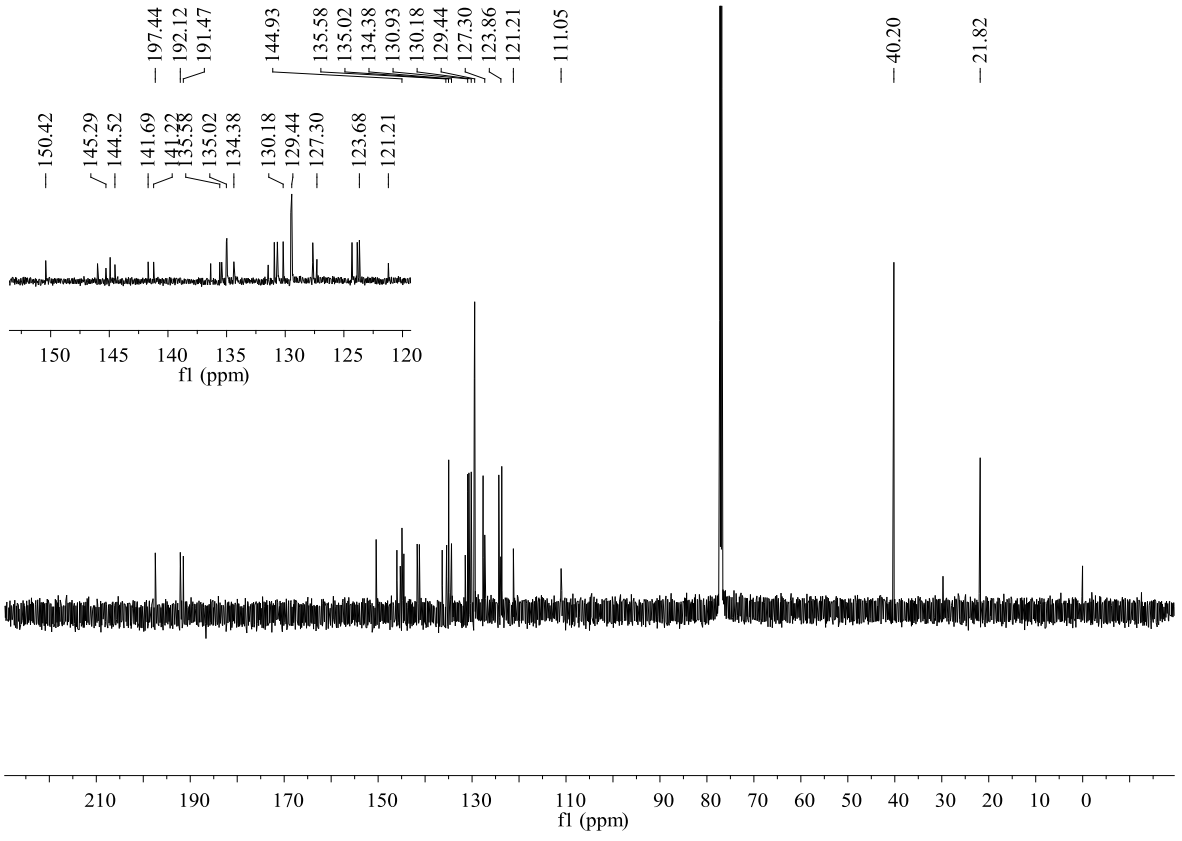
6-(4-Methoxyphenyl)-5-(4-nitrobenzoyl)indeno[1,2-*a*]fluorene-7,12-dione (4m):



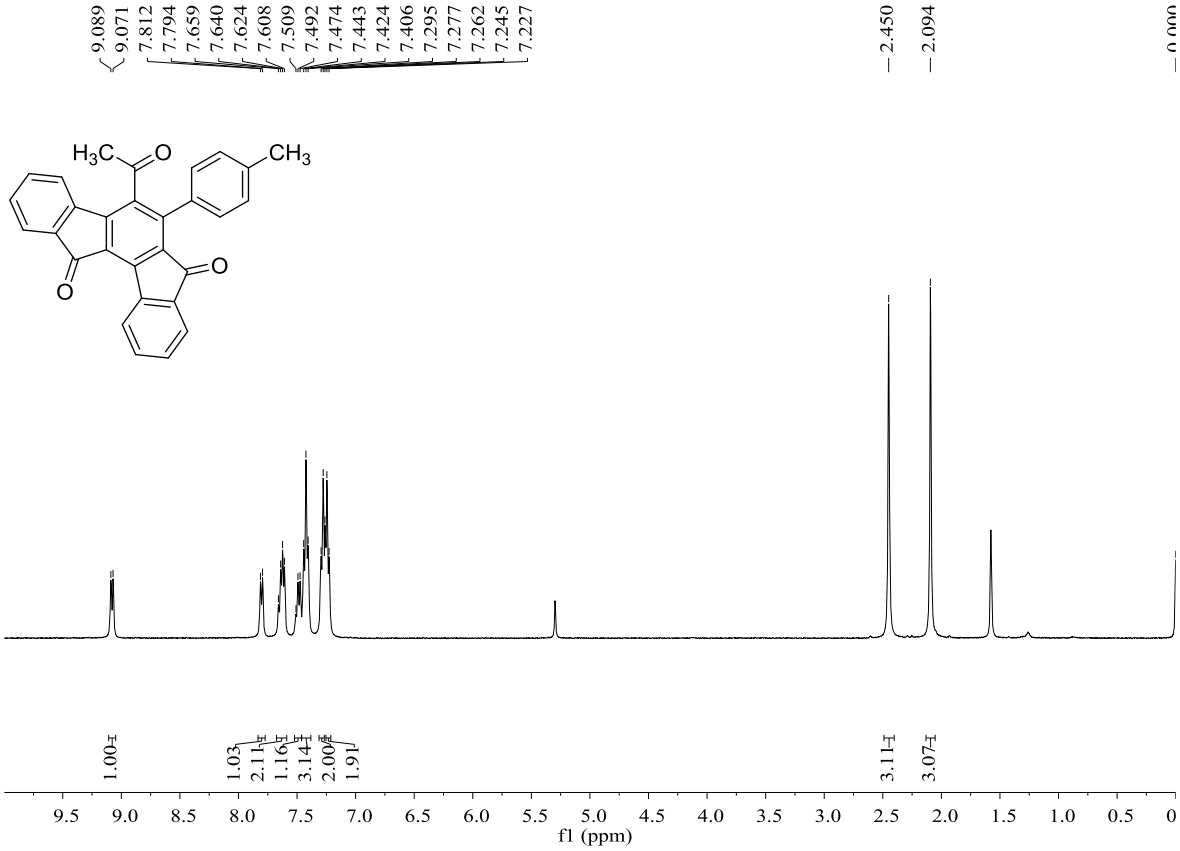


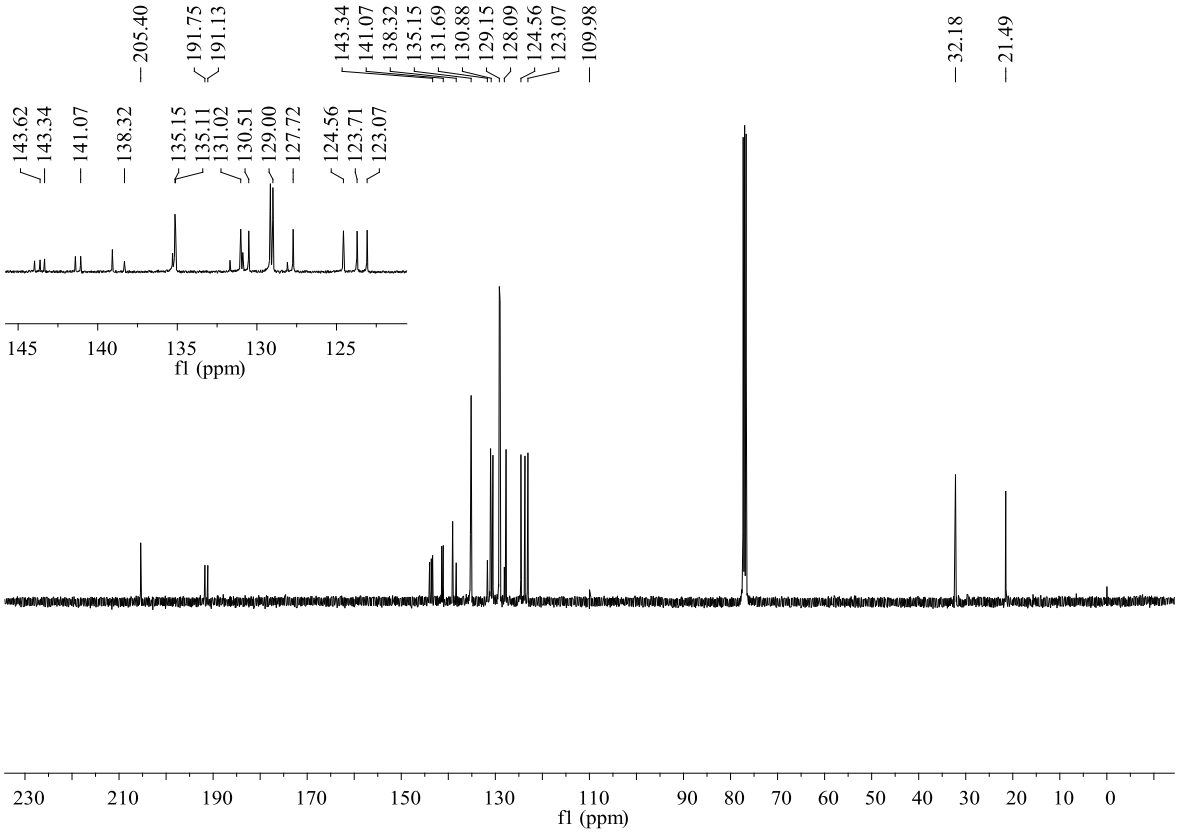
6-(4-(Dimethylamino)phenyl)-5-(4-methylbenzoyl)indeno[1,2-*a*]fluorene-7,12-dione (4n):





5-Acetyl-6-(*p*-tolyl)indeno[1,2-*a*]fluorene-7,12-dione (4o):





5-Acetyl-6-(4-bromophenyl)indeno[1,2-*a*]fluorene-7,12-dione (4p):