Supporting Information 1

Rh(I)-Catalyzed CO Gas-Free Carbonylative Cyclization Reactions of Alkynes with 2-Bromophenylboronic Acids Using Formaldehyde

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General Information. ^{1}H NMR and ^{31}P NMR were recorded on a JEOL JNM-ECP500 spectrometer in $CDCl_3$ using tetramethylsilane (0 ppm) as an internal standard and CD_2Cl_2 with phosphoric acid (0 ppm) as an external standard. ^{103}Rh NMR was recorded on a JEOL Lambda300WB spectrometer using CD_2Cl_2 with $[C_5M_5RhCl_2]_2$ (3678 ppm) as an external standard.[1] Data are reported as follows: chemical shift in ppm (δ), multiplicity (s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet, and c = complex), coupling constant (Hz), integration, and interpretation. Analytical GC was carried out on a HITACHI G-3900 gas chromatograph, equipped with a flame ionization detector. Column chromatography was performed using a SiO_2 (MERCK Silica gel 60).

Materials. $[RhCl(cod)]_2$ was prepared using the reported method.[2] 1,1'-(Bis(diphenylphosphino)-2,2'-binaphthyl (BINAP), 1,1'-bis(diphenylphosphino)-2,2'-biphenyl

(BIPHEP), 1,2-bis(diphenylphosphino)ethane (dppe), 1,3-bis(diphenylphosphino)propane (dppp), 1,4-bis(diphenylphosphino)butane (dppb), 1,1-bis(diphenylphosphino)ferrocene (dppf), and triphenylphosphine were purchased from Strem Chemicals Inc. Paraformaldehyde, which was purchased from Nacalai Tesque, Inc., was dried over P_2O_5 under vacuum, before it was used. 4-octyne (**1**), 1-phenyl-2-(trimethylsilyl)acetylene, 2-bromophenylboronic acid (**2**), 2-bromo-4,5-difluorophenylboronic acid, 2-bromo-6-fluorophenylboronic acid, 2-chlorophenylboronic acid, and 3-methoxyphenylboronic acid were purchased from Aldrich Chemical Co. Diphenyl acetylene and 1-phenyl-1-butyne were purchased from Tokyo Kasei Kogyo Co. 1,4-Dioxane (dehydrated), sodium carbonate, 1-phenyl-1-propyne, 1-(trimethylsilyl)-1-propyne, methyl propiolate, ethyl 3-(trimethylsilyl)propiolate and 2,5-dichlorophenylboronic acid were purchased from Wako Pure Chemical Industries, Ltd. 2-Bromo-5-methoxyphenylboronic acid was prepared using a method reported by Kuivila.[3]

^{31}P NMR Experiments. All the operations were conducted in a glove-box. The ^{31}P NMR analysis revealed that the treatment of 10 μmol of $[RhCl(cod)]_2$ with 4 μmol of BINAP in 0.65 mL of CD_2Cl_2 afforded a doublet signal at 49.5 ppm (d, $J_{P\text{-}Rh}$ = 199 Hz). The signal was consistent with that of $[RhCl(BINAP)]_2$, which was prepared using the reported method.[4] See the page S1-9.

^{103}Rh NMR experiments. All the operations were conducted in a glove-box. It was clarified that, from ^{103}Rh NMR, the treatment of 0.406 mmol of $[RhCl(cod)]_2$ with 0.162 mmol of BINAP in 0.65 mL of CD_2Cl_2 and 4 mL of CH_2Cl_2 afforded two signals: one was the singlet at 2438 ppm and the other was the triplet at 1620 ppm ($J_{Rh\text{-}P}$ = 199 Hz), as shown in page S1-10 and 11. Although the ^{103}Rh NMR analysis of $[RhCl(BINAP)]_2$ failed because of extremely low solubility in all solvents tested ($CHCl_3$, CH_2Cl_2, acetone, benzene, and toluene), the latter could be assigned to that of $[RhCl(BINAP)]_2$ from its coupling constant.

Typical Procedure for an Rh(I)-Catalyzed Carbonylative Cyclization Reaction of Alkynes with 2-Bromoarylboronic Acid Using Paraformaldehyde (Table 1, entry 2). In a 7-mL screw-capped tube were placed 4-octyne (110 mg, 1 mmol), 2-bromophenylboronic acid (602 mg, 3 mmol), $[RhCl(cod)]_2$ (12.3 mg, 0.025 mmol), BINAP (6.23 mg, 0.01 mmol), Na_2CO_3 (212 mg, 2 mmol), and 1,4-dioxane/water (100/1, 2 mL). The mixture was then degassed, charged with N_2, sealed, and stirred at 100 °C. After 30 h, the reaction mixture was filtered, and the filtered cake was washed with ethyl acetate (10 mL X 3). The combined filtrates were concentrated in vacuo, and the residue was purified by column chromatography on silica-gel (eluent; hexane/AcOEt=30/1) to give 2,3-dipropyl-1H-indene-1-one (**2**) (R_f 0.20, 178 mg, 0.83 mmol) in 83% yield as yellow oil.

Procedure for an Rh(I)-Catalyzed Carbonylative Cyclization Reaction of 2-Bromophenyl(trimethylsilyl)acetylene (21) with Phenylboronic Acid Using Paraformaldehyde (Scheme 3). In a 7-mL screw-capped tube were placed 2-bromophenyl(trimethylsilyl)acetylene (**21**) (253 mg, 1 mmol), phenylboronic acid (366 mg, 3 mmol), $[RhCl(cod)]_2$ (12.3 mg, 0.025 mmol), BINAP (6.23 mg, 0.01 mmol), Na_2CO_3 (212 mg, 2 mmol), styrene (208 mg, 2 mmol), and 1,4-dioxane/water (100/1, 2 mL). The mixture was then degassed, charged with N_2, sealed, and stirred at 100 °C. After 30 h, the reaction mixture was filtered, and the filtered cake was washed with ethyl acetate (10 mL X 3). The combined filtrates were concentrated in vacuo, and the residue was purified by column chromatography on silica-gel (eluent; hexane/AcOEt=20/1) to give 3-phenyl-2-(trimethylsilyl)-1*H*-inden-1-one **(8)** (R_f 0.30, 161 mg, 0.58 mmol) in 58% yield as yellow oil.

Products. All the compounds are known and their spectral data were compared with those of authentic specimen.[5-8] Their ^1H and ^{13}C NMR data are shown as follows:

2,3-Dipropyl-1*H*-inden-1-one (2).[5] Yellow oil. R_f 0.20 (hexane/AcOEt = 30/1). ^1H NMR ($CDCl_3$) δ: 0.94 (t, J = 7.3 Hz, 3H), 1.03 (t, J = 7.3Hz, 3H), 1.65 (qt, J = 7.3 Hz, 7,6 Hz, 2H), 2.24 (qt, J = 7.3 Hz, 7.6 Hz, 2H), 2.53 (t, J = 7.6 Hz, 2H), 2.40 (t, J = 7.6 Hz, 2H), 7.03 (dd, J = 1.2 Hz, 7.3 Hz, 1H), 7.15

(ddd, J = 1.2 Hz, 7.3 Hz, 7.3 Hz, 1H), 7.30 (ddd, J = 1.2 Hz, 7.3 Hz, 7.3 Hz, 1H), 7.37 (d, J = 7.3 Hz, 1H). ^{13}C NMR ($CDCl_3$) δ: 14.1, 14.3, 21.2, 22.4, 24.8, 28.2, 118.9, 121.6, 127.8, 131.1, 133.1, 134.8, 145.6, 157.6, 198.7.

2,3-Diphenyl-1*H*-inden-1-one (4).[6] Orange solid. R_f 0.18 (hexane/AcOEt = 20/1). ^{1}H NMR ($CDCl_3$) δ: 7.11 (d, J = 7.3 Hz, 1H), 7.21-7.25 (c, 6H), 7.31-7.37 (c, 6H), 7.55 (d, J = 7.3 Hz, 1H). ^{13}C NMR ($CDCl_3$) δ: 121.2, 122.9, 127.7, 128.0, 128.7, 128.9, 129.2, 129.9, 130.1, 132.3, 133.4, 145.1, 155.2, 196.1.

3-Methyl-2-phenyl-1*H*-inden-1-one (5).[7] Orange solid. R_f 0.20 (hexane/AcOEt = 20/1). ^{1}H NMR ($CDCl_3$) δ: 2.33 (s, 3H), 7.17 (d, J = 7.3 Hz, 1H), 7.27 (dd, J = 6.7 Hz, 7.3 Hz, 1H), 7.35 (dddd, J = 1.9 Hz, 1.9 Hz, 6.7 Hz, 6.7 Hz, 1H), 7.41-7.46 (c, 5H), 7.49 (d, J = 7.3 Hz, 1H). ^{13}C NMR ($CDCl_3$) δ: 12.4, 119.3, 121.8, 127.5, 128.1, 128.7, 129.3, 130.1, 131.0, 133.1, 145.6, 154.6, 196.2.

3-Butyl-2-phenyl-1*H*-inden-1-one (6) and **2-butyl-3-phenyl-1*H*-inden-1-one (6').**[8] Orange oil. R_f 0.28 (hexane/AcOEt = 20/1). ^{1}H NMR ($CDCl_3$) δ: [0.84 (t, J = 7.3 Hz, 3H, **6'**), 0.93 (t, J = 7.3 Hz, 3H, **6**)], [1.27-1.50 (c, 4H, **6'**), 1.44 (tq, J = 7.3 Hz, 7.4 Hz, 2H, **6**), 1.68 (tt, J = 7.4 Hz, 8.2 Hz, 2H, **6**)], [2.34 (t, J = 7.9 Hz, 2H, **6'**), 2.71 (t, J = 8.2 Hz, 2H, **6**)], [7.00 (d, 1H, **6'**), 7.24-7.51 (c, 9H, **6** and c, 8H, **6'**)]. ^{13}C NMR ($CDCl_3$) δ: 13.6, 22.6 (**6'**), 22.8, 26.3, 30.1, 31.2 (**6'**), 119.7, 120.3 (**6'**), 122.0, 122.1 (**6'**), 127.4, 127.5 (**6'**), 128.0 (**6'**), 128.5, 128.9, 129.2 (**6**+**6'**), 130.5, 130.7 (**6'**), 131.1, 132.6 (**6'**), 132.9 (**6'**), 133.0, 133.3, 135.2 (**6'**), 144.9, 145.6 (**6'**), 154.8 (**6'**), 158.7, 196.4, 198.0 (**6'**).

3-Methyl-2-(trimethylsilyl)-1*H*-inden-1-one (7).[8] Orange solid. R_f 0.28 (hexane/AcOEt = 20/1). ^{1}H NMR ($CDCl_3$) δ: 0.29 (s, 9H), 2.30 (s, 3H), 7.13 (d, J = 7.3 Hz, 1H), 7.24 (dd, J = 6.7 Hz, 7.9 Hz, 1H), 7.37 (dd, J = 6.7 Hz, 7.3 Hz, 1H), 7.40 (d, J = 6.7 Hz, 1H). ^{13}C NMR ($CDCl_3$) δ: -0.3, 14.3, 118.7, 121.1, 128.7, 132.2, 132.7, 147.0, 168.8, 201.6.

3-Phenyl-2-(trimethylsilyl)-1*H*-inden-1-one (8).[5] Orange oil. R_f 0.30 (hexane/AcOEt = 20/1). ^{1}H NMR($CDCl_3$) δ: 0.05 (s, 9H), 6.89 (d, *J* = 6.7 Hz, 1H), 7.24-7.50 (c, 8H). ^{13}C NMR ($CDCl_3$) δ: -0.2, 120.7, 122.1, 127.5, 128.2, 128.9, 129.0, 132.2, 132.8, 134.6, 134.8, 147.1, 170.6, 201.6.

1-Oxo-3-Phenyl-1*H*-indene-2-carboxylic acid methyl ester (9_{major}).[8] Yellow solid. R_f 0.20 (hexane/AcOEt = 5/1). ^{1}H NMR ($CDCl_3$) δ: 3.75 (s, 9H), 7.20 (m, 1H), 7.41-7.62 (c, 8H). ^{13}C NMR ($CDCl_3$) δ: 51.8, 123.3, 123.4, 128.0, 128.3, 130.3, 130.5, 131.1, 131.2, 133.5, 142.9, 163.3, 165.6, 191.9.

1-Oxo-2-Phenyl-1*H*-indene-3-carboxylic acid methyl ester (9_{minor}).[8] Orange solid. R_f 0.27 (hexane/AcOEt = 5/1). ^{1}H NMR ($CDCl_3$) δ: 3.84 (s, 9H), 7.31-7.58 (c, 9H).

1-Oxo-2-(Trimethylsilyl)-1*H*-indene-3-carboxylic acid ethyl ester (10_{major}).[8] Yellow oil. R_f 0.44 (hexane/AcOEt = 5/1). ^{1}H NMR ($CDCl_3$) δ: 0.29 (s, 9H), 1.44 (t, *J* = 7.0 Hz, 3H), 4.42 (q, *J* = 7.1 Hz, 2H), 7.25-7.49 (c, 4H). ^{13}C NMR ($CDCl_3$) δ: -0.8, 14.1, 61.6, 121.8, 123.0, 129.2, 131.4, 133.7, 141.6, 143.5, 157.7, 165.4, 200.7.

1-Oxo-3-(Trimethylsilyl)-1*H*-indene-2-carboxylic acid ethyl ester (10_{minor}).[8] Yellow oil. R_f 0.40 (hexane/AcOEt = 5/1). ^{1}H NMR ($CDCl_3$) δ: 0.39 (s, 9H), 1.37 (t, *J* = 7.0 Hz, 3H), 4.32 (q, *J* = 7.1 Hz, 2H), 7.29 (dd, *J* = 7.3 Hz, 7.9 Hz, 1H), 7.34 (d, *J* = 7.3 Hz, 1H), 7.40 (ddd, *J* = 1.2 Hz, 7.3 Hz, 7.9 Hz, 1H), 7.49 (d, *J* = 7.3 Hz, 1H).

5-Methoxy-2,3-dipropyl-1*H*-inden-1-one (11).[8] Yellow oil. R_f 0.18 (hexane/AcOEt = 20/1). ^{1}H NMR ($CDCl_3$) δ: 0.93 (t, *J* = 7.3 Hz, 3H), 1.02 (t, *J* = 7.3 Hz, 3H), 1.49 (tq, *J* = 7.3 Hz, 7.9 Hz, 2H), 1.63 (tq, *J* = 7.3 Hz, 7.9 Hz, 2H), 2.23 (t, *J* = 7.9 Hz, 2H), 2.48 (t, *J* = 7.9 Hz, 2H), 3.84 (s, 3H), 6.53 (dd, *J* = 1.8 Hz, 7.9 Hz, 1H), 6.60 (d, *J* = 1.8 Hz, 1H), 7.33 (d, *J* = 7.9 Hz, 1H). ^{13}C NMR ($CDCl_3$) δ: 14.1, 14.3, 21.4, 22.5, 25.0, 28.0, 55.6, 108.5, 108.6, 123.4, 123.9, 136.4, 148.3, 155.2, 164.3, 197.2.

5-Methoxy-3-methyl-2-(trimethylsilyl)-1*H*-inden-1-one (12).[8] Yellow solid. R_f 0.23 (hexane/AcOEt = 20/1). ^{1}H NMR ($CDCl_3$) δ: 0.27 (s, 9H), 2.23 (s, 3H), 3.83 (s, 3H), 6.61 (dd, *J* = 1.8 Hz, 7.9 Hz, 1H), 6.65 (d, *J* = 1.8, 1H), 7.32 (d, *J* = 7.9 Hz, 1H). ^{13}C NMR ($CDCl_3$) δ: -0.2, 14.2, 55.6, 107.5, 110.4, 123.0, 125.1, 134.6, 149.9, 164.1, 166.5, 200.6.

5-Methoxy-3-phenyl-2-(trimethylsilyl)-1*H*-inden-1-one (13).[8] Yellow solid. R_f 0.25 (hexane/AcOEt = 20/1). ^{1}H NMR ($CDCl_3$) δ: 0.04 (s, 9H), 3.78 (s, 3H), 6.43 (d, *J* = 1.8 Hz, 1H), 6.65 (dd, *J* = 1.8 Hz, 7.9 Hz, 1H), 7.33-7.35 (c, 2H), 7.44-7.49 (c, 4H). ^{13}C NMR ($CDCl_3$) δ: -0.2, 55.7, 109.4, 110.8, 124.0, 125.1, 127.7, 128.3, 129.0, 134.8, 136.6, 149.9, 164.1, 168.5, 200.4.

5,6-Difluoro-2,3-dipropyl-1*H*-inden-1-one (14).[8] Yellow oil. R_f 0.33 (hexane/AcOEt = 20/1). ^{1}H NMR ($CDCl_3$) δ: 0.93 (t, *J* = 7.3 Hz, 3H), 1.03 (t, *J* = 7.3 Hz, 3H), 1.48 (tq, *J* = 7.3 Hz, 7.6 Hz, 2H), 1.62 (tq, *J* = 7.3 Hz, 7.6 Hz, 2H), 2.23 (t, *J* = 7.6 Hz, 2H), 2.48 (t, *J* = 7.6 Hz, 2H), 6.85 (dd, *J* = 6.5 Hz, 9.5 Hz, 1H), 7.21 (dd, *J* = 7.7 Hz, 7.9 Hz, 1H). ^{13}C NMR ($CDCl_3$) δ: 14.0, 14.1, 21.0, 22.3, 25.0, 28.1, 109.3 (d, *J* = 20.1 Hz), 112.0 (dd, *J* = 1.9 Hz, 20.1 Hz), 127.1 (dd, *J* = 4.8 Hz), 136.0 (d, *J* = 4.8 Hz), 142.4 (dd, *J* = 3.8 Hz, 6.7 Hz), 149.5 (dd, *J* = 13.7 Hz, 218.1 Hz), 153.2 (dd, *J* = 13.6 Hz, 221.5 Hz), 155.6, 195.42.

5,6-Difluoro-3-methyl-2-(trimethylsilyl)-1*H*-inden-1-one (15).[8] Yellow solid. R_f 0.35 (hexane/AcOEt = 20/1). ^{1}H NMR ($CDCl_3$) δ: 0.28 (s, 9H), 2.27 (s, 3H), 6.94 (dd, *J* = 6.4 Hz, 8.8 Hz, 1H), 7.23 (dd, *J* = 7.3 Hz, 8.6 Hz, 1H). ^{13}C NMR ($CDCl_3$) δ: -0.3, 14.6, 108.9 (d, *J* = 20.2 Hz), 111.6 (d, *J* = 18.2 Hz), 128.6 (dd, *J* = 3.8 Hz, 4.8 Hz), 134.5 (d, *J* = 4.8 Hz), 143.9 (dd, *J* = 3.8 Hz, 6.7 Hz), 149.8 (dd, *J* = 14.3 Hz, 229.7 Hz), 153.0 (dd, *J* = 14.4 Hz, 233.5 Hz), 166.7, 198.9.

5,6-Difluoro-3-phenyl-2-(trimethylsilyl)-1*H*-inden-1-one (16).[8] Yellow solid. R_f 0.33 (hexane/AcOEt = 20/1). ^{1}H NMR ($CDCl_3$) δ: 0.05 (s, 9H), 6.71 (dd, *J* = 6.1 Hz, 9.2 Hz, 1H), 7.28-7.35

(c, 3H), 7.46-7.52 (c, 3H). ^{13}C NMR ($CDCl_3$) δ: -0.4, 110.7 (d, J = 21.2 Hz), 112.3 (d, J = 21.2 Hz), 127.4, 128.6, 129.5, 134.0, 136.1 (d, J = 4.8 Hz), 143.8 (dd, J = 3.8 Hz, 6.7 Hz), 150.9 (dd, J = 14.4 Hz, 248.6 Hz), 153.0 (dd, J = 14.4 Hz, 256.2 Hz), 168.6, 198.7.

4-Fluoro-2,3-dipropyl-1*H*-inden-1-one (17).[8] Yellow oil. R_f 0.28 (hexane/AcOEt = 20/1). ^{1}H NMR ($CDCl_3$) δ: 0.93 (t, J = 7.3 Hz, 3H), 1.03 (t, J = 7.3 Hz, 3H), 1.48 (tq, J = 7.3 Hz, 7.6 Hz, 2H), 1.65 (tq, J = 7.3 Hz, 7.6 Hz, 2H), 2.24 (t, J = 7.6 Hz, 2H), 2.59 (t, J = 7.6 Hz, 2H), 7.00 (dd, J = 8.6 Hz, 9.2 Hz, 1H), 7.13 (ddd, J = 4.3 Hz, 6.7 Hz, 8.6 Hz, 1H), 7.21 (d, J = 6.7 Hz, 1H). ^{13}C NMR ($CDCl_3$) δ: 14.1, 14.2, 21.3 (d, J = 1.9 Hz), 22.5, 24.6, 30.2 (d, J = 1.9 Hz), 117.9 (d, J = 1.9 Hz), 122.4 (d, J = 23.0 Hz), 129.6 (d, J = 12.5 Hz), 130.2 (d, J = 6.7 Hz), 134.0 (d, J = 3.8 Hz), 135.1 (d, J = 1.8 Hz), 155.4 (d, J = 252.4 Hz), 156.9 (d, J = 3.8 Hz), 197.3 (d, J = 2.9 Hz).

4-Fluoro-3-methyl-2-(trimethylsilyl)-1*H*-inden-1-one (18).[8] Yellow solid. R_f 0.30 (hexane/AcOEt = 20/1). ^{1}H NMR ($CDCl_3$) δ: 0.29 (s, 9H), 2.46 (s, 3H), 7.01-7.06 (m, 1H), 7.19-7.24 (c, 2H). ^{13}C NMR ($CDCl_3$) δ: -0.2, 17.8 (d, J = 3.8 Hz), 117.6 (d, J = 1.9 Hz), 121.8 (d, J = 23.0 Hz), 131.1 (d, J = 12.5 Hz), 131.3 (d, J = 6.7 Hz), 133.3 (d, J = 1.9 Hz), 135.7 (d, J = 2.8 Hz), 156.0 (d, J = 255.3 Hz), 167.9 (d, J = 3.8 Hz), 200.5 (d, J = 1.9 Hz).

4-Fluoro-3-phenyl-2-(trimethylsilyl)-1*H*-inden-1-one (19).[8] Yellow solid. R_f 0.28 (hexane/AcOEt = 20/1). ^{1}H NMR ($CDCl_3$) δ: 0.01 (s, 9H), 6.99 (t, J = 9.0 Hz, 1H), 7.23-7.44 (c, 7H). ^{13}C NMR ($CDCl_3$) δ: -0.4, 118.4, (d, J = 2.9 Hz), 122.4 (d, J = 23.0 Hz), 127.2 (d, J = 1.9 Hz), 127.9, 128.9, 130.9 (d, J = 11.5 Hz), 131.6 (d, J = 6.7 Hz), 135.3 (d, J = 1.9 Hz), 136.1 (d, J = 1.9 Hz), 136.2 (d, J = 1.9 Hz), 155.7 (d, J = 258.2 Hz), 168.8 (d, J = 2.9 Hz), 200.2 (d, J = 1.9 Hz).

5-Chloro-2,3-dipropyl-1*H*-inden-1-one (20).[8] Yellow oil. R_f 0.30 (hexane/AcOEt = 20/1). ^{1}H NMR ($CDCl_3$) δ: 0.94 (t, J = 7.3 Hz, 3H), 1.04 (t, J = 7.3 Hz, 3H), 1.49 (tq, J = 7.3 Hz, 7.6 Hz, 2H), 1.63 (tq, J = 7.3 Hz, 7.6 Hz, 2H), 2.24 (t, J = 7.6 Hz, 2H), 2.50 (t, J = 7.6 Hz, 2H), 7.00 (d, J = 1.8 Hz,

1H), 7.14 (dd, J = 1.8 Hz, 7.9 Hz, 1H), 7.29 (d, J = 7.9 Hz, 1H). ^{13}C NMR ($CDCl_3$) δ: 14.1, 14.2, 21.1, 22.3, 24.9, 28.0, 119.8, 122.5, 127.3, 129.3, 136.4, 139.1, 147.5, 156.3, 197.3.

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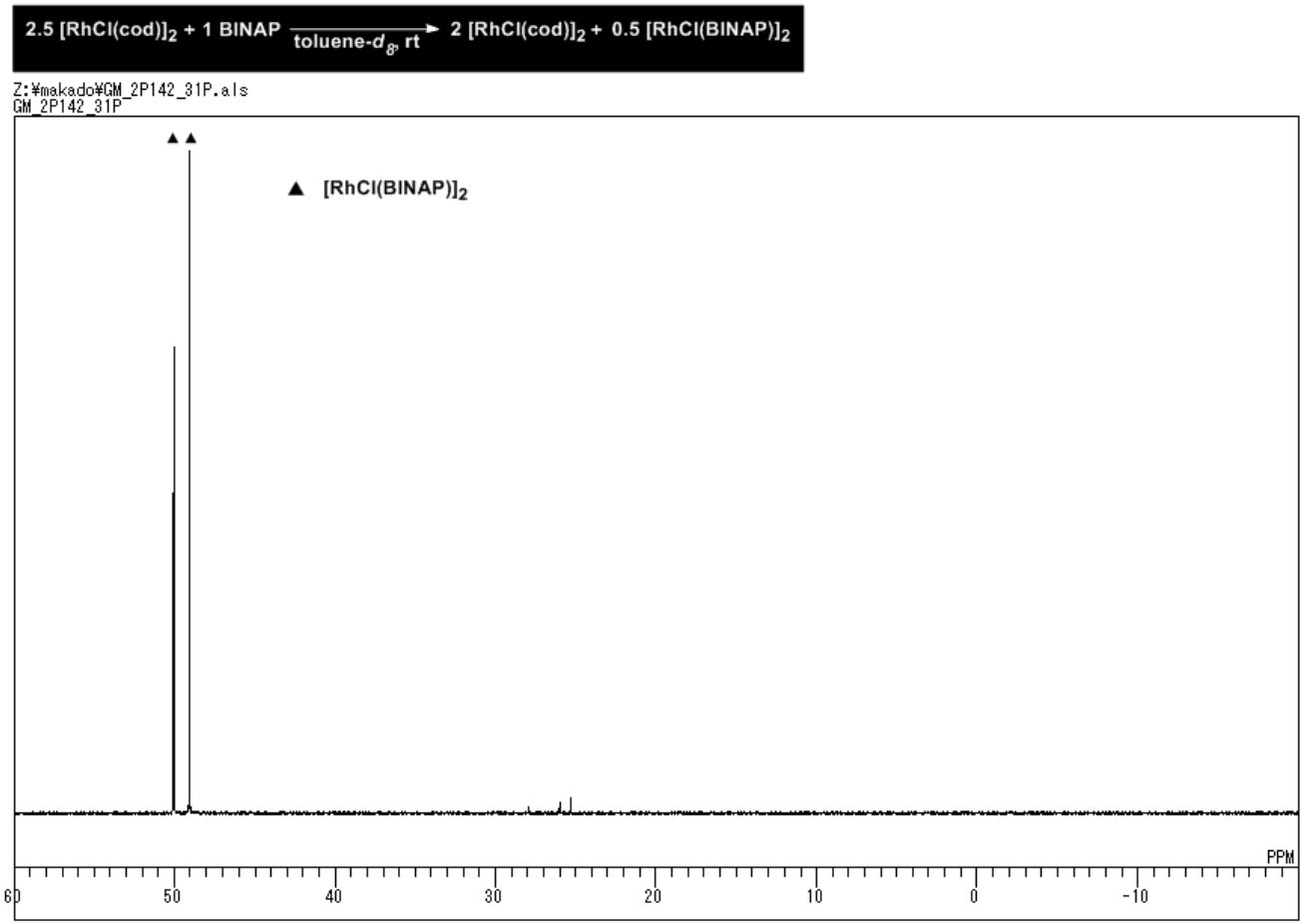


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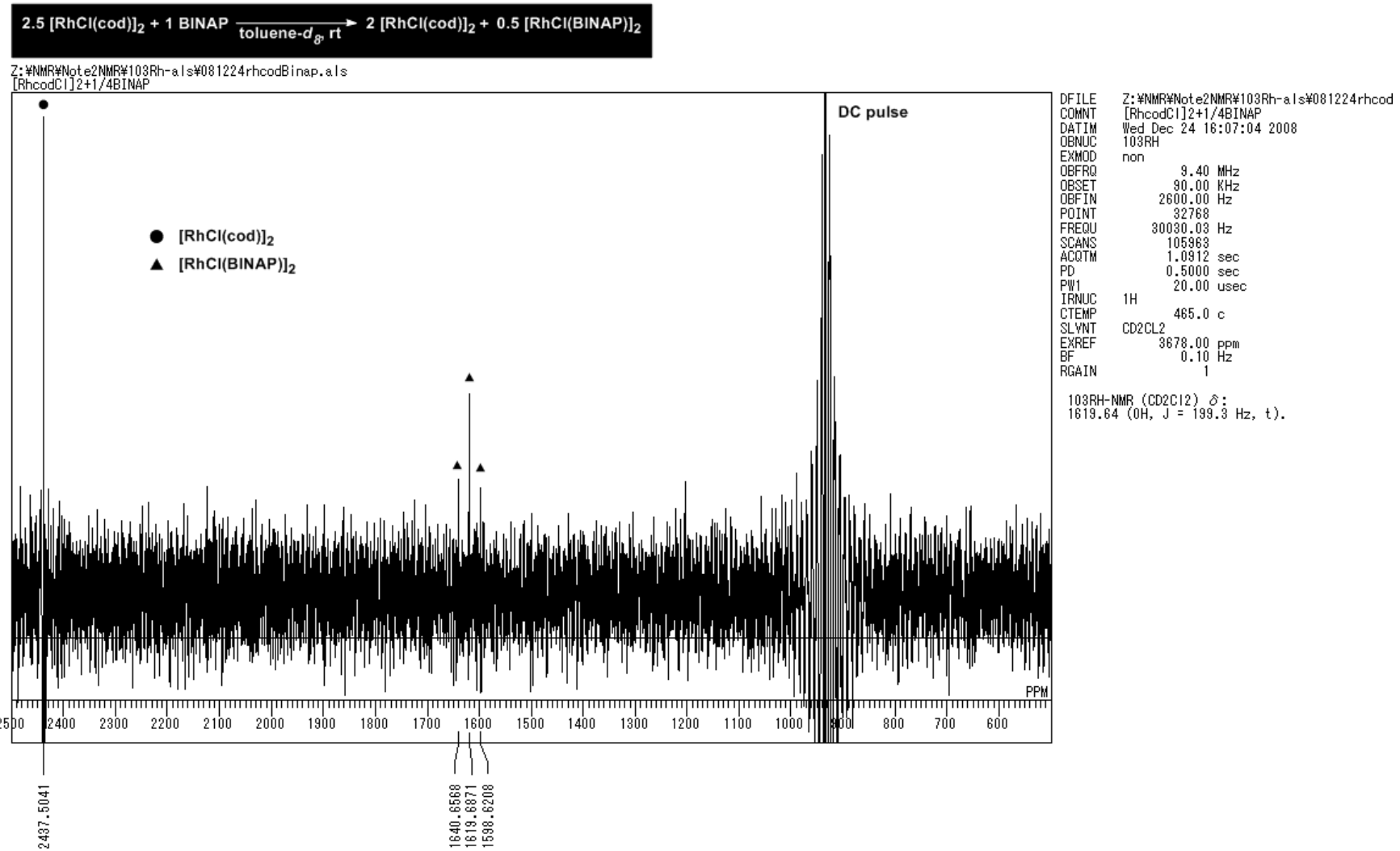
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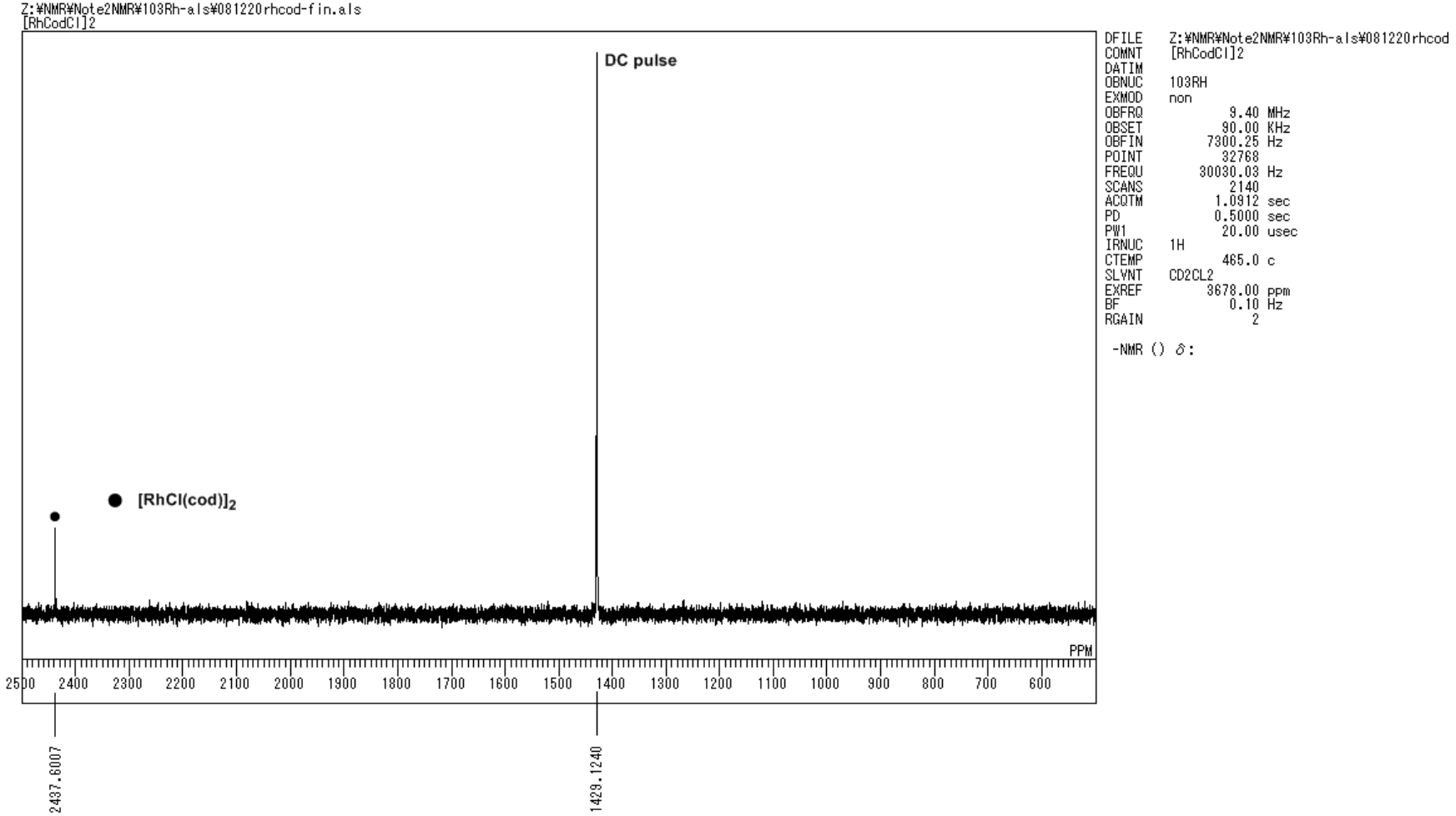
PD 0.5000 sec
PW1 20.00 usec
IRNUC 1H
CTEMP 465.0 c
SLVNT CD2CL2
EXREF 3678.00 ppm
BF 0.10 Hz
RGAIN 1
103RH-NMR (CD2Cl2) δ:
1619.64 (OH, J = 199.3 Hz, t).

[RhCl(cod)]$_2$


Z:¥NMR¥Note2NMR¥103Rh-als¥081220rhcod-fin.als
[RhCodCl]2
DC pulse
[RhCl(cod)]2
PPM
2500 2400 2300 2200 2100 2000 1900 1800 1700 1600 1500 1400 1300 1200 1100 1000 900 800 700 600
2437.6007
1429.1240
DFILE Z:¥NMR¥Note2NMR¥103Rh-als¥081220rhcod
COMNT [RhCodCl]2
DATIM
OBNUC 103RH
EXMOD non
OBFRQ 9.40 MHz
OBSET 90.00 KHz
OBFIN 7300.25 Hz
POINT 32768
FREQU 30030.03 Hz
SCANS 2140
ACQTM 1.0912 sec
PD 0.5000 sec
PW1 20.00 usec
IRNUC 1H
CTEMP 465.0 c
SLVNT CD2CL2
EXREF 3678.00 ppm
BF 0.10 Hz
RGAIN 2
-NMR () δ: