

## Palladium nanoparticles immobilized onto supported ionic liquid-like phases (SILLPs) for the carbonylative Suzuki coupling reaction

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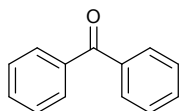
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### Characterization data for products shown in Table 3.

#### Benzophenone<sup>1</sup> (Table 3, entry 1)

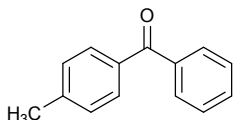


IR (KBr) (cm<sup>-1</sup>): 2963, 2925, 2859, 1655, 1587, 1437, 1313, 1275, 1066, 944, 906.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.78-7.67 (m, 4H), 7.55-7.47 (m, 2H), 7.44-7.36 (m, 4H). <sup>13</sup>C NMR (101 MHz, CDCl<sub>3</sub>) δ 196.79, 137.61, 132.44, 130.08, 128.29.

HRMS (ESI): m/z calculated for C<sub>13</sub>H<sub>10</sub>ONa<sup>+</sup> [M<sup>+</sup>Na<sup>+</sup>]: 205.0624, found: 205.0628.

#### phenyl(p-tolyl)methanone<sup>1</sup> (Table 3, entries 2 and 12)

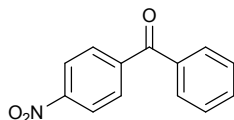


IR (KBr) (cm<sup>-1</sup>): 3056, 2967, 2925, 2848, 1650, 1585, 1446, 1320, 1275, 940, 770.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.72-7.67 (m, 2H), 7.66-7.60 (m, 2H), 7.52-7.43 (m, 2H), 7.42-7.32 (m, 2H), 7.19 (d, J = 7.9 Hz, 2H), 2.35 (s, 3H). <sup>13</sup>C NMR (101 MHz, CDCl<sub>3</sub>) δ 196.51, 143.26, 137.97, 134.90, 132.18, 130.33, 129.95, 129.00, 128.23, 21.67.

HRMS (ESI): m/z calculated for C<sub>14</sub>H<sub>12</sub>ONa<sup>+</sup> [M<sup>+</sup>Na<sup>+</sup>]: 219.0780, found 219.0786.

#### (4-nitrophenyl)(phenyl)methanone<sup>2</sup> (Table 3, entry 7)

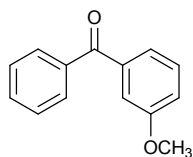


IR (KBr) (cm<sup>-1</sup>): 3015, 2925, 2848, 1646, 1597, 1512, 1446, 1360, 1275, 953, 867, 716.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 8.40-8.31 (m, 2H), 7.97-7.93 (m, 2H), 7.84-7.78 (m, 2H), 7.65 (d, J = 7.4 Hz, 1H), 7.58-7.49 (m, 2H). <sup>13</sup>C NMR (101 MHz, CDCl<sub>3</sub>) δ 194.81, 149.84, 142.90, 136.30, 133.49, 130.71, 130.11, 128.70, 123.56.

GC-MS (EI, 70 eV): m/z (%) = 227 [M<sup>+</sup>] (41), 105(100), 77 (44).

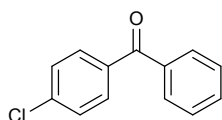
**(3-methoxyphenyl)(phenyl)methanone<sup>1</sup> (Table 3, entry 13)**



IR(KBr)(cm<sup>-1</sup>):3065,2925,2836,1669,1590,1488,1287,1057,956,820,779.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.81 (dt, J = 8.4, 1.6 Hz, 2H), 7.63-7.54 (m, 1H), 7.52-7.44 (m, 2H), 7.41-7.30 (m, 3H), 7.17-7.10 (m, 1H), 3.85 (s, 3H). <sup>13</sup>C NMR (101 MHz, CDCl<sub>3</sub>) δ 196.51, 159.59, 138.92, 137.64, 132.43, 130.04, 129.22, 128.27, 122.87, 118.86, 114.34, 55.47. HRMS (ESI): m/z calculated for C<sub>14</sub>H<sub>12</sub>O<sub>2</sub>Na<sup>+</sup> [M<sup>+</sup>Na<sup>+</sup>]: 235.0730, found 235.0733.

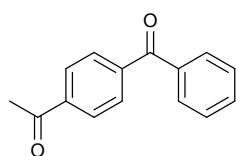
**(4-chlorophenyl)(phenyl)methanone<sup>1</sup> (Table 3, entries 9 and 11)**



IR (KBr) (cm<sup>-1</sup>):3094,3066,3047,2981,2925,2848,1646,1313,1284,1085,848,782,707,669.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.83-7.71 (m, 4H), 7.66-7.55 (m, 1H), 7.53-7.42 (m, 4H). <sup>13</sup>C NMR (101 MHz, CDCl<sub>3</sub>) δ 195.49, 138.91, 137.26, 135.89, 132.64, 131.47, 129.93, 128.65, 128.41. HRMS (ESI): m/z calculated for C<sub>13</sub>H<sub>9</sub>ClONa<sup>+</sup> [M<sup>+</sup>Na<sup>+</sup>]: 239.0234, found 239.0257.

**1-(4-benzoylphenyl)ethanone<sup>1</sup> (Table 3, entry 8)**

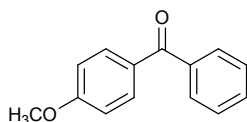


IR (KBr) (cm<sup>-1</sup>):2977, 2862, 1689, 1657, 1593, 1445, 1402, 1358, 1277,1072, 963, 931, 845, 795, 698

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 8.02-7.94 (m, 2H), 7.82-7.76 (m, 2H), 7.76-7.70 (m, 2H), 7.59-7.50 (m, 1H), 7.43 (dd, J = 10.8, 4.4 Hz, 2H), 2.60 (s, 3H). <sup>13</sup>C NMR (101 MHz, CDCl<sub>3</sub>) δ 141.34, 139.57, 136.93, 133.00, 130.07, 128.49, 128.17, 26.89.

HRMS (ESI): m/z calculated for C<sub>15</sub>H<sub>12</sub>O<sub>2</sub>Na<sup>+</sup> [M<sup>+</sup>Na<sup>+</sup>]: 247.0730, found 247.0742.

**(4-methoxyphenyl)(phenyl)methanone<sup>1</sup> (Table 3, entries 3 and 14)**

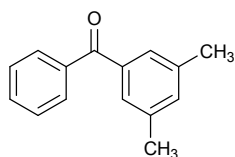


IR (KBr) (cm<sup>-1</sup>):3066,3010,2953,2838,1664,1587,1484,1275,1123,1047,963,820,707.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.88-7.79 (m, 2H), 7.79-7.71 (m, 2H), 7.60-7.51 (m, 1H), 7.52-7.43 (m, 2H), 7.02-6.91 (m, 2H), 3.88 (s, 3H). <sup>13</sup>C NMR (101 MHz, CDCl<sub>3</sub>) δ 195.61, 163.24, 138.28, 132.59, 131.92, 130.14, 129.75, 128.21, 113.57, 55.51.

HRMS (ESI): m/z calculated for C<sub>14</sub>H<sub>12</sub>O<sub>2</sub>Na<sup>+</sup> [M<sup>+</sup>Na<sup>+</sup>]: 235.0730, found 235.0733.

**(3,5-dimethylphenyl)(phenyl)methanone (Table 3, entry 15)**

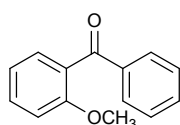


IR(KBr)(cm<sup>-1</sup>):3071,2950,2927,2846,1656,1587,1437,1325,1266,927,764,693.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.79 (dt, J = 8.4, 1.6 Hz, 2H), 7.63-7.53 (m, 1H), 7.52-7.43 (m, 2H), 7.43-7.36 (m, 2H), 7.22 (s, 1H), 2.37 (d, J = 0.4 Hz, 6H).<sup>13</sup>C NMR (101 MHz, CDCl<sub>3</sub>) δ 197.21, 137.95, 137.92, 137.71, 134.12, 132.29, 130.05, 128.24, 127.84, 21.27.

HRMS (ESI): m/z calculated for C<sub>15</sub>H<sub>14</sub>ONa<sup>+</sup> [M<sup>+</sup>Na<sup>+</sup>]: 233.0937, found 233.0957.

**(2-methoxyphenyl)(phenyl)methanone<sup>1</sup> (Table 3, entry 5)**

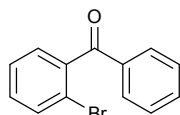


IR (KBr) (cm<sup>-1</sup>):3062,2964,2934,2835,1667,1591,1477,1439,1295,1250,1023,923,758,696.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.79-7.70 (m, 2H), 7.50-7.43 (m, 1H), 7.42-7.31 (m, 3H), 7.27 (dt, J = 8.4, 4.2 Hz, 1H), 7.00-6.85 (m, 2H), 3.63 (s, 3H).<sup>13</sup>C NMR (101 MHz, CDCl<sub>3</sub>) δ 195.49, 156.30, 138.42, 136.74, 131.91, 130.87, 128.79, 128.55, 127.18, 119.44, 110.40, 54.54.

HRMS (ESI): m/z calculated for C<sub>14</sub>H<sub>12</sub>O<sub>2</sub>Na<sup>+</sup> [M<sup>+</sup>Na<sup>+</sup>]: 235.0730, found 275.0739.

**(2-bromophenyl)(phenyl)methanone (Table 3, entry 10)**

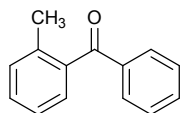


IR(KBr)(cm<sup>-1</sup>):3057,2915,1674,1587,1437,1294,1153,1019,925.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.79-7.68 (m, 2H), 7.59-7.47 (m, 2H), 7.43-7.21 (m, 5H).<sup>13</sup>C NMR (101 MHz, CDCl<sub>3</sub>) δ 195.91, 140.68, 136.12, 133.79, 133.22, 131.20, 130.25, 129.01, 128.68, 127.24, 119.54.

HRMS (ESI): m/z calculated for C<sub>13</sub>H<sub>9</sub>ONa<sup>+</sup> [M<sup>+</sup>Na<sup>+</sup>]: 282.9729, found 282.9725.

**phenyl(o-tolyl)methanone<sup>1</sup> (Table 3, entries 4 and 16)**

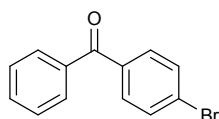


IR (KBr) (cm<sup>-1</sup>):3066,2963,2925,2848,1674,1587,1446,1322,1266,934,763,697.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.70 (dd, J = 5.1, 3.3 Hz, 2H), 7.51-7.43 (m, 1H), 7.33 (dd, J = 10.6, 4.7 Hz, 2H), 7.28 (td, J = 7.5, 1.5 Hz, 1H), 7.23-7.09 (m, 3H), 2.23 (s, 3H).<sup>13</sup>C NMR (101 MHz, CDCl<sub>3</sub>) δ 197.53, 137.52, 136.64, 135.66, 132.07, 129.93, 129.18, 129.05, 127.45, 127.39, 124.13, 18.92.

HRMS (ESI): m/z calculated for C<sub>14</sub>H<sub>12</sub>ONa<sup>+</sup> [M<sup>+</sup>Na<sup>+</sup>]: 219.0780, found 219.0786.

**(4-bromophenyl)(phenyl)methanone<sup>2</sup> (Table 3, entry 17)**

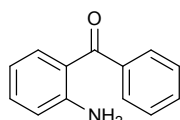


IR (KBr) ( $\text{cm}^{-1}$ ): 3093, 3062, 2963, 2915, 1652, 1578, 1437, 1387, 1294, 1153, 1019, 925

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  7.74-7.59 (m, 2H), 7.58-7.51 (m, 2H), 7.51-7.41 (m, 3H), 7.40-7.27 (m, 2H).  $^{13}\text{C}$  NMR (101 MHz,  $\text{CDCl}_3$ )  $\delta$  195.51, 137.13, 136.28, 132.70, 131.61, 131.58, 129.95, 128.43, 127.51.

HRMS (ESI):  $m/z$  calculated for  $\text{C}_{13}\text{H}_9\text{ONa}^+$  [ $\text{M}^+\text{Na}^+$ ]: 282.9729, found 282.9724.

#### (4-aminophenyl)(phenyl)methanone<sup>2</sup> (Table 3, entry 6)



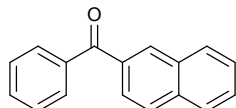
IR(KBr)( $\text{cm}^{-1}$

) : 3427, 3322, 3047, 2925, 2859, 1625, 1559, 1484, 1437, 1313, 1247, 1153, 1019, 934, 754, 697, 639.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  7.68-7.61 (m, 2H), 7.52 (dt,  $J = 2.8, 2.0$  Hz, 1H), 7.45 (ddd,  $J = 8.2, 3.8, 1.4$  Hz, 3H), 7.32-7.26 (m, 1H), 6.74 (dd,  $J = 8.3, 0.8$  Hz, 1H), 6.66-6.55 (m, 1H), 6.10 (s, 2H).  $^{13}\text{C}$  NMR (101 MHz,  $\text{CDCl}_3$ )  $\delta$  199.13, 150.95, 140.10, 134.62, 134.26, 131.06, 129.13, 128.10, 118.15, 117.01, 115.53.

HRMS (ESI):  $m/z$  calculated for  $\text{C}_{13}\text{H}_{11}\text{NONa}^+$  [ $\text{M}^+\text{Na}^+$ ]: 220.0733, found 220.0727.

#### naphthalen-2-yl(phenyl)methanone<sup>1</sup> (Table 3, entry 18)



IR(KBr)( $\text{cm}^{-1}$ ): 3085, 3066, 3038, 2925, 1646, 1587, 1493, 1446, 1399, 1294, 1085, 934, 893, 726, 697.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  8.16 (s, 1H), 7.89-7.72 (m, 6H), 7.57-7.47 (m, 2H), 7.47-7.37 (m, 3H).  $^{13}\text{C}$  NMR (101 MHz,  $\text{CDCl}_3$ )  $\delta$  196.79, 137.92, 135.29, 134.84, 132.43, 132.28, 131.92, 130.14, 129.45, 128.34, 128.34, 127.86, 126.84, 125.82.

HRMS (ESI):  $m/z$  calculated for  $\text{C}_{17}\text{H}_{12}\text{ONa}^+$  [ $\text{M}^+\text{Na}^+$ ]: 255.0780, found 255.0788.

1. S. Zheng, L. Xu and C. Xia, *Appl. Organomet. Chem.*, 2007, **21**, 772-776.

2. M. V. Khedkar, T. Sasaki and B. M. Bhanage, *RSC Adv.*, 2013, **3**, 7791-7797.