

**Stabilizing Pd on the surface of amine-functionalized hollow
Fe₃O₄ spheres: a highly active and recyclable catalysts for
Suzuki cross-coupling and hydrogenation reactions**

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1. Biphenyl. ^1H NMR (CDCl_3 , 400 MHz, 25°C)
 δ 7.341 (t, 2H, $J_{\text{HH}}=7.3$ Hz), 7.440 (t, 4H, $J_{\text{HH}}=7.3$ Hz), 7.596 (d, 4H, $J_{\text{HH}}=4.2$ Hz)
2. 4-methyl-biphenyl. ^1H NMR (CDCl_3 , 400 MHz, 25°C)
 δ 2.378 (s, 3H, CH_3), 7.232 (d, 2H, $J_{\text{HH}}=4.0$ Hz), 7.305 (t, 1H, $J_{\text{HH}}=7.2$ Hz), 7.407 (t, 2H, $J_{\text{HH}}=7.6$ Hz), 7.470 (t, 2H, $J_{\text{HH}}=9.6$ Hz), 7.566 (d, 2H, $J_{\text{HH}}=4.0$ Hz)
3. 4-Nitro-biphenyl. ^1H NMR ($(\text{CD}_3)_2\text{SO}$, 400 MHz, 25°C)
 δ 6.849 (d, 1H, $J_{\text{HH}}=8.8$ Hz), 7.268 (t, 2H, $J_{\text{HH}}=7.6\text{Hz}$), 7.402 (t, 2H, $J_{\text{HH}}=7.8$ Hz), 7.478 (d, 2H, $J_{\text{HH}}=8.4$ Hz), 7.566 (d, 2H, $J_{\text{HH}}=7.6$ Hz)
4. 4-Methoxy-biphenyl. ^1H NMR (CDCl_3 , 400 MHz, 25°C)
 δ 3.846 (s, 3H, OCH_3), 6.977 (d, 2H, $^2J_{\text{HH}}=4.4$ Hz), 7.299 (t, 1H, $^3J_{\text{HH}}=7.2$ Hz), 7.413 (t, 2H, $^3J_{\text{HH}}=7.6$ Hz), 7.541 (t, 4H, $^3J_{\text{HH}}=7.6$ Hz)
5. 1-biphenyl-4-yl-ethanone. ^1H NMR (CDCl_3 , 400 MHz, 25°C)
 δ 2.645 (s, 3H, COCH_3), 7.406 (t, 1H, $J_{\text{HH}}=7.2$ Hz), 7.476 (t, 2H, $J_{\text{HH}}=7.6$ Hz), 7.630 (d, 2H, $J_{\text{HH}}=3.6$ Hz), 7.686 (d, 2H, $J_{\text{HH}}=4.0$ Hz), 8.035 (d, 2H, $J_{\text{HH}}=4.0$ Hz)
6. Benzophenone. ^1H NMR (CDCl_3 , 400 MHz, 25°C)
 δ 7.81 (d, $J_{\text{HH}}=8.2\text{Hz}$, 4H), 7.60 (m, 2H), 7.50 (t, $J_{\text{HH}}=7.6$ Hz, 4H)
7. phenyl(p-tolyl)methanone. ^1H NMR (CDCl_3 , 400 MHz, 25°C)
 δ 7.79 (d, $J_{\text{HH}}=7.2\text{Hz}$, 2H), 7.723 (d, $J=8.0\text{Hz}$, 2H), 7.58 (t, $J_{\text{HH}}=7.4$ Hz, 1H), 7.53 (t, $J_{\text{HH}}=7.8\text{Hz}$, 2H), 7.29 (d, $J=8.0\text{Hz}$, 2H), 2.43 (s, 3H)
8. (4-methoxyphenyl)(phenyl)methanone. ^1H NMR (CDCl_3 , 400 MHz, 25°C)
 δ 7.81 (d, $J_{\text{HH}}=7.2\text{Hz}$, 2H), 7.75 (d, $J_{\text{HH}}=5.2\text{Hz}$, 2H), 7.54 (t, $J_{\text{HH}}=7.2$ Hz, 1H), 7.45 (t, $J_{\text{HH}}=7.4\text{Hz}$, 2H), 6.98 (d, $J_{\text{HH}}=7.6\text{Hz}$, 2H), 3.86 (s, 3H)
9. (4-chlorophenyl)(phenyl)methanone. ^1H NMR (CDCl_3 , 400 MHz, 25°C)
 δ 7.77 (m, 4H), 7.60 (m, 1H), 7.49 (m, 4H),
10. (4-methoxyphenyl)(p-tolyl)methanone. ^1H NMR (CDCl_3 , 400 MHz, 25°C)
 δ 7.82 (m, 2H), 7.68 (d, $J_{\text{HH}}=8.0\text{Hz}$, 2H), 7.27 (d, $J_{\text{HH}}=8.4\text{Hz}$, 2H), 6.97 (m, 2H), 3.89 (s, 3H), 2.44 (s, 3H).