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# Selective Liquid Phase Oxidation of Ethyl Benzene to Acetophenone by Palladium Nanoparticles Immobilized on g-$C_3N_4$-rGO Composite as Recyclable Catalyst

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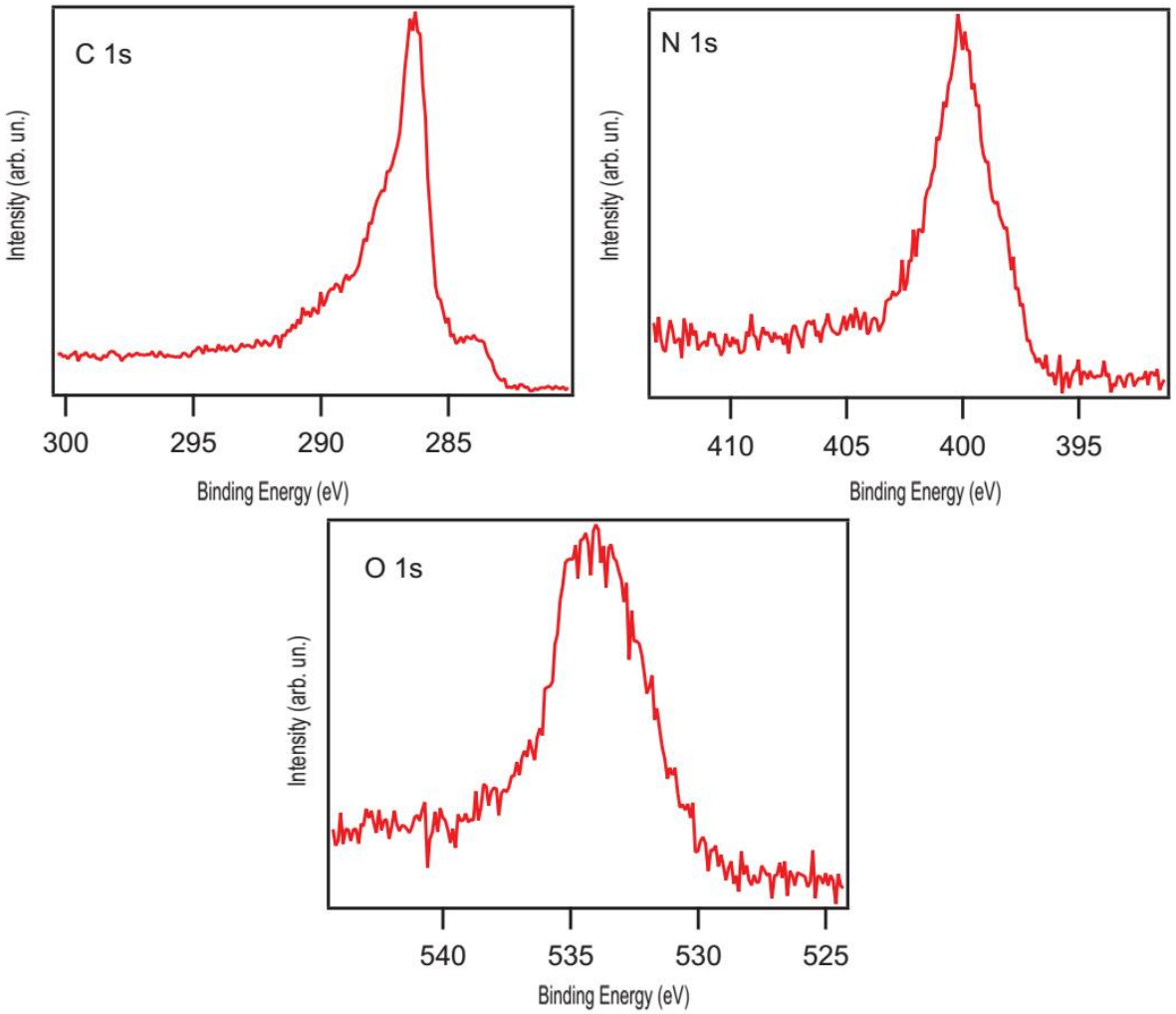



XPS scan survey

**Figure S1.** The XPS spectra carbon (1s), nitrogen (1s) and oxygen (1s)

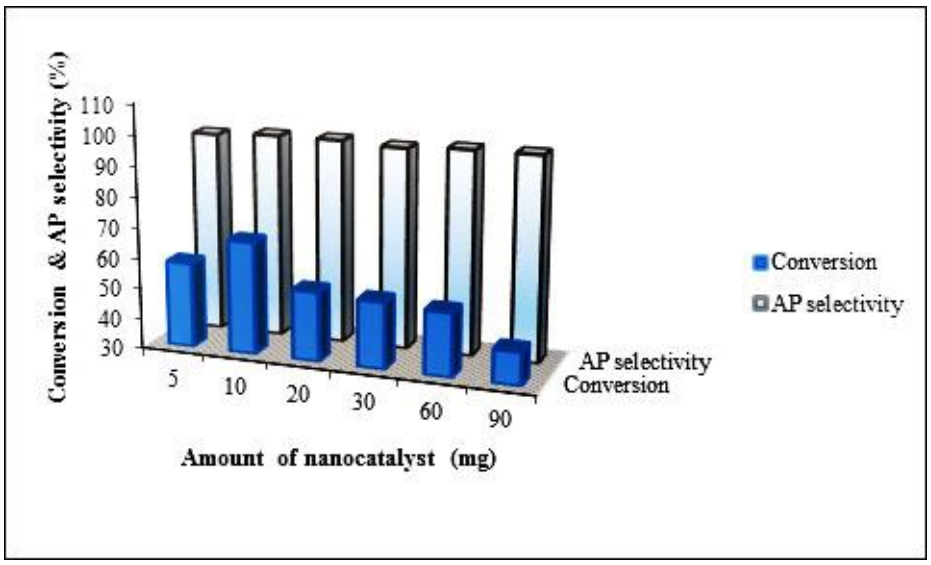



**Figure S2.** The effect of amount of catalyst on the oxidation of EB
Reaction conditions: EB: TBHP (mol ratio) = 1:4, 36 h, temperature = reflux, 10 mL $CH_3CN$, 10 mg Pd/g-$C_3N_4$-rGO

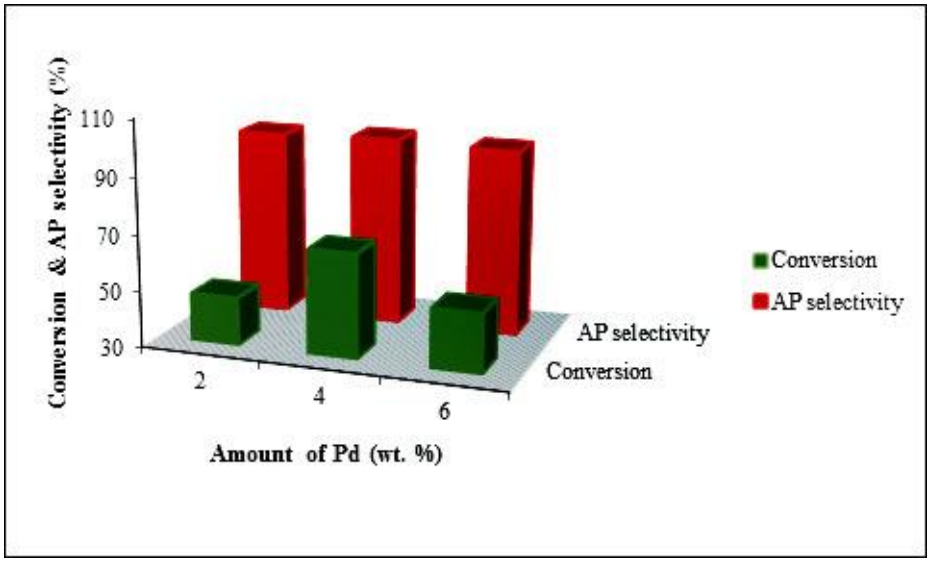
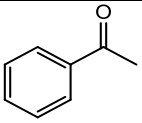
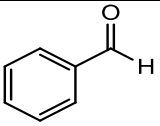



**Figure S3.** The effect of Pd loading on the oxidation of EB
Reaction conditions: EB: TBHP (mol ratio) = 1:4, 24 h, temperature = reflux, 10 mL $CH_3CN$, 10 mg x%Pd/g-$C_3N_4$-rGO

**Table S1.** The activity of recycled Pd/g$C_3N_4$-rGO in the oxidation of EB

| Entry | Cycle number | Conversion (%) | Selectivity (%) | |
|---|---|---|---|---|
| | | |  |  |
| 1 | 1 | 67 | 97 | 3 |
| 2 | 2 | 67 | 96 | 4 |
| 3 | 3 | 66 | 96 | 4 |
| 4 | 4 | 65 | 96 | 4 |
| 5 | 5 | 63 | 96 | 4 |

Reaction conditions: EB: TBHP (mol ratio) = 1:4, 24 h, temperature = reflux, 10 mL $CH_3CN$, 10 mg Pd/g-$C_3N_4$-rGO

**Table S2.** An overview of the research on oxidation of EB

| Catalyst | Oxidant | Reaction time (h) | T(°C) | Conversion (%) | Selectivity (%)[a] | | | Reference |
|---|---|---|---|---|---|---|---|---|
| | | | | | AP | BZ | Others | |
| Si/Al-pr-NH-et-N methyl-2-pyridylketone-Mn | TBHP | 8 | 120 | 91 | 98.1 | 1.8 | - | 92 |
| Mn(TMCPP)[b] | TBHP | 6 | 150 | 40.8 | 96.6 | 2.2 | 1.2 | 93 |
| Pd-nanoparticles | TBHP | 24 | 80 | 92.3 | 93.5 | 0.6 | 5.9 | 72 |
| Si/Al-pr-NH-et-N methyl-2-pyridylketone-Mn | TBHP | 2 | 80 | 33 | 74 | 13 | 12 | 55 |
| Si/Al-pr-NH-et-N methyl-2-pyridylketone-Mn | TBHP | 24 | 80 | 67 | 93 | 27 | 4.3 | 55 |
| Ag/$SiO_2$ | TBHP | 12 | 120 | 38 | 88 | - | 12 | 52 |
| Co-N-C/$CeO_2$[c] | $O_2$ | 5 | 120 | 33.1 | 74.8 | 2.5 | 22.7 | 58 |
| Co-N-C/g-$C_3N_4$[d] | $O_2$ | 5 | 120 | 28 | 78.1 | 1.9 | 20 | 19 |
| Pd/g-$C_3N_4$-rGO | TBHP | 24 | 80 | 67 | 97 | 3 | - | Present work |

[a] AP: Acetophenone, BZ: Benzaldehyde

[b] 5, 10, 15, 20-tetrakis (4-methoxy carbonyl phenyl) porphyrin)

[c] Cobalt(II) 5-(4-carboxyphenyl)-10,15,20-triphenylporphyrin

[d] Cobalt(II) 5,10,15,20-tetraphenylporphyrin