**Electronic Supplementary Information (ESI) File**

Nanostructural Synergism as Mn-N-C Channels in Manganese (IV) Oxide and Fluffy g-C3N4 Layered Composite with Exceptional Catalytic Capabilities

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**Figure S1:** SEM images for MnO2/g-C3N4 catalyst taken at two different magnifications **(A)** at 2µm and **(B)** at 200 nm

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**Figure S2:** 4-nitrophenol absorption peaks before and after the addition of NaBH4

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**Figure S3:** UV-absorption spectrum for the reduction of 4-nitrophenol into 4-aminophenol by using g-C3N4 catalyst.

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**Figure S4:** Time-dependent degradation of MB in the photocatalysis reaction under visible light irradiation for g-C3N4 catalyst

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**Figure S5:** Comparison of ORR activity for g-C3N4 and MnO2/g-C3N4 catalysts at 1600 rpm in O2 saturated 0.1 M KOH solution.

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**Figure S6:** Accelerated durability test for ORR activity of MnO2/g-C3N4 catalyst at 1600 rpm in O2 saturated 0.1 M KOH with 10 mV/s scan rate up to 1000 cycles.

**Table S1:** Comparison of 4-NP reduction performance of MnO2/g-C3N4 (this work) catalyst with reported materials. “Time (min) = reduction time & K (min-1) calculated rate constant”.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sr. No.** | **Catalyst** | **Time (min)** | **K (min-1)** | **Ref. No.** |
| 1 | MnO2/g-C3N4 | 6 | 0.734 | This work |
| 2 | Au@MnO2 | 10 | 0.2898 | 1 |
| 3 | Ag/g-C3N4/CS | 25 | 0.14816 | 2 |
| 4 | Pd–Ni/rGO | 13 | 0.1596 | 3 |
| 5 | SiO2/Au/g-Fe2O3 | 13 | 0.396 | 4 |
| 6 | Fe3O4@Au | 16 | 0.0114 | 5 |
| 7 | Ag/g-C3N4 | 40 | 0.094 | 6 |

**Table S2:** Comparison of MB degradation performance of MnO2/g-C3N4 (this work) catalyst with reported materials. “Time (min) = degradation time & K (min-1) calculated rate constant”.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sr. No.** | **Catalyst** | **Time (min)** | **K (min-1)** | **Ref. No.** |
| 1 | MnO2/g-C3N4 | 22 | 0.208 | This work |
| 2 | MnO2 (nanosheets) | 60 | 0.00355 | 7 |
| 3 | β-MnO2 | 120 | - | 8 |
| 4 | PProDOT/MnO2 | 120 | 0.0931 | 9 |
| 5 | g-C3N4/TiO2 | 100 | 0.0231 | 10 |
| 6 | ZnO/g-C3N4 | 120 | 0.01993 | 11 |
| 7 | g‑C3N4/Ca2Fe2O5 | 50 | 0.058 | 12 |

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