Supporting Information

Silver doped reduced graphene oxide as promising plasmonic photocatalyst for oxidative coupling of benzylamines under visible light irradiation

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Calculation: -

The identification of product was done by gas chromatography-mass spectrometry (GC-MS). (Fig. S1) The conversion of benzylamine, yield and selectivity of imine were analysed based on the following equations:

$$\text{Conversion (\%)} = [(C_0 - C_{benzylamine})/C_0] \times 100$$

$$\text{Yield (\%)} = C_{imine}/C_0 \times 100$$

$$\text{Selectivity (\%)} = [C_{imine}/(C_0 - C_{benzylamine})] \times 100$$

Where C_0 is the whole quantity of benzylamine in the reaction mixture before irradiation; $C_{benzylamine}$ is the amount of benzylamine in the solution after irradiation for 12 h; C_{imine} is the amount of imine in the solution after irradiation for 12 h.

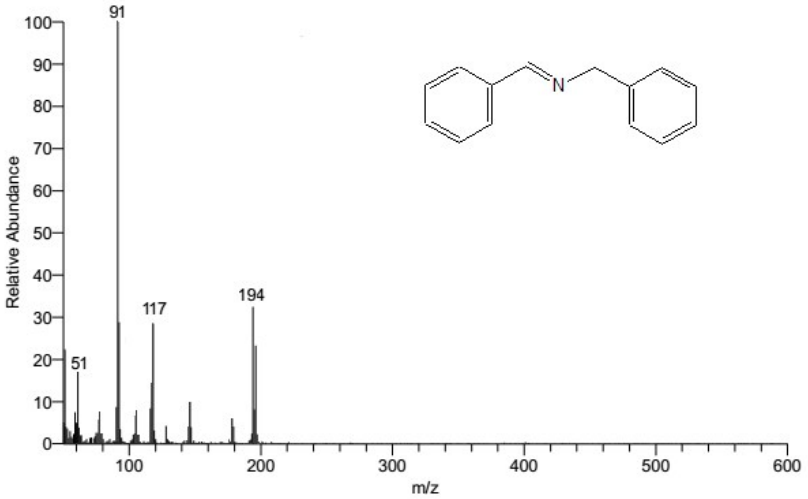

Fig. S13: GC-MS of the product obtained from oxidative coupling of benzylamine using Ag@rGO photocatalyst after 12 h irradiation time.

Table S1: A comparison of the Ag@rGO with literature known photocatalyst for the oxidation of benzylamine

Entry	Photocatalyst	T [°C]	Oxidant	Product Yield [%][a] or [μmol g^{-1} h^{-1}][b]	Ref. No.
1	Ag@rGO	RT	O_2	97[a]	This work
2	Cu_2O/CQD	RT	O_2	95[a]	[1]
3	Au/TiO_2	RT	Air	883[b]	[2]
4	Au-Pd/ZrO_2	45 °C	O_2	198[b]	[3]
5	$Fe(bpy)_3$/npg-C_3N_4	RT	O_2	94[a]	[4]
6	$BiVO_4$/g-C_3N_4	RT	O_2	1089[b]	[5]
7	WS_2	50 °C	O_2	94[a]	[6]
8	WO_3	RT	O_2	950[b]	[7]

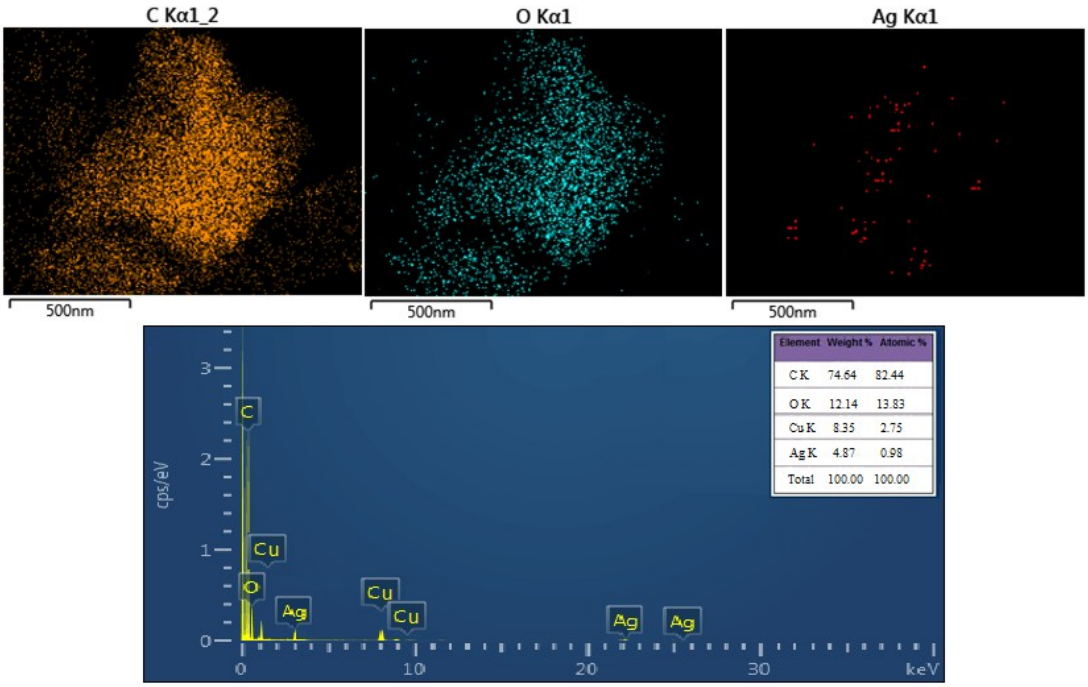

Fig. S2: EDX Pattern of Ag@rGO showing elemental composition

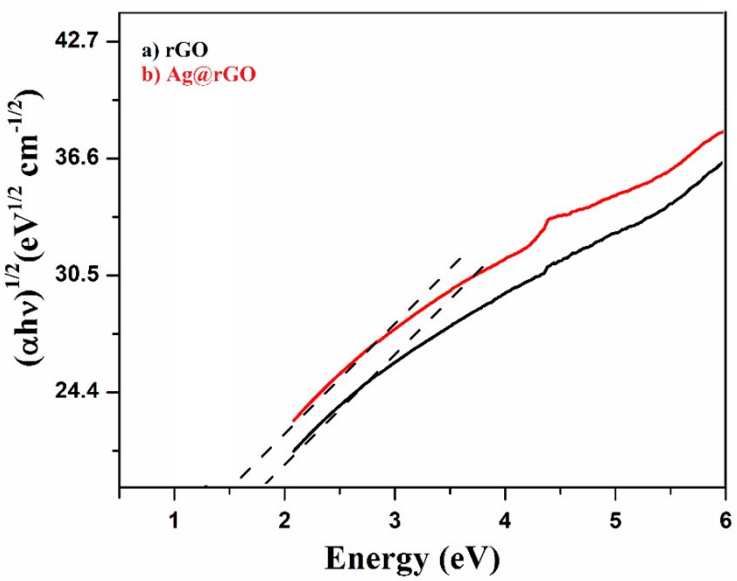

Fig. S3: Tauc plot for band gap determination of a) rGO, b) Ag@rGO.

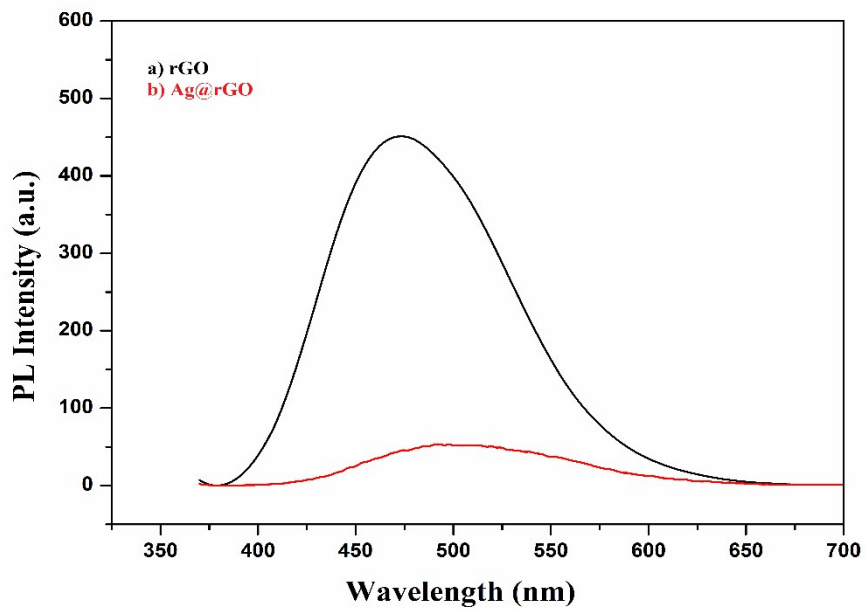

Fig. S4: PL spectra of a) rGO, b) Ag@ rGO photocatalyst.

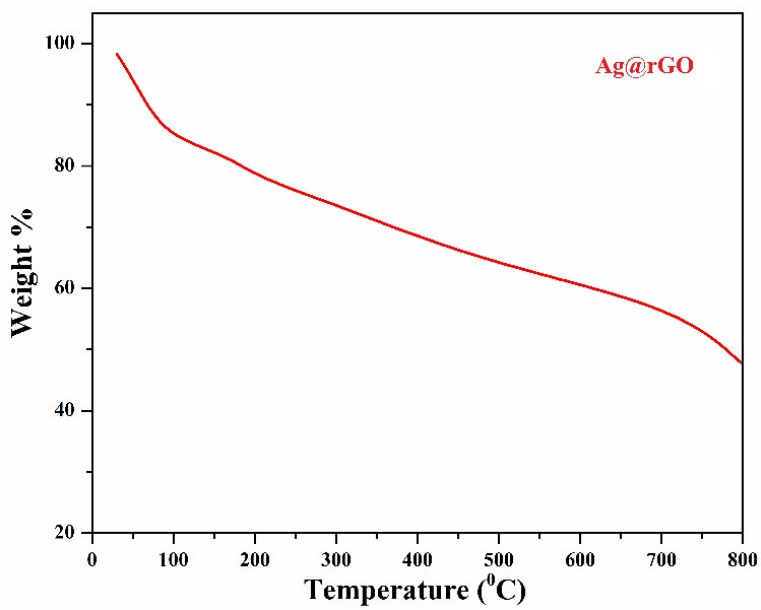

Fig. S5: TGA diagram of Ag@rGO.

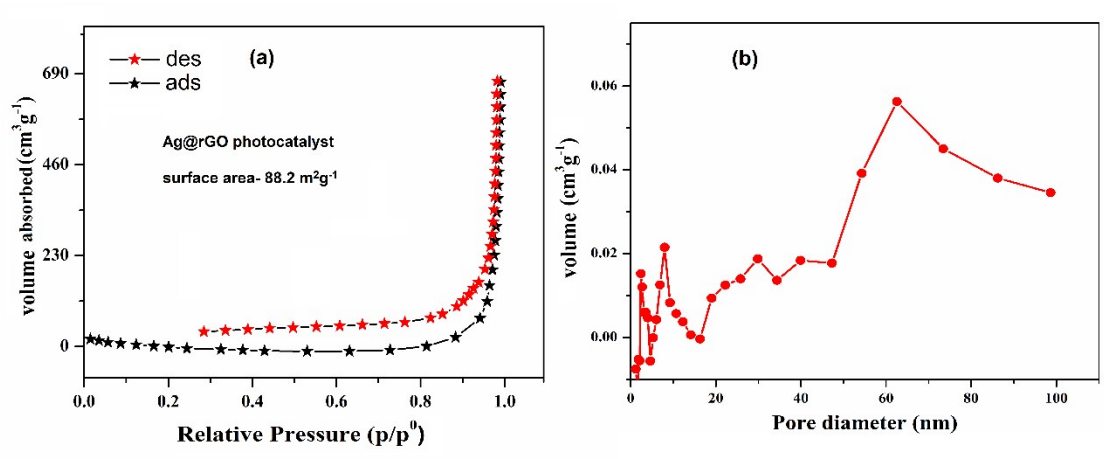

Fig. S6: N_2 adsorption-desorption isotherms; b) BJH pore size distribution curves of Ag@rGO.

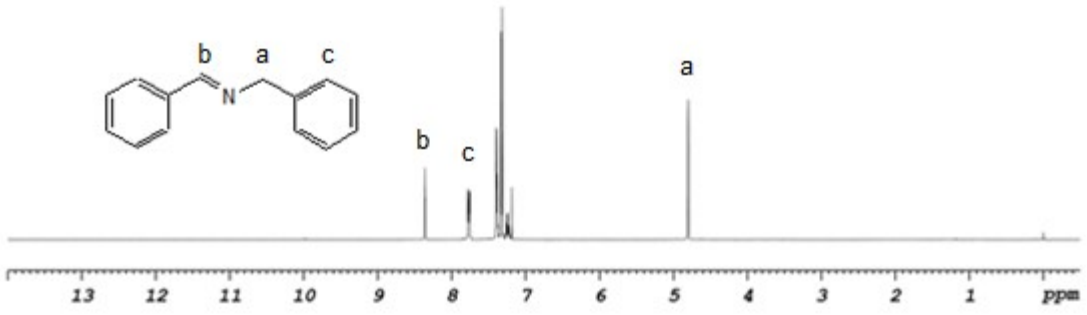

Fig. S7: ^{1}H NMR of N-benzylidenebenzylamine.

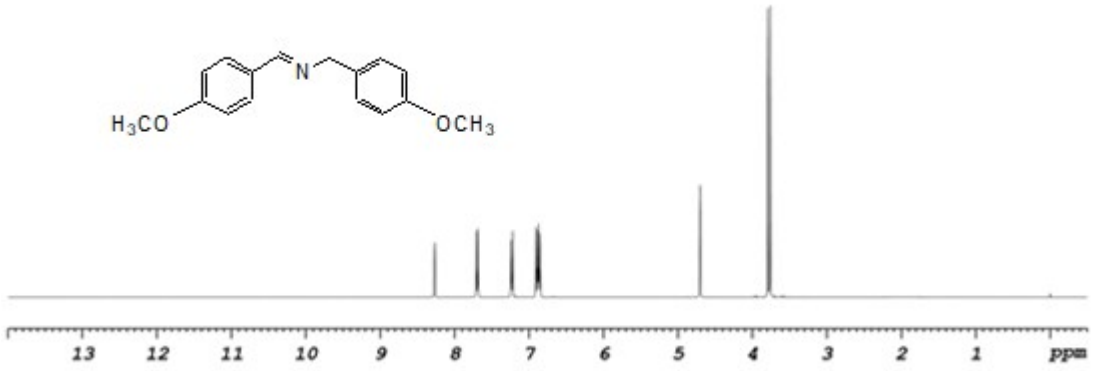

Fig. S8: ^{1}H NMR of N-(4-methoxybenzylidene)-p-methoxybenzylamine.

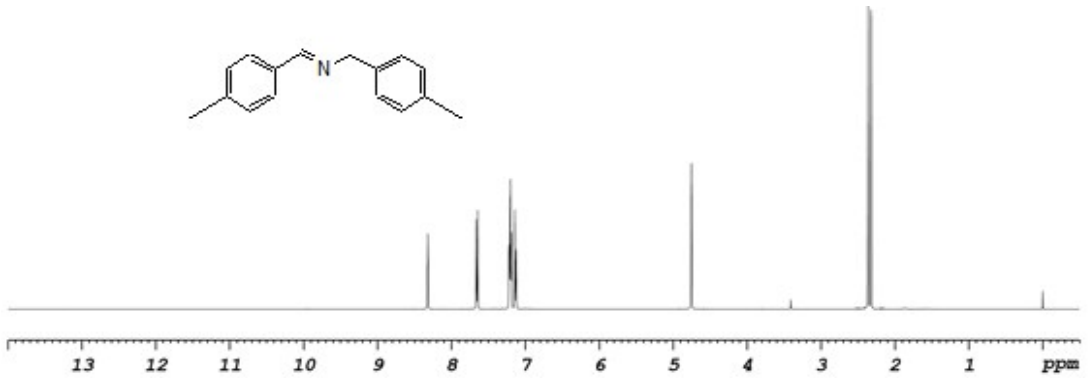

Fig. S9: ^{1}H NMR of N-(4-methylbenzylidene)-p-methylbenzylamine.

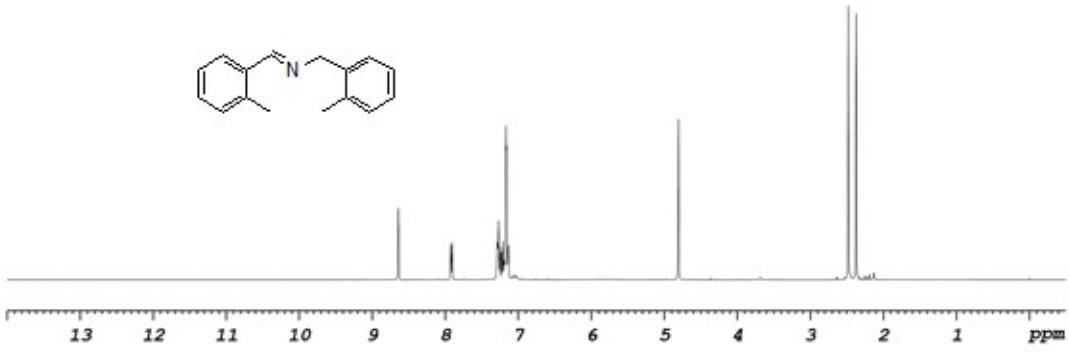

Fig. S10: ^{1}H NMR of N-(2-methylbenzylidene)-o-methylbenzylamine.

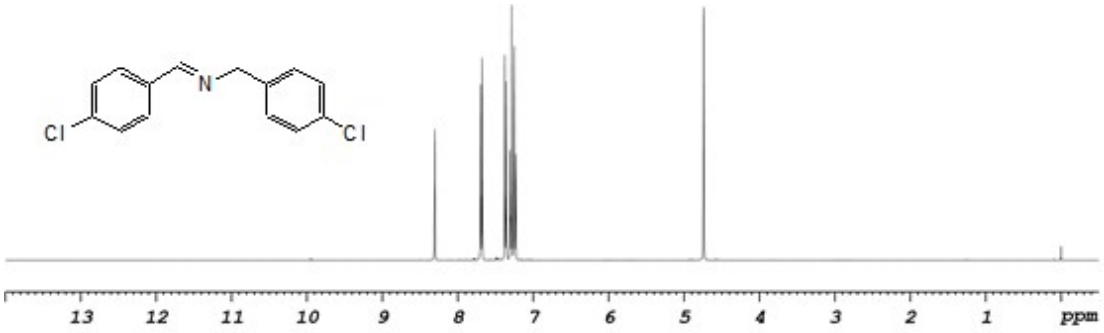

Fig. S11: ^{1}H NMR of N-(4-chlorobenzylidene)-p-chlorobenzylamine.

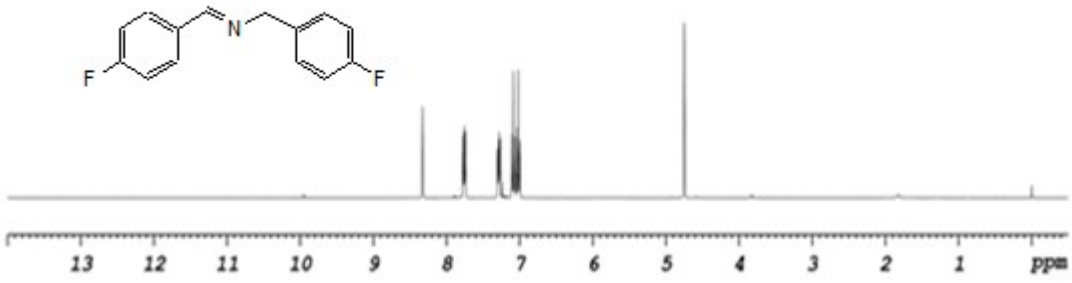

Fig. S12: ^{1}H NMR of N-(4-bromobenzylidene)-p-fluorobenzylamine.

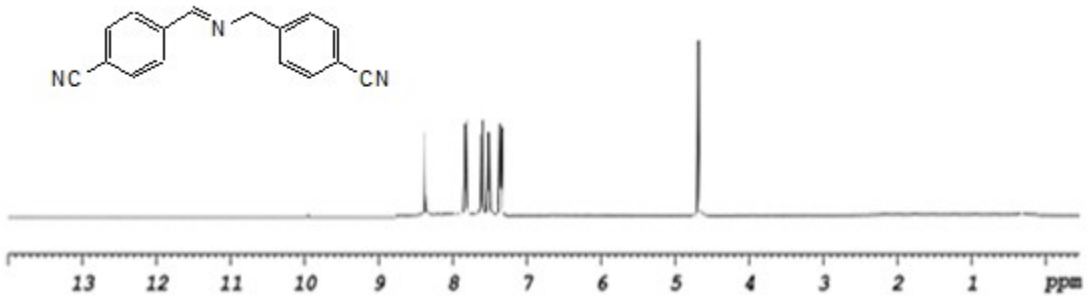

Fig. S13: ^{1}H NMR of N-(4-cyanobenzylidene)-p-fluorobenzylamine.

References:

[1]. A. Kumar, A. Hamdi, Y. Coffinier, A. Addad, P. Roussel, R. Boukherroub, S. L. Jain, *J. Photochem. Photobio. A*, 2018, 356, 457-463.

[2]. S. Naya, K. Kimura, H. Tada, *ACS Catal.,* 2012, 3, 10.

[3]. S. Sarina, H. Y. Zhu, E. Jaatinen, Q. Xiao, H. W. Liu, J. F. Jia, C. Chen, J. Zhao, *J. Am. Chem. Soc.,* 2013, 135, 5793.

[4]. A. Kumar, P. Kumar, C. Joshi, S. Ponnada, A. K. Pathak, A. Ali, B. Sreedhar, S. L. Jain, *Green Chem.*, 2016, 18, 2514.

[5]. S. Samanta, S. Khilari, D. Pradhan, R. Srivastava, *ACS Sustainable Chem. Eng*., 2017, 5, 2562.

[6]. F. Raza, J. H. Park, H. R. Lee, H. I. Kim, S. J. Jeon, J. H. Kim, *ACS Catal.*, 2016, 6, 2754.

[7]. N. Zhang, X. Y. Li, H. C. Ye, S. G. Chen, H. X. Ju, D. B. Liu, L. Yue, W. Ye, C. M. Wang, Q. Xu, J. F. Zhu, L. Song, J. Jiang, Y. J. Xiong, *J. Am. Chem. Soc.*, 2016, 138, 8928.