Supporting Information

Green Synthesis of Ag/TiO_2 Composites Coated Porous Vanadophosphates with Enhanced Visible-Light Photo-degradation and Catalytic Reduction Performance for Removing Organic Dyes

Shuang Wang, [a] Yujie Wang, [a] Linghan Li, [a] Lei Li, [a] Guoyuan Fu, [a] Rui Shi, [a] Xinyu Zou, [a] Zhijuan Zhang, [a] Fang Luo*, [a]

[†] *Key Laboratory of Polyoxometalate Science of Ministry of Education, Faculty of Chemistry, Northeast Normal University, Changchun, 130024, P. R. China*

Corresponding authors

Key Laboratory of Polyoxometalate Science of Ministry of Education, Faculty of Chemistry, Northeast Normal University, Changchun, 130024, P. R. China

E-mail address: luof746@nenu.edu.cn

Postal address: Northeast Normal University, Renmin Street No. 5268, Changchun, Jilin Province, 130024, P. R. China

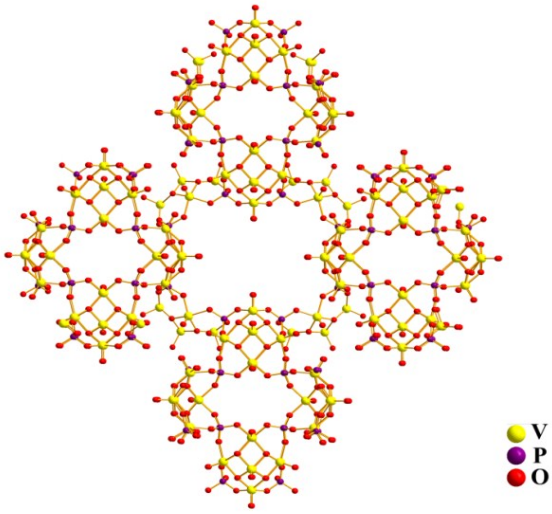

Fig. S1. Polyhedral view of the inorganic framework of VPO.

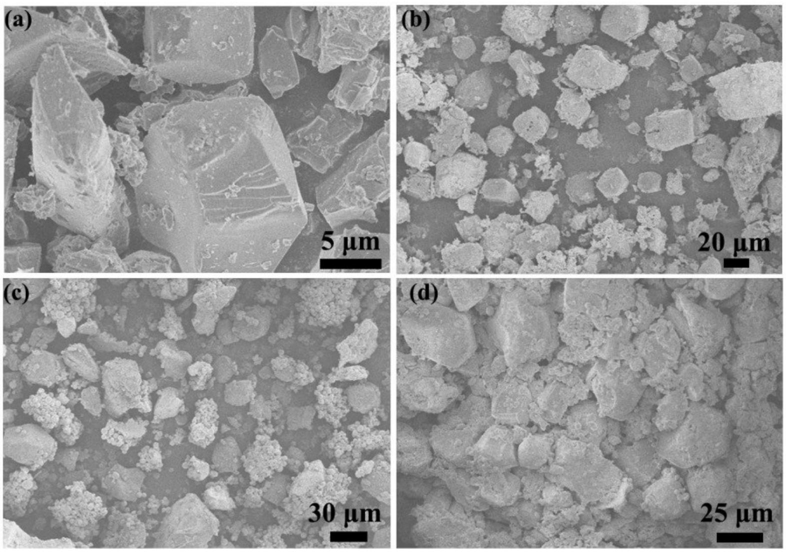

Fig. S2. SEM images of prepared VPO@TiO_2 composies at amount of (a) 60 µl TBT (b) 100 µl TBT (c) 200 µl TBT (d) 400 µl TBT.

Fig. S3. The physical map of (a) single VPO water-soluble and (b) the prepared VPO@TiO_2 composite.

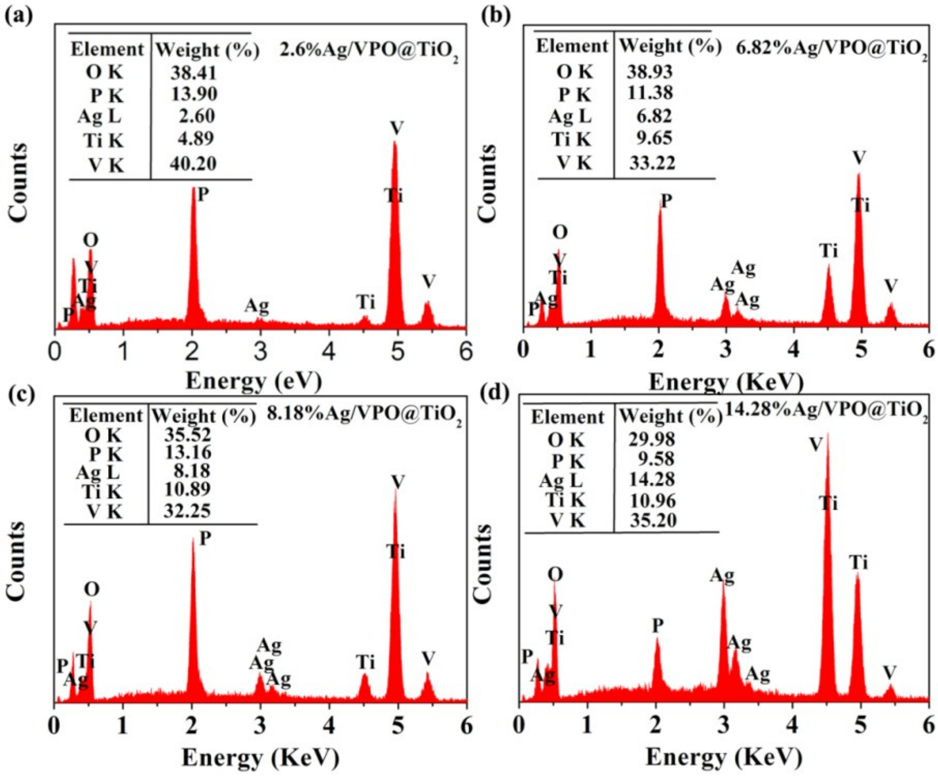

Fig. S4. EDX of (a) 2.6%Ag/VPO@TiO_2; (b) 6.82%Ag/VPO@TiO_2; (c) 8.18%Ag/VPO@TiO_2; (d) 14.28%Ag/VPO@TiO_2, respectively.

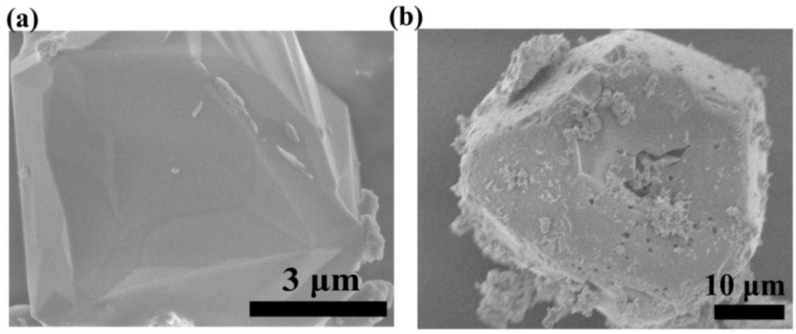

Fig. S5. (a) SEM images of pure VPO; (b) SEM images of Ag/VPO composite.

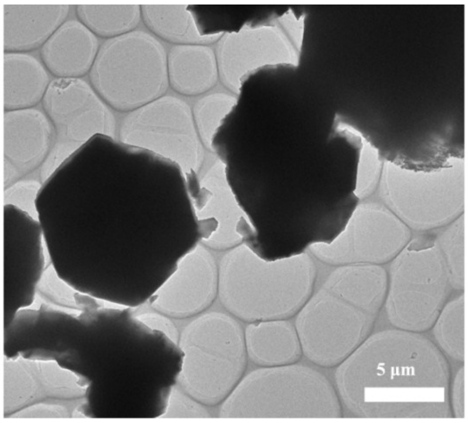

Fig. S6. TEM images of 6.82%Ag/VPO@TiO_2.

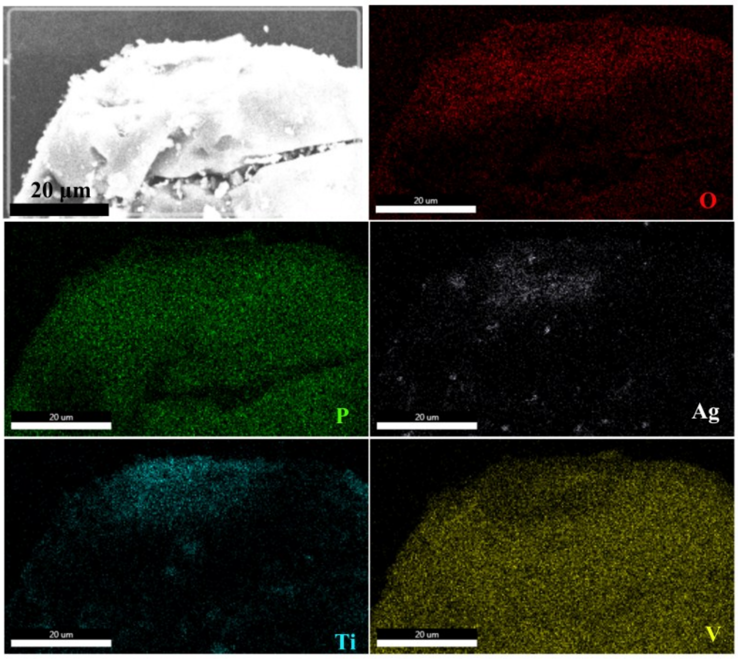

Fig. S7. Elemental mapping of 6.82%Ag/VPO@TiO_2.

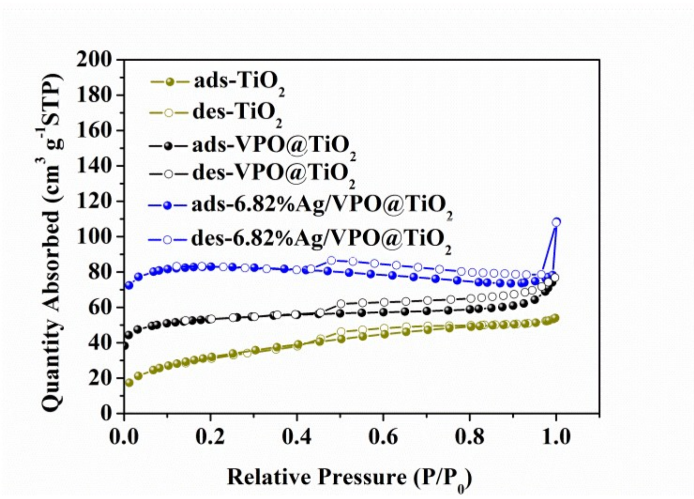

Fig. S8. N_2 adsorption-desorption isotherms of TiO_2, VPO@TiO_2 and 6.82%Ag/VPO@TiO_2, respectively.

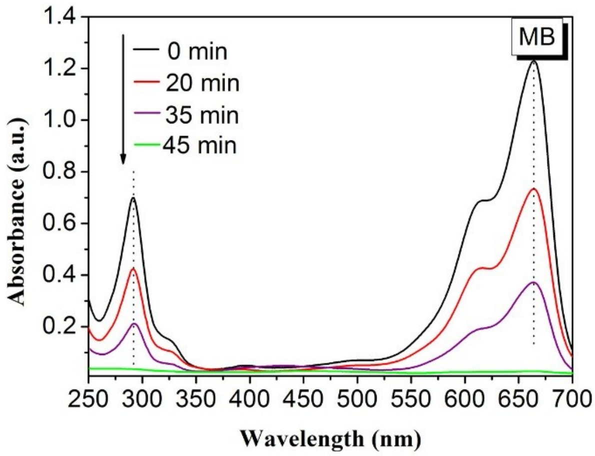

Fig. S9. Photocatalytic degradation profiles of MB for 6.82%Ag/VPO@TiO_2 composite under visible light irradiation.

Tab S1. Visible degradation rate constants *k* (sec^{-1}) for the reported Ag/TiO_2 type and the 6.82%Ag/VPO@TiO_2 composite

Catalysts	Catalyst used	Rate constants (*k*)	Reaction time	Reference
Ag@TiO_2	0.5 mM	0.20519×10^{-3} sec^{-1}	240 min	1
Ag@TiO_2/Pani	2 mg	0.6111×10^{-4} sec^{-1}	360 min	2
Ag(1)/TiO_2 films	-	0.4833×10^{-4} sec^{-1}	30 min	4
TiO2/Ag films	15×20 mm	0.265×10^{-3} sec^{-1}	180 min	5
BN–Ag/TiO_2	0.4 g L^{-1}	0.775×10^{-3} sec^{-1}	80 min	6
Ag:TiO_2	-	0.667×10^{-4} sec^{-1}	200 min	7
Ag/TiO_2/graphene	100 mg	0.1167×10^{-2} sec^{-1}	60 min	8
6.82%Ag/VPO@TiO_2	**30 mg**	**0.2231×10^{-3} sec^{-1}**	**75 min**	**This work**

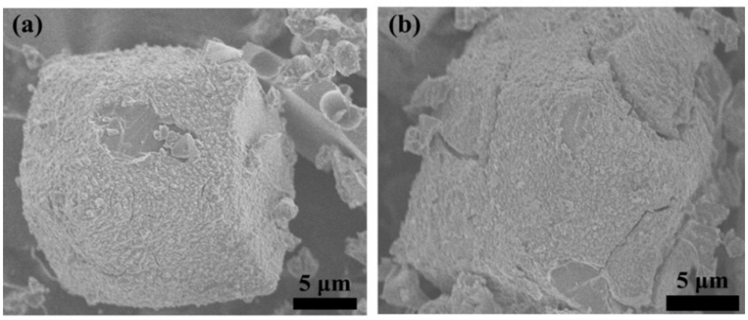

Fig. S10. (a) SEM images of 8.18%Ag/VPO@TiO_2; (b) SEM images of 14.28%Ag/VPO@TiO_2.

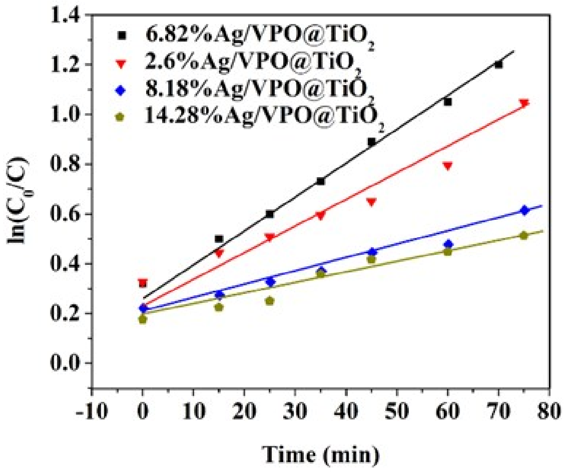

Fig. S11 First-order kinetic plots for the photodegradation of MB by different samples.

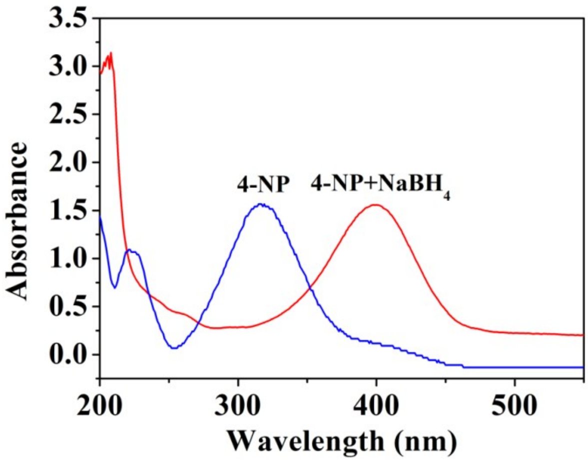

Fig. S12. UV-visible absorption spectra of 4-NP with and without the presence of $NaBH_4$.

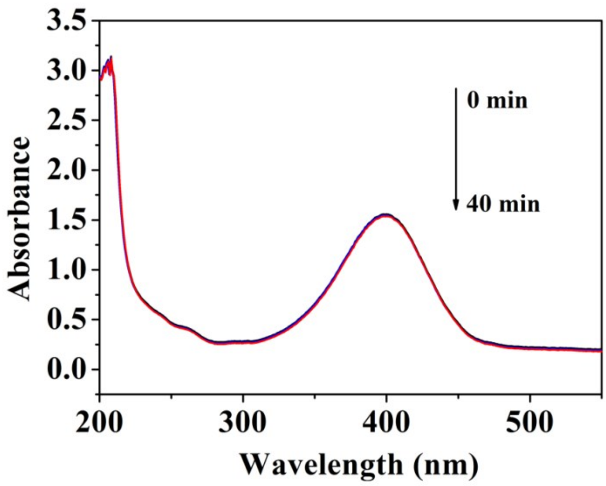

Fig. S13. UV-Vis absorption spectra of 4-NP with only the addition of $NaBH_4$ for 40 min.

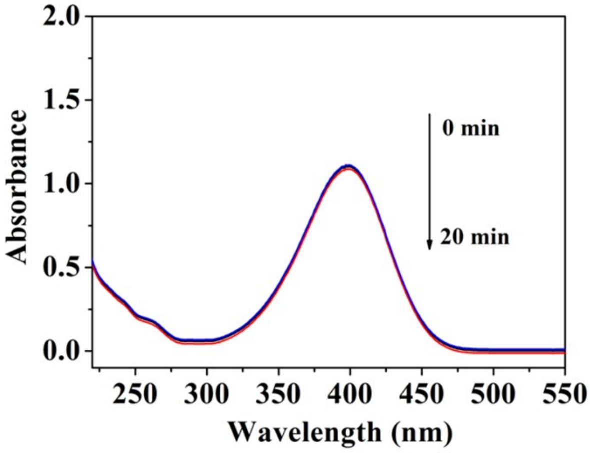

Fig. S14. UV-Vis absorption spectra of 4-NP with TiO_2 as a catalyst.

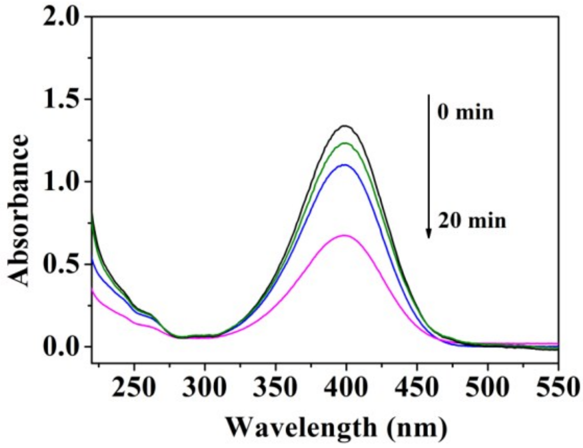

Fig. S15. UV-Vis absorption spectra of p-nitrophenol with VPO@TiO_2 as catalyst.

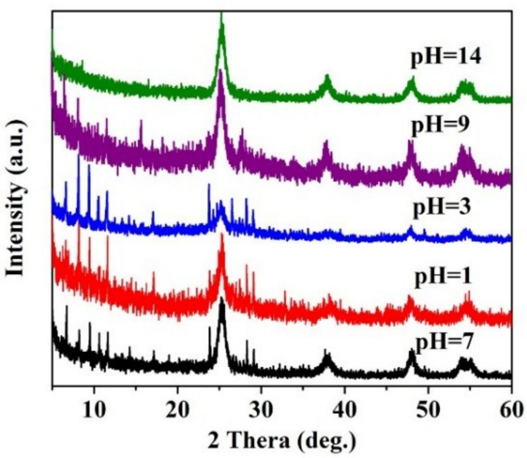

Fig. S16. PXRD patterns of 6.82%Ag/VPO@TiO_2 composites after soaking for one day at pH = 1, 3, 9, 14 respectively.

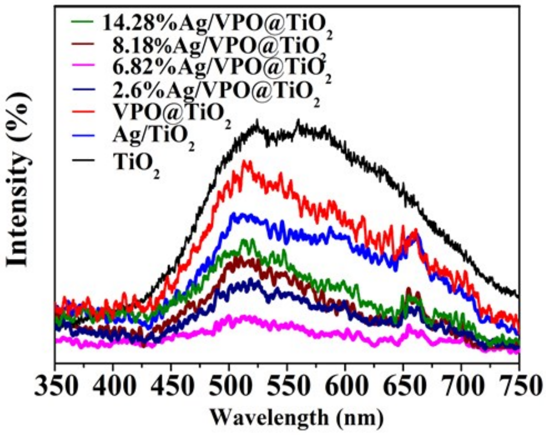

Fig. S17. The PL spectra of different samples.

Tab S2. First-Order Rate Constants of 4-NP Reduction Catalyzed by Different Ag nanoparticles loading catalysts [a].

Entry	Catalyst (mg)	$NaBH_4$ (μL)	[b]Rate constants k(s)$^{-1}$	Time (s)
1	Ag/TiO_2	300	0.012	240
2	2.6%Ag/VPO@TiO_2	300	0.16	100
3	6.82%Ag/VPO@TiO_2	300	0.95	40
4	8.18%Ag/VPO@TiO_2	300	0.09	150
5	14.28%Ag/VPO@TiO_2	300	0.03	180

[a]Reaction conditions: p-nitrophenol (0.1 mM), catalyst (30 mg), $NaBH_4$ (0.05 mM).
[b]The rate constants was calculated as the dynamic behavior over a 40 s.

Tab. S3. Comparison of particle size, contents of Ag (μg), quality of 4-NP and catalytic performance for 4-NP reduction presented in literatures and the present work

Catalysts	Particle size (nm)	Quality of 4-NP (mmol)	Catalyst used	Reduction time	Reference
Cu_2O-Ag	18	1×10^{-4}	1 mg	7min	1

Ag-coated PVDF nanofiber	66 ± 10	4.8×10^{-4}	-	60 min	2
Ag-SiO_2	12	5	0.2 mg	15 min	3
Fe_3O_4@Ag	52.2	5	0.4 mg	6 min	4
Ag/Fe_3O_4@C	10	0.2	20 mg	10 min	5
Ag-γ-Fe_2O_3	7.8	10	28.77 mM	13 min	6
Ag@CeO_2	180	1	5 mg	550 s	7
6.82%Ag/VPO@TiO_2	**10-25**	**0.1**	**5 mg**	**40 s**	**This work**

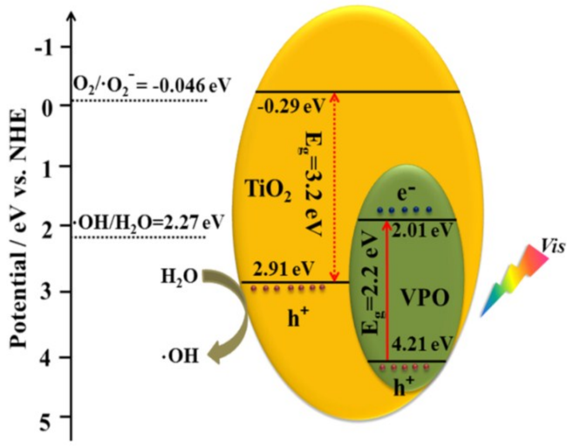

Fig. S18. The photodegradated mechanism of MB molecules by the VPO@TiO_2 composite under visible light irradiation.

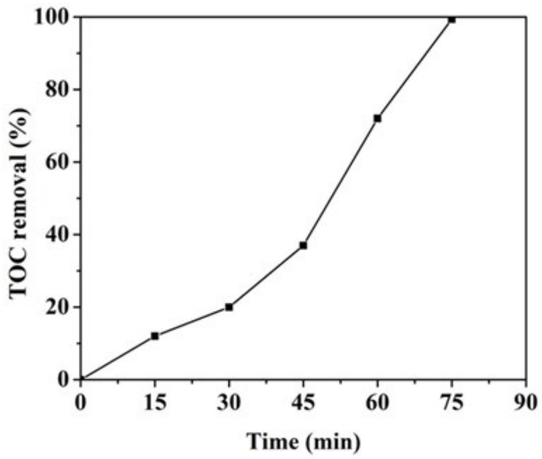

Fig. S19. MB removal with 6.82%Ag/VPO@TiO_2 composites.

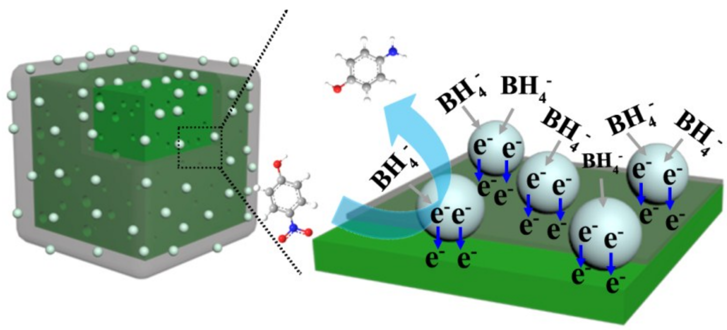

Fig. S20. Schematic illustrati0on for the catalytic reduction of 4-NP molecules with the 6.82%Ag/VPO@TiO_2 composite.

Reference

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