Electronic Supplementary Information

Z-Schemed WO_3/rGO/$SnIn_4S_8$ Sandwich Nanohybrids for Efficient Visible Light Photocatalytic Water Purification

Pingfan Xu [1,2], Siyi Huang [2], Minghua Liu [2,*], Yuancai Lv [2], Zhonghui Wang [1], Jinlin Long [3], Wei Zhang [4] and Haojun Fan [1,*]

[1] National Engineering Laboratory for Clean Technology of Leather Manufacture, Sichuan University, Chengdu 610065, China; shoppingfan@126.com (P.X.); wangzhonghui652@163.com (Z.W.)
[2] College of Environment & Resource, Fuzhou University, Fuzhou 350116, China; hsy920329@163.com (S.Y.); yclv@fzu.edu.cn (Y.L.)
[3] State Key Lab of Photocatalysis on Energy and Environment, College of Chemistry, Fuzhou University, Fuzhou 350116, China; jllong@fzu.edu.cn
[4] State Key Laboratory of Polymer Materials Engineering, Polymer Research Institute at Sichuan University, Chengdu 610065, China; weizhang@scu.edu.cn
* Correspondence: mhliu2000@fzu.edu.cn (M.L.); fanhaojun@scu.edu.cn (H.F.)

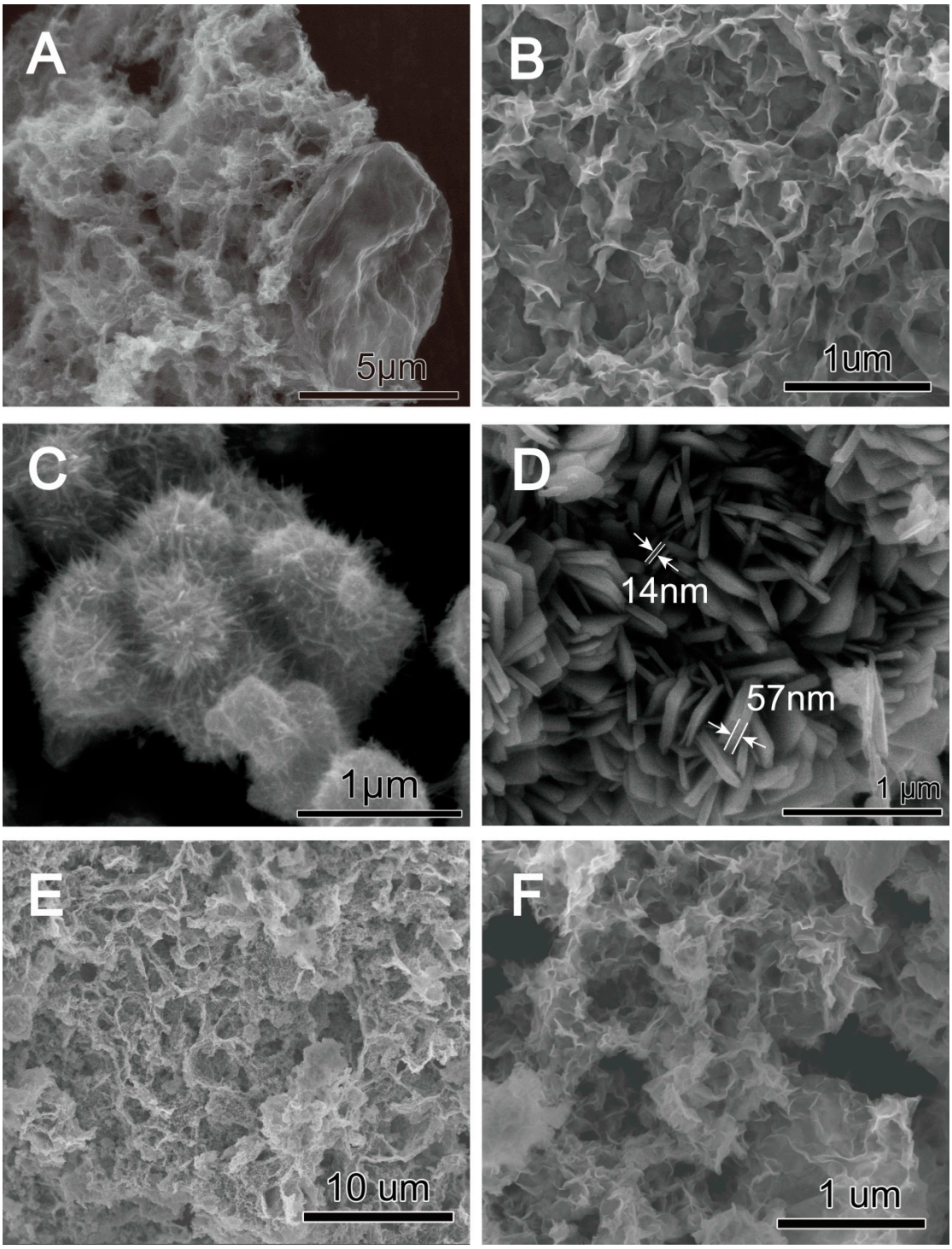

Figure S1. SEM images (A) rGO; (B) SIS; (C) Original WO_3; (D) WO_3; (E-F) WGS-5%.

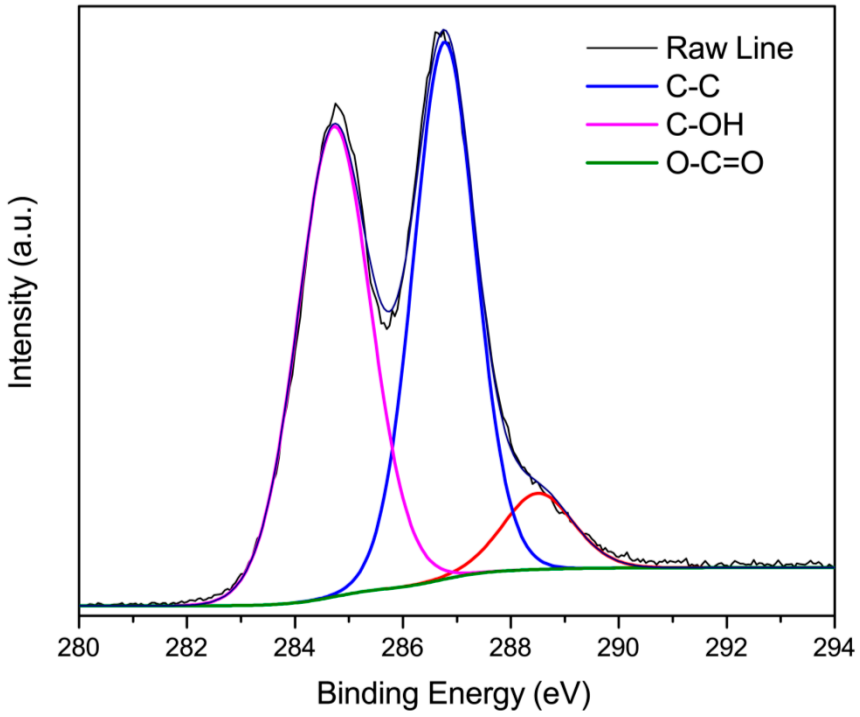

Figure S2. XPS spectra of GO, detail scan of C 1s.

Table S1. the peak separation and area ratios of Sn, In, and W.

Element	Peak location(eV)		Peak separation(eV)	Area ratio ($d_{5/2}$:$d_{3/2}$ or $f_{7/2}$:$f_{5/2}$)
Sn	452.5($d_{5/2}$)	444.9($d_{3/2}$)	8.5	1.53
In	494.9($d_{5/2}$)	452.5($d_{3/2}$)	7.6	1.5
W	37.85($f_{7/2}$)	35.71($f_{5/2}$)	2.15	1.38

Table S2. The optical properties of WO_3 and SIS.

Sample /Frequency(kHZ)	Y = BX + A	*V* (V vs. SCE)	E_{fb} (V vs. SCE)	$E_{fb} \approx E_{CB}$ [a] (V vs. NHE)	E_g (eV)	E_{VB} [b] (V vs. NHE)
WO_3-1	Y = 6.23X + 0.567	-0.091	-0.12			
WO_3-1.5	Y = 6.00X + 0.639	-0.106	-0.13	0.12	2.67	2.79
WO_3-2	Y = 5.68X + 0.669	-0.118	-0.14			
SIS-1.5	Y = 3.80X + 3.28	-0.863	-0.89	-0.66	1.95	1.29
SIS-2	Y = 3.63X + 3.22	-0.887	-0.91			

[a] E_{fb}**(V vs. SCE) =** E_{fb}**(V vs. NHE) + 0.245;** [b] $E_{VB} = E_g + E_{CB}$.

Table S3. Z-scheme heterojunction with rGO as electron mediator for degradation of pollutants

under visible light irradiation.

PSI	PSII	Pollutants	Catalyst dosage (g/L)	Conc (mg/L): Volume (mL)	Degradation (%)/time	Refs
g-C_3N_4	Bi_2MoO_6	RhB	1.0	10:250	97.3/1 h	[1]
g-C_3N_4	$FeWO_4$	RhB	1.0	5:80	92.3/100 min	[2]
g-C_3N_4	$BiVO_4$	Tetracycline	1.0	35:40	72.5/150 min	[3]
TiO_2	$W_{18}O_{49}$	RhB	0.29	10:35	99/15 min	[4]
g-C_3N_4	Bi_2WO_6	TCP	1.0	20:250	98/2 h	[5]
BiOI	Bi_2S_3	Cr(VI)	1.0	50:50	41.3/4 h	[6]
WO_3	$SnIn_4S_8$	RhB	0.1	30:100	99.4/1 h	Present work
WO_3	$SnIn_4S_8$	Cr(VI)	0.1	20:100	94.3/30 min	

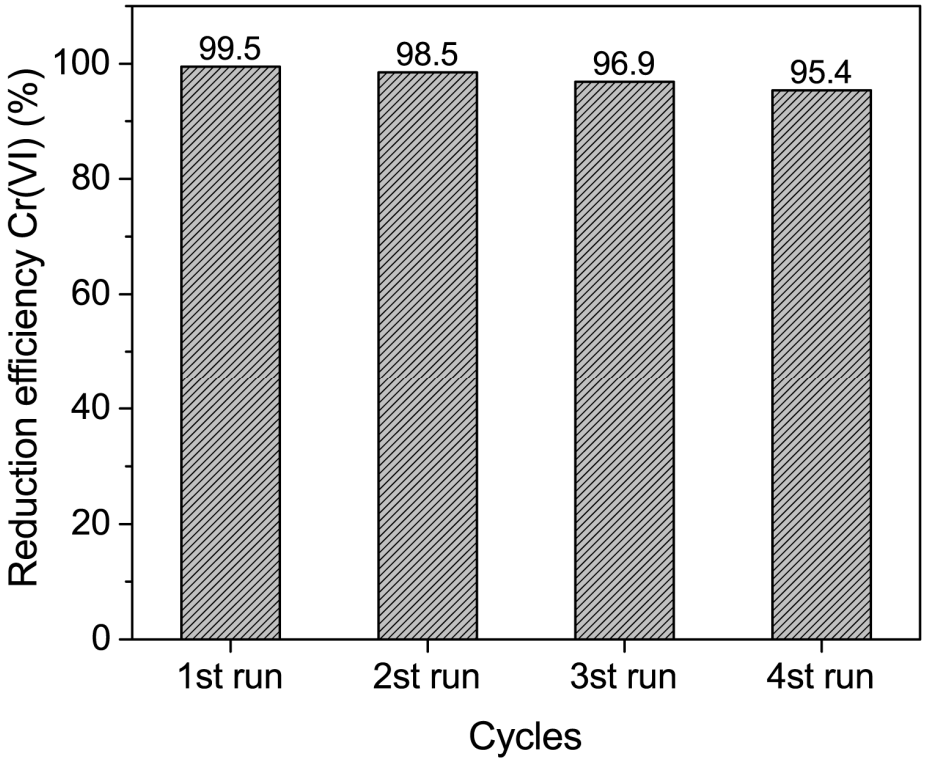

Figure S3. Reusability of WGS-2.5% for the photocatalytic reduction of Cr(VI) at pH 4.

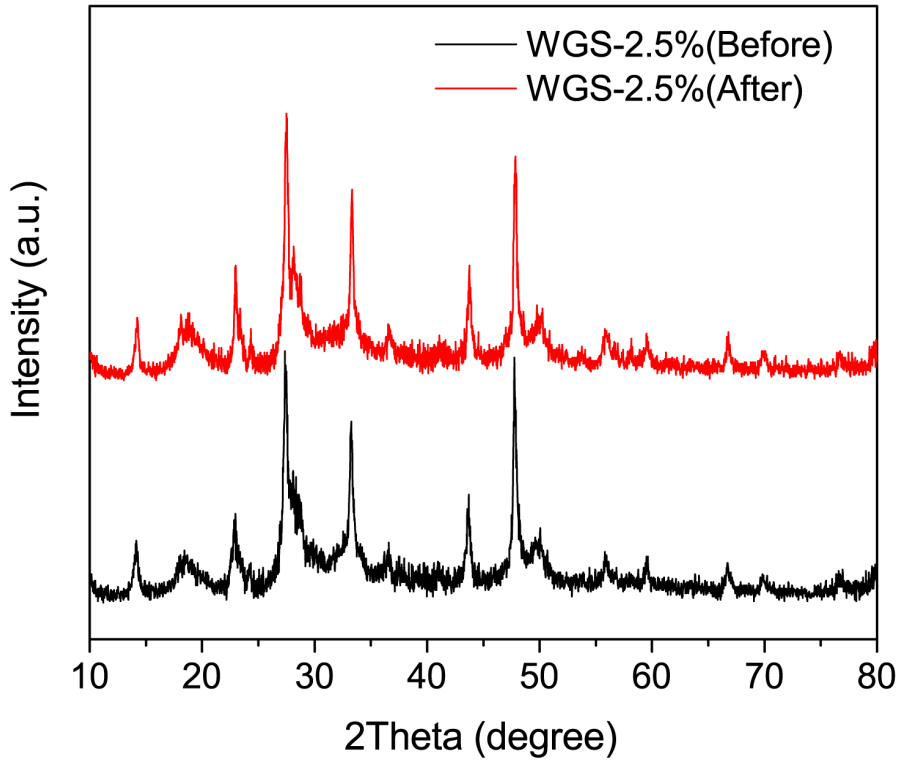

Figure S4. XRD pattern of WGS-2.5% before and after four cycles used.

References

1. Ma, D.; Wu, J.; Gao, M.; Xin, Y.; Sun, Y.; Ma, T. Hydrothermal synthesis of an artificial Z-scheme visible light photocatalytic system using reduced graphene oxide as the electron mediator. *Chem. Eng. J.* 2017, *313*, 1567-1576.
2. Wang, C.; Wang, G.; Zhang, X.; Dong, X.; Ma, C.; Zhang, X.; Ma, H.; Xue, M. Construction of g-C_3N_4 and $FeWO_4$ Z-scheme photocatalyst: effect of contact ways on the photocatalytic performance. *RSC Adv*. 2018, *8*, 18419-18426.
3. Jiang, D.; Xiao, P.; Shao, L.; Li, D.; Chen, M. RGO-Promoted All-Solid-State g-C_3N_4/$BiVO_4$ Z-Scheme Heterostructure with Enhanced Photocatalytic Activity toward the Degradation of Antibiotics. *Ind. Eng. Chem. Res.* 2017, 56, 8823-8832.
4. Jia, C.; Zhang, X.; Matras-Postolek, K.; Huang, B.; Yang, P. Z-scheme reduced graphene oxide/TiO_2-Bronze/$W_{18}O_{49}$ ternary heterostructure towards efficient full solar-spectrum photocatalysis. *Carbon*. 2018, *139*, 415-426.
5. Ma, D.; Wu, J.; Gao, M.; Xin, Y.; Ma, T.; Sun, Y. Fabrication of Z-scheme g -C_3N_4/RGO/Bi_2WO_6 photocatalyst with enhanced visible-light photocatalytic activity. *Chem. Eng. J*. 2016, *290*, 136-146.
6. Chen, A.; Bian, Z.; Xu, J.; Xin, X.; Wang, Hui. Simultaneous removal of Cr(VI) and phenol contaminants using Z-scheme bismuth oxyiodide/reduced graphene oxide/bismuth sulfide system under visible-light irradiation. *Chemosphere*. 2017, 188, 659-666.