

This is an Open Access document downloaded from ORCA, Cardiff University's institutional repository: <https://orca.cardiff.ac.uk/id/eprint/125826/>

This is the author's version of a work that was submitted to / accepted for publication.

Citation for final published version:

Pudkon, Watcharapong, Kaowphong, Sulawan, Pattisson, Samuel, Miedziak, Peter J., Bahruji, Hasliza, Davies, Thomas E., Morgan, David J. and Hutchings, Graham J. 2019. Microwave synthesis of ZnIn₂S₄/WS₂ composites for photocatalytic hydrogen production and hexavalent chromium reduction. *Catalysis Science and Technology* 9 (20) , pp. 5698-5711. 10.1039/C9CY01553A

Publishers page: <http://dx.doi.org/10.1039/C9CY01553A>

Please note:

Changes made as a result of publishing processes such as copy-editing, formatting and page numbers may not be reflected in this version. For the definitive version of this publication, please refer to the published source. You are advised to consult the publisher's version if you wish to cite this paper.

This version is being made available in accordance with publisher policies. See <http://orca.cf.ac.uk/policies.html> for usage policies. Copyright and moral rights for publications made available in ORCA are retained by the copyright holders.



Supporting Information

Microwave synthesis of ZnIn₂S₄/WS₂ composites for photocatalytic hydrogen production and hexavalent chromium reduction

Watcharapong Pudkon^{a,b}, Sulawan Kaowphong^{a,c}, Samuel Pattisson^d, Peter J. Miedziak^{d,e}, Hasliza Bahruji^d, Thomas E. Davies^d, David J. Morgan^d and Graham J. Hutchings^{d,*}

^a*Department of Chemistry, Faculty of Science, Chiang Mai University, Chiang Mai 50200, Thailand*

^b*Graduate School, Chiang Mai University, Chiang Mai 50200, Thailand*

^c*Center of Excellence in Materials Science and Technology, Chiang Mai University, Chiang Mai 50200, Thailand*

^d*Cardiff Catalysis Institute, School of Chemistry, Cardiff University, Main Building, Park Place CF10 3AT, Cardiff, UK*

^e*School of Applied Sciences, University of South Wales, Pontypridd CF37 4AT, UK*

Table S1. The apparent quantum yield (AQY) of the ZnIn₂S₄/WS₂ photocatalyst for the photocatalytic H₂ production compared with the previous literatures.

Photocatalyst	Weight of photocatalyst (mg)	Light source details	AQY (%)	Ref.
ZnIn ₂ S ₄ /WS ₂ (Our work)	100	150 W Xe lamp ($\lambda > 400$ nm)	9.22	-
ZnIn ₂ S ₄ /RGO/BiVO ₄	200	350 W Xe lamp ($\lambda > 420$ nm)	0.8	[1]
ZnIn ₂ S ₄ /g-C ₃ N ₄	500	300 W Xe lamp ($\lambda > 400$ nm)	0.28	[2]
ZnIn ₂ S ₄ /In ₂ S ₃	100	300 W Xe lamp ($\lambda > 400$ nm)	1.4	[3]
ZnIn ₂ S ₄ /RGO/MoS ₂	100	300 W Xe lamp ($\lambda > 420$ nm)	0.4	[4]
ZnIn ₂ S ₄ /NH ₂ -MIL-125(Ti)	50	300 W Xe lamp ($\lambda > 420$ nm)	4.3	[5]

Table S2. The apparent quantum yield (AQY) of the ZnIn₂S₄/WS₂ photocatalyst for the photocatalytic Cr(VI) reduction compared with the previous literature.

Photocatalyst	Weight of photocatalyst (mg)	Light source details	AQY (%)	Ref.
ZnIn ₂ S ₄ /WS ₂ (Our work)	100	150 W Xe lamp ($\lambda > 400$ nm)	5.89	-
ZnIn ₂ S ₄ /CaIn ₂ S ₄	50	300 W Xe lamp ($\lambda > 420$ nm)	6.6	[6]

References

- [1] R. Zhu, F. Tian, G. Cao and F. Ouyang, *International Journal of Hydrogen Energy*, 2017, **42**, 17350-17361.
- [2] Z. Zhang, K. Liu, Z. Feng, Y. Bao and B. Dong, *Scientific Reports*, 2016, **6**, 19221(1)-19221(10).
- [3] Z. Mei, S. Ouyang, D.-M. Tang, T. Kako, D. Golberg and J. Ye, *Dalton Transactions*, 2013, **42**, 2687-2690.
- [4] N. Ding, Y. Fan, Y. Luo, D. Li and Q. Meng, *APL Materials*, 2015, **3**, 104417(1)-104417(7).
- [5] H. Liu, J. Zhang and D. Ao, *Applied Catalysis B: Environmental*, 2018, **221**, 433-442.
- [6] S. Xu, J. Dai, J. Yang, J. You and J. Hao, *Nanomaterials*, 2018, **8**, 472(1)-472(17).