

Supporting Information

One-step dry coating of hybrid ZnO-WO₃ nanosheet photoanodes for photoelectrochemical water splitting with composition-dependent performance

Muhammad Shehroze Malik ^a, Deepto Roy ^a, Doo-Man Chun ^{a, *}, and A. G. Abd-Elrahim ^{a, b}

^a School of Mechanical Engineering, University of Ulsan, Ulsan, 44610, Korea

^b Physics Department, Faculty of Science, Assiut University, Assiut 71516, Egypt

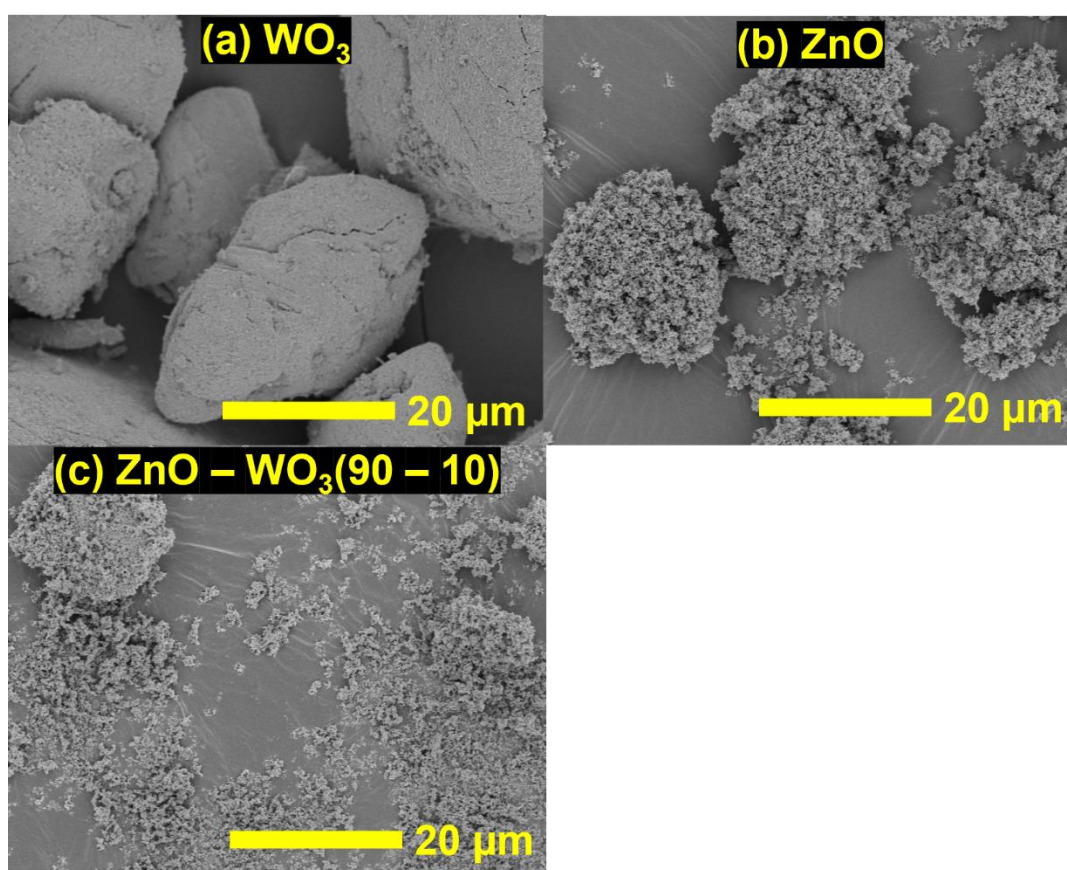


Figure S1: Scanning electron microscopy images of ZnO powder (a), WO₃ powder (b), and ZnO–WO₃ composite powder with 10% WO₃ content (c)

* Corresponding Author: dmchun@ulsan.ac.kr (Doo-Man Chun)

Table S1. The average consumable time for different material coatings in different techniques.

Coating Techniques	Material	Average Consumable Time (Hours)	Ref
Nanoparticle Deposition System (NPDS)	ZnO-WO ₃	0.5	Our work
Sol-gel method+ Hummer's method	ZnO – Graphene Oxide	6.5	[1]
Aqueous chemical method	ZnO	11.3	[2]
Hydrothermal and cation exchange method	ZnO/CuInS ₂	16	[3]
Solvothermal method	ZnO-WO _{3-x}	21	[4]

References:

- [1] M. Ghorbani, H. Abdizadeh, M. Taheri, M.R. Golobostanfard, Enhanced photoelectrochemical water splitting in hierarchical porous ZnO/Reduced graphene oxide nanocomposite synthesized by sol-gel method, *Int. J. Hydrogen Energy*. 43 (2018) 7754–7763. <https://doi.org/10.1016/j.ijhydene.2018.03.052>.
- [2] R. Lv, T. Wang, F. Su, P. Zhang, C. Li, J. Gong, Facile synthesis of ZnO nanopencil arrays for photoelectrochemical water splitting, *Nano Energy*. 7 (2014) 143–150. <https://doi.org/10.1016/j.nanoen.2014.04.020>.
- [3] Y. Li, Z. Liu, Y. Wang, Z. Liu, J. Han, J. Ya, ZnO/CuInS₂ core/shell heterojunction nanoarray for photoelectrochemical water splitting, *Int. J. Hydrogen Energy*. 37 (2012) 15029–15037. <https://doi.org/10.1016/j.ijhydene.2012.07.117>.
- [4] Y. Chen, L. Wang, R. Gao, Y.C. Zhang, L. Pan, C. Huang, K. Liu, X.Y. Chang, X. Zhang, J.J. Zou, Polarization-Enhanced direct Z-scheme ZnO-WO_{3-x} nanorod arrays for efficient piezoelectric-photoelectrochemical Water splitting, *Appl. Catal. B Environ*. 259 (2019) 118079. <https://doi.org/10.1016/j.apcatb.2019.118079>.