Electronic Supplementary Material (ESI) for Nanoscale.
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Supporting Information

Charge Separation in Facet Engineered Chalcogenide Photocatalyst: A Selective Photocorrosion Approach**

Naixu Li,[a] Maochang Liu,[b] Zhaohui Zhou,[b] Jiancheng Zhou,*[a] Yueming Sun,[a]and Liejin Guo*[b]

[a] Prof. J. Zhou, Prof. Y. Sun, N. Li
School of Chemistry and Chemical Engineering
Southeast University, Nanjing, Jiangsu, 211189 (P. R. China)
E-mail: jczhou@seu.edu.cn

[b] Prof. L. Guo, Dr. M. Liu, Dr. Z. Zhou
International Research Center for Renewable Energy
State Key Laboratory of Multiphase Flow
Xi'an Jiaotong University, Xi'an, Shaanxi 710049 (P. R. China)
E-mail: lj-guo@mail.xjtu.edu.cn

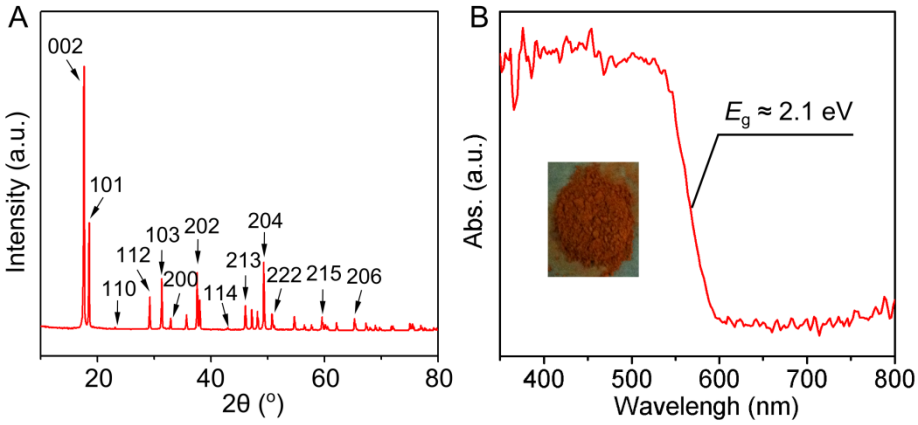

Figure S1. A) XRD pattern, and B) UV-vis spectrum of Cu_2WS_4 photocatalyst. Inset in (B) shows the photo of Cu_2WS_4 powder. XRD pattern with dominating diffraction peaks of 002 and 101, to some degree, indicate an exposure of {001} and {101} facets. The band gap of the photocatalyst was calculated to be about 2.1 eV according to the Kubelka-Munk method from the UV-vis spectrum.[1,2]

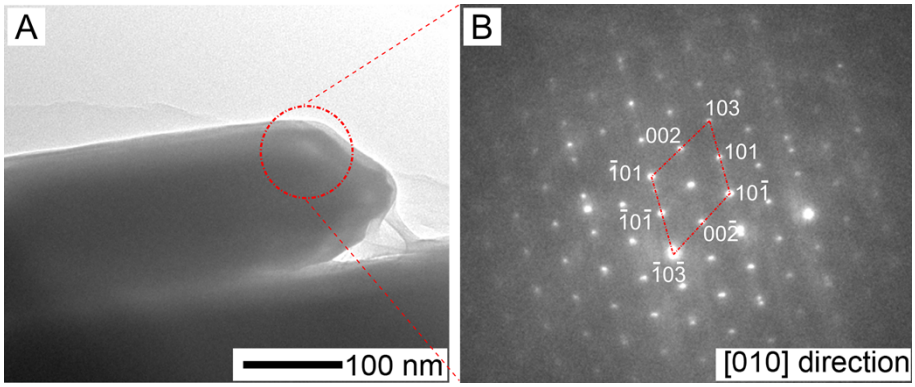

Figure S2. A) TEM image viewed from [010] direction, and B) corresponding selected-area electron diffraction (SAED) pattern in the marked area.

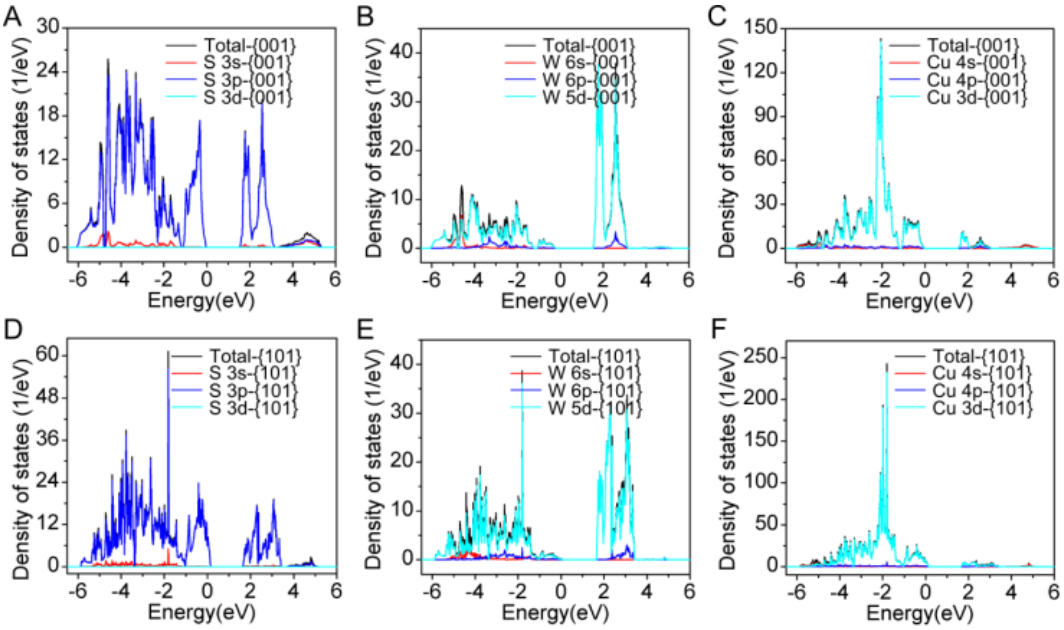

Figure S3. Partial density of states (DOS) of S, W, and Cu on the (A-C) {001} and (E-F) {101} facets of *I*-Cu_2WS_4. This picture clearly shows the composition of the valence band and conduction band in Cu_2WS_4.

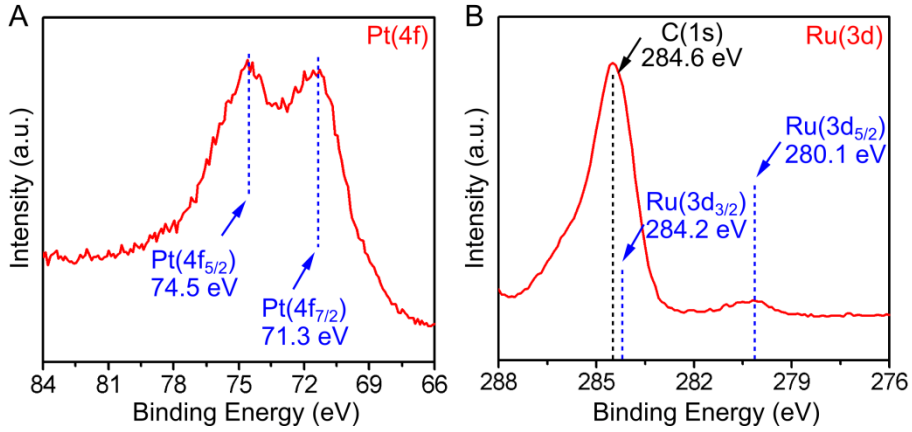

Figure S4. High-resolution XPS spectra of A) Pt and B) Ru of 5 wt% Pt/Cu_2WS_4 and 5 wt% Ru/Cu_2WS_4 photocatalysts. As indicated by the XPS analysis, Pt and Ru are mainly confirmed in their valence states of zero.[1]

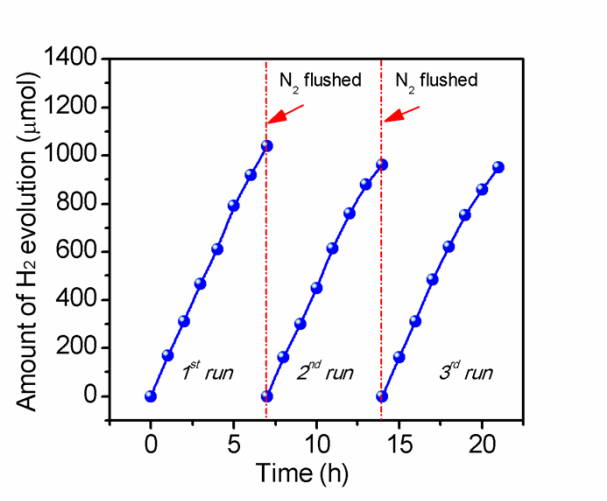

Figure S5. Time-coursed photocatalytic hydrogen production over Cu_2WS_4 decahedra with biggest {001} facets.

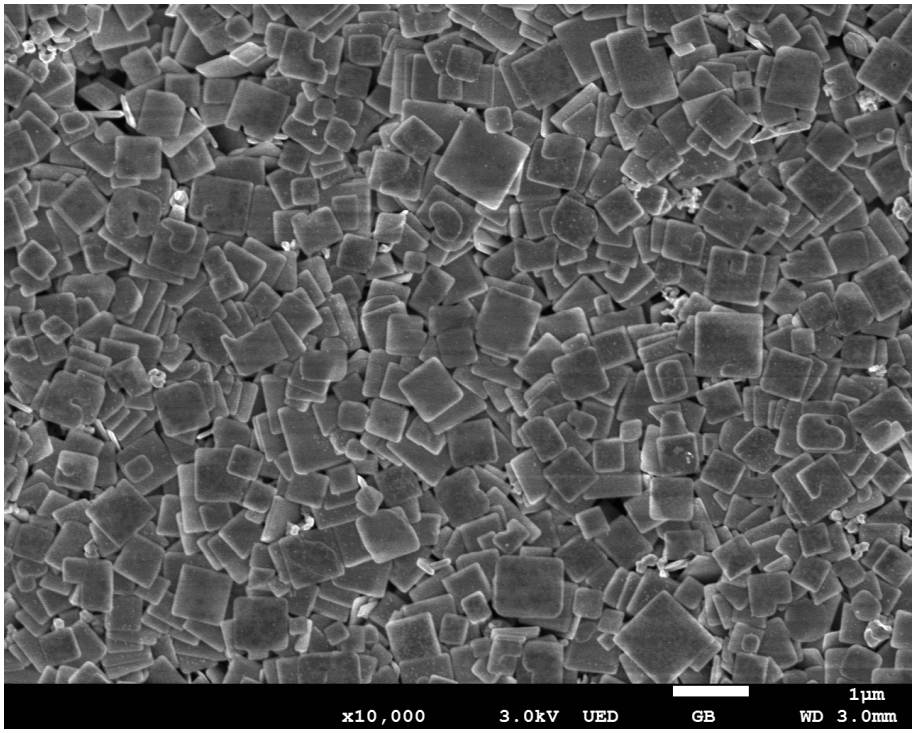

Figure S6. SEM image of recovered Pt-Cu_2WS_4 sample after the reaction shown in Figure S5.

References

[1] C. D. Wagner, *Handbook of x-ray photoelectron spectroscopy: a reference book of standard data for use in x-ray photoelectron spectroscopy*, Physical Electronics Division, Perkin-Elmer Corp., **1979**.

[2] II Y. Kim, S. Atherton, E. S. Brigham, T. E. Mallouk, *J. Phys. Chem.* **1993**, 97, 11802.