

Design of Nano-Photocatalytic Materials for Solar Fuel Conversion and Environmental Remediation

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Nano photocatalytic materials have shown great potentials not only in environmental remediation, but also in solar-chemical conversion by photocatalytic water-splitting as well as CO₂ reduction. Up to now, we have been involved in researching novel semiconductor photocatalytic materials for a more efficient utilization of solar energy, as well as application of these materials for degradation of hazardous organics and solar fuel production. In this talk, recent achievements and future prospects in challenging the possibilities of the nano-structured photocatalytic materials [1-13], especially for the purpose of carbon dioxide reduction and CH₄ fuel production, will be introduced and discussed, from the view point of new materials development, design and control of surface/interface nano-structures for promotion of multi-electron reactions, as well as mechanism study from both experimental and theoretical approaches.

References

- [1] Z. Yi, J. Ye, N. Kikugawa, T. Kako, et al., *Nature Mater.* 9, 559-564 (2010).
- [2] S. Ouyang and J. Ye, *J. Am. Chem. Soc.* 133, 7757-7763 (2011).
- [3] Y. Bi, S. Ouyang, N. Umezawa, J. Cao, J. Ye, *J. Am. Chem. Soc.* 133, 6490-6492 (2011).
- [4] X. Chen, J. Ye, S. Ouyang, T. Kako, et al, *ACS Nano*, 5(6), 4310-4328(2011).
- [5] H. Tong, S. Ouyang, Y. Bi, N. Umezawa, M. Oshikiri, J. Ye, *Adv. Mater.*, 24(2), 229-251, (2012).
- [6] S. Yan, S. Ouyang, J. Ye, Z. Zou, et al, *Angew. Chemie*, 49, 6400-6404, (2010).
- [7] K. Xie, N. Umezawa, N. Z. Ye, *Energy Environ. Sci.*, 4, 4211-4219, (2011).
- [8] N. Zhang, S. Ouyang, T. Kako, and J. Ye, *Chem. Comm.*, 48, 1269-1271, (2012).
- [9] S. Ouyang, H. Tong, N. Umezawa, J. Cao, P. Li, Y. Bi, Y. Zhang, J. Ye, *J. Am. Chem. Soc.*, 134, 1974-1977 (2012).
- [10] G. Xi, S. Ouyang, P. Li, J. Ye, et al., *Angew Chem Int. Ed.*, 51, 2395-2399(2012).
- [11] J. Guo, S. Ouyang, P. Li, Y. Zhang, T. Kako, and J. Ye, *Appl. Catal. B: Environ.*, 134-135, 286-292 (2013).
- [12] H. Zhou, J. Guo, P. Li, J. Ye, et al., *Scientific Reports*, DOI: 10.1038/srep01667 (2013).
- [13] L. Liu, S. Ouyang, J. Ye, *Angew. Chem. Int. Ed.*, 52, 6689-6693 (2013).