

Solar energy storage and conversion via photocatalytic water

splitting

Rengui Li

¹ State Key Laboratory of Catalysis, Dalian Institute of Chemical Physics, Chinese Academy of Sciences, Dalian National Laboratory for Clean Energy, Dalian, 116023, China.

Email: rgli@dicp.ac.cn

Abstract: Artificial photosynthesis for solar energy conversion via water splitting using particulate photocatalysts is promising for renewable energy utilization. Photogenerated charge separation is a challenging and long-standing issue in artificial photosynthesis, and meanwhile, it still suffers from slow water oxidation kinetics, severe reverse reaction, and H₂/O₂ gas separation for potential scalable applications. In this presentation, we will show our recent results on the spatial charge separation between different facets of a semiconductor-based crystal, which is a different from the traditional heterojunction or p-n junction for charge separation. Following this, rationally construct the reduction and oxidation cocatalysts on the different facets can be realized at micro/nano scale, which was found to greatly improve the charge separation and inhibit the charge recombination. Based on the findings in spatial charge separation, a practically feasible approach named hydrogen farm was very recently proposed to mimic nature photosynthesis, which is composed of solar energy capturing and hydrogen production subsystems integrated by a shuttle ion loop. A state-of-the-art solar-to-hydrogen efficiency exceeding 1.8% could be achieved and a scalable outdoor panel for solar energy storage was demonstrated, which offers a promising and practical strategy for solar energy harvesting and solar hydrogen production on a large scale by using particulate photocatalysts.

References:

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Biography:



Rengui Li received his B.S. degree from Xiamen University in 2009, and PhD degree from Dalian Institute of Chemical Physics (DICP), Chinese Academy of Sciences (CAS) in 2014 under the supervision of Prof. Can Li. He worked as a visiting research associate in Prof. K. Domen's group at the University of Tokyo (2011) and in Prof. Harry Atwater's group at California Institute of Technology (2019-2020). He started his career at State Key Laboratory of Catalysis in DICP as an associate Professor in 2014. From 2017, he is working as group leader of Micro/Nano Photo(electro)catalyst and Photocatalysis Research Group in Solar Energy Division of DICP. He was promoted as a full professor at DICP in 2018. His research interest is mainly focused on the photocatalytic solar energy conversion. He has published more than 50 papers on Nature Commun., Joule, Angew. Chem. Int. Ed., J. Am Chem. Soc., Adv. Mater. Energy Environ. Sci., ACS Energy Lett. etc. with more than 4000 citations. Dr. Rengui Li won various academic awards including Young Scientist Prize at International Congress on Catalysis and Rising Star in Catalysis of China.