



## Modulating Carrier Transport via Defect Engineering in Solar Water Splitting Devices

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**Abstract:** Photoelectrochemical water splitting illuminates a direct pathway of solar energy conversion to clean chemical fuel. Design and synthesis of semiconductor photoelectrodes for efficient water splitting have been highly sought after for over forty years. However, the number of semiconductor compounds with efficient photocatalytic performance is very limited. Our research aims to accelerate discovery and development of new semiconductor photoelectrodes by means of a unique thin film approach. This approach employs epitaxial thin films as a model system to reveal mechanistic correlation between lattice/electronic structure, carrier transport and energy conversion efficiencies. In this talk, I will discuss our research efforts by controlling two types of structural defects, intrinsic domain boundary and extrinsic cation doping, in order to modulate carrier transport and to improve the water splitting performance in state-of-the-art bismuth vanadate photoanodes. Unconventional carrier transport is revealed through combined photoelectrochemical and solid-state electronic transport characterizations. The mechanistic insights gained in our research are expected to get translated into current theoretical models, to provide design strategies leveraging carrier transport and photon collection, and to lay the foundation to develop new semiconductor photoelectrodes for renewable energy production.

**Biography:** Dr. Wenrui Zhang is a postdoctoral research fellow at Oak Ridge National Laboratory. He received his Ph.D. degree in Materials Science and Engineering from Texas A&M University in 2015. After his Ph.D., Dr. Zhang worked at Brookhaven National Laboratory from 2016-2018 and then at Oak Ridge National Laboratory as a postdoctoral research fellow. His research focuses on thin film and heterostructure synthesis with atomic precision; quantum materials and device physics; exotic carrier transport and dynamics in semiconductors for solar energy conversion. Dr. Zhang has authored more than 60 peer-reviewed publications, with a total citation over 1700 times and a H index of 22. Dr. Zhang was the recipient of outstanding presentation award consecutively for two years from Brookhaven National Laboratory. He currently serves as advisory panel for Journal of Physics D: Applied Physics.