

Tuning Photocatalytic Semiconducting Materials for Environmental and Greenchemistry

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A tuning of the energy band gap of semiconducting materials including transition metal chalcogenides (TMCs) including TiO_2 , AMoS_2 , and CoS_2 have been paid attention for energy conversion and environmental issues. Here in we like to introduce new findings about the visible-light driven blue TiO_2 materials for photo-catalytic hydrogen evolving reaction (HER) and for a removal of algae from water. In addition, we like to report new layered ternary transition metal chalcogenides (TTMCs) material to overcome to the limitation of active sites which is challenging in binary transition metal chalcogenides (BTMC) such as MoS_2 towards electrochemical hydrogen production. We carefully designed the TTMC materials that contain two transition metals Cu and Mo with chalcogen S. The TTMC, Cu_2MoS_4 has been successfully synthesized by a facile solution-processed method. Moreover, by anion doping such as Se in as the synthesized Cu_2MoS_4 , it has been found that TTMC can be exfoliated into single layer nanosheets. Furthermore, by controlling the number of layers, single layers TTMC exhibit the highest electrocatalytic activity towards HER because the single layers can provide more catalytic active sites than multilayers and bulk. As a result, our TTMC work can guide new strategy for the developments of applications of TMCs in HER. Finally, we like to demonstrate new strategy to satisfy all requirements for the development of a highly active and remarkably durable HER electrocatalyst in both acidic and alkaline media via anion-cation double substitution into a CoS_2 moiety for preparing 3D mesoporous pyrite-metal vanadium-cobalt phosphorsulphide ($\text{Co}_{1-x}\text{V}_x\text{SP}$).

Biography:

Prof. Hyoyoung Lee has completed his PhD at Department of Chemistry, University of Mississippi, USA in 1997. He did his postdoctoral studies at North Carolina State University. He worked at Electronics and Telecommunications Research Institute and then moved to Dept. of chemistry, Sungkyunkwan University as a full professor. He served as a director of National Creative Research Initiatives. Currently, he has served as an associate director of Centre for Integrated Nanostructure Physics, Institute of Basic Science. His current research area is low energy band gap 0-2D semiconducting materials. He has written more than 141 journal articles with top-tier journals.