

Electrocatalytic Reduction of Nitrogen to Ammonia

Liang-Xin Ding, Gao-Feng Chen, Haihui Wang

School of Chemistry and Chemical Engineering, South China University of
Technology, Guangzhou, 510640
Email: lxding@scut.edu.cn

Abstract: Ammonia is vital to life and industrial manufacture. The traditional technology of ammonia synthesis, Haber-Bosch process, has been plagued for decades with problems of the harsh conditions required (typically 300 °C-500 °C and 200-300 atm). The mechanism studies of nitrogenase enzymes have recently motivated an alternative electrochemical technology to reduce N₂ to NH₃ using renewable resources under ambient conditions. Unfortunately, the NRR has seriously subjected to an ultralow Faradaic efficiency and yield rate due to the inert triple bond of N₂ molecule and competing hydrogen evolution reaction (HER). This talk will present our strategies focusing on the perspective of catalyst design to tackle challenges of electrochemical nitrogen reduction reaction (NRR), such as proposing a Li⁺ incorporation strategy to facilitate the N₂ activation,^[1] recommending a finding of the possibility of efficient NRR catalysts accompanied with vigorous HER,^[2] disclosing the significance of sized and spatial effects of two-dimension materials (Ti₃C₂, black phosphorus) for NRR.^[3-4] Moreover, considering the current low yield of electrocatalytic nitrogen reduction synthesis of ammonia, some new electrochemical ammonia synthesis systems will also be discussed.^[5]

References:

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Biography:



Liang-Xin Ding obtained his Ph.D. in Material Physics and Chemistry from Sun Yat-Sen University in 2013. He is briefly seconded to the National Natural Science Foundation of China in 2015. He is currently a full professor at South China University of Technology. His research interests focus on the fuel cell and electrosynthesis ammonia, with main focus on the design of catalysts and the optimization of electrochemical reaction systems. His main academic contribution is to put forward the control experiment scheme of electrocatalytic nitrogen reduction ammonia and the accurate quantitative method of ammonia, which promoted the research and development of electrochemical ammonia synthesis. He has authored/co-authored more than 70 peer-reviewed research articles, including *Joule*; *J. Am. Chem. Soc.*; *Angew. Chem. Int. Ed.*; *Adv. Mater.*; *Chem. Sci.* *ACS Catalysis*; etc.