Proton Exchange Membrane Fuel Cells Powered with H_2/CO Mixture and Pure Carbon Monoxide

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Abstract: Proton exchange membrane fuel cells (PEMFCs) suffer extreme CO poisoning even at PPM level, owning to the preferential CO adsorption and the consequential blockage of the catalyst surface. Herein, however, we report that CO itself can become an easily convertible fuel in PEMFC using atomically dispersed M-N-C catalysts. With CO to CO_2 conversion initiates at 0 V vs. RHE, pure CO powered fuel cell attains unprecedented power density at 236 mW cm^{-2}, with maximum CO turnover frequency (64.65 s^{-1}, 363 K) far exceeds any chemical or electrochemical catalysts reported. Moreover, by regulating the active center of the catalysts, we achieve a high fuel cell performance with H_2+CO mixture as fuel. The carefully regulated M-N-C catalyst confers the PEMFCs with a maximum power density at ~650 mW cm^{-2} using H_2+1000 ppm CO as fuel. We attribute such catalytic behavior to the weak CO adsorption and the co-activation of H_2O due to the interplay between two adjacent single metal sites.

References:

[1] Yang Li, Xian Wang, Bingbao Mei, Ying Wang, Zhaoyan Luo, Ergui Luo, Xiaolong Yang, Zhaoping Shi, Liang Liang, Zhao Jin, Zhijian Wu, Zheng Jiang, Changpeng Liu, Wei Xing, Junjie Ge, *Science Bulletin*, **2021**, *In Press*.

Biography:

Prof. Dr. Junjie Ge received her Ph.D. in physical chemistry from Chinese Academy of Sciences in 2010. She worked at University of South Carolina and University of Hawaii as a postdoc fellow for almost 5 years. She joined Changchun Institute of Applied Chemistry in 2015 as a professor, where she was recruited in the Hundred Talents Program in CAS (2015). Her research interests comprehend fuel cells, electrochemistry, and catalysis. She has published 80+ peer-reviewed papers on J. Am. Chem. Soc., Nat. Commun, Angew. Chem. Int. Ed., Energy Environ. Sci., etc. She's currently a board committee member of IAOEES, a youth editor of 《Chinese Chemical Letters》，a member of international society of electrochemistry (ISE), and etc.