Unveiling the electrolyte effects of CO2 electroreduction to CO and H2 evolution from the interfacial pH perspective

Liu, X.

List of Publications

Chapter 2

Monteiro, M. C. O.; **Liu, X.**; Hagedoorn, B. J. L.; Snabilié, D. D.; Koper, M. T. M., Interfacial pH Measurements Using a Rotating Ring-Disc Electrode with a Voltammetric pH Sensor. ChemElectroChem 2021, 9 (1), e202101223.

Chapter 3

Liu, X.; Monteiro, M. C. O.; Koper, M. T. M., Interfacial pH measurements during CO(2) reduction on gold using a rotating ring-disk electrode. Phys. Chem. Chem. Phys. 2023, 25 (4), 2897-2906.

Chapter 4

Liu, X.; Koper, M. T. M., Tuning the Interfacial Reaction Environment for CO(2) Electroreduction to CO in Mildly Acidic Media. J Am Chem Soc, 2024, 146 (8), 5242-5251.

Chapter 5

Liu, X.; Koper, M. T. M., The Effect of the Electroinactive Species on the Steady-State behavior of Hydrogen Evolution in Mildly Acidic Media. Electrochimica Acta. 507, 145068.

Other Publications

Ye, C, **Liu, X**., Koper, M. T. M., The role of cations in hydrogen evolution reaction on a platinum electrode in mildly acidic media. *Electrochemistry Communications* 166 (2024): 107784.

Wang, Y., Seki, T., **Liu, X.**, Yu, X., Yu, C. C., Domke, K. F., ... & Bonn, M., Direct probe of electrochemical pseudocapacitive pH jump at a graphene electrode. Angewandte Chemie International Edition, 2023, 62(10), e202216604.

Nan, W.J., **Liu, X**, Originating the Driving Force of Photoinduced Interfacial Electron Transfer by Multimode Scanning Electrochemical Microscopy, *The Proceedings of the National Academy of Sciences* (submitted).

Liu, X., Tian, Z. Q., & Zhan, D. Optimizing the interfacial electron transfer capability of single layer graphene by thermal annealing. Chemical communications, 2020, 56(2), 253-256.

Han, S., Liu, S., Wang, R., **Liu, X**., Bai, L., & He, Z. One-Step Electrodeposition of Nanocrystalline ZnxCo3–xO4 Films with High Activity and Stability for Electrocatalytic Oxygen Evolution. *ACS Applied Materials & Interfaces*, 2017, *9*(20), 17186-17194.

Curriculum vitae

Xuan Liu was born on the 7th of August 1995 in Sichuan, China, where she spent her childhood and has a most beautiful memory. In 2003, she moved to Chengdu, where she finished her primary and secondary education and developed an interest in Chemistry.

In 2013, Xuan entered Central South University in Changsha, China, and majored in Applied Chemistry. During her four-year undergraduate study, she was well-prepared in the chemical fundamentals and principles and awarded the Excellence prize and the First-prize Scholarship each year. Most importantly, she developed a passion for electrochemistry and started her science journey in a lab of the electrochemical research institute in 2015. Her first project here was concerned with CO2RR, where she synthesized three different-structured copper materials and examined their CO2RR performances. The flower-like nano-Cu particles showed the highest amount of active sites and therefore the highest CO2RR activity compared with the oxide-derived Cu and the planar Cu, making her realize that the nature of the electrode surface largely influences the electrochemical reaction activity.

In 2017, Xuan continued the research of electrode surface engineering as a master student at Xiamen University in China under the supervision of Zhongqun Tian, during which she was thoroughly educated in the basics and methods of electrochemistry and became experienced with the Scanning Electrochemical Microscopy (SECM) technique. She designed and synthesized a model electrocatalytic system consisting of monodispersed hexagonal nano-Ag crystals electrodeposited on single-layer pristine graphene, and SECM characterization suggested that electron transfer performance of the system correlates with the surface potential along the Ag-graphene interface, making her increasingly appreciate the vital importance of the electrode surface and the structure-activity relationship in electrochemical studies. This study was prized as the Provincial Excellent Master Project.

In 2020, Xuan was enrolled in the TRANSCRIPT project which aimed to transform carbon-rich industrial waste gases of metallurgical plants into valuable products. This project was a collaboration between Leiden University and Utrecht University and supported by Tata Steel Nederland Technology BV and the Dutch Research Council (NWO). In the pursuit of a PhD career at Leiden University in the Netherlands under the supervision of Marc Koper, her research extended from the electrode surface to the other side of the electrochemical interface, namely the interfacial electrolyte. With an interfacial pH sensor devised by RRDE coupled with a voltammetric redox couple, she succeeded in monitoring the variation of the interfacial pH with the electrolyte conditions during the reaction process of CO2RR and HER,

and uncovering the interaction between the interfacial pH and other interfacial electrolyte effects, and its influence on the CO2RR and HER. During the four years, Xuan was devoted to activities more than research, which enriched her PhD career and improved her multiple skills. She attended the Catalysis An Integrated Approach (CAIA 2021) course and the SurfCat summer school in Denmark and presented her work at the 74th annual meeting of ISE, the 32nd Topical meeting of ISE, the Netherlands' Catalysis and Chemistry Conference (NCCC) and the MaterialenNL conference. She also assisted in the practical courses and internships of BSc students at Leiden Institute of Chemistry.

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