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Role of near-surface environment in tuning electrochemical CO₂ reduction reaction and H₂ evolution reaction

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List of Publications

Chapter 2

Goyal, A.; Marcandalli, G.; Mints, V. A.; Koper, M. T. M., Competition between CO₂ Reduction and Hydrogen Evolution on a Gold Electrode under Well-Defined Mass Transport Conditions. *Journal of the American Chemical Society* **2020**, *142* (9), 4154-4161

Chapter 3

Goyal, A.; Koper, M. T. M., The Interrelated Effect of Cations and Electrolyte pH on the Hydrogen Evolution Reaction on Gold Electrodes in Alkaline Media. *Angewandte Chemie International Edition* **2021**, *60* (24), 13452-13462

Chapter 4

Goyal, A.; Koper, M. T. M., Understanding the role of mass transport in tuning the hydrogen evolution kinetics on gold in alkaline media. *The Journal of Chemical Physics* **2021**, *155* (13), 134705.

Chapter 5

Goyal, A.; Bondü, C. J.; Graf, M.; Koper, M. T. M., Effect of pore diameter and length on electrochemical CO₂ reduction reaction at nanoporous gold catalysts. *Chemical Science* (Submitted)

Other Publications

Marcandalli, G.; Goyal, A.; Koper, M. T. M., Electrolyte Effects on the Faradaic Efficiency of CO₂ Reduction to CO on a Gold Electrode. *ACS Catalysis* **2021**, *11* (9), 4936-4945.

Bondue, C. J.; Graf, M.; Goyal, A.; Koper, M. T. M., Suppression of Hydrogen Evolution in Acidic Electrolytes by Electrochemical CO₂ Reduction. *Journal of the American Chemical Society* **2021**, *143* (1), 279-285.

Monteiro, M. C. O.; Goyal, A.; Moerland, P.; Koper, M. T. M., Understanding Cation Trends for Hydrogen Evolution on Platinum and Gold Electrodes in Alkaline Media. *ACS Catalysis* **2021**, *11* (23), 14328-14335.

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Curriculum Vitae

Akansha Goyal was born on 9th of July 1994 in Delhi, India, where she lived for the first 20 years of her life. She did her schooling at Guru Harkishan Public School where she chose science as her direction of study upon entering the secondary phase of her education. She was awarded the excellence award during this time for getting the highest score in Chemistry and Physics in the All India Senior Secondary Examination.

After graduating from school, Akansha enrolled in B.Sc. Chemistry (hons.) programme at Delhi University which she graduated from in 2014. During this time, she also did an internship at the Indian Institute of Technology (IIT), in Gandhinagar, India, where she studied the photochemical properties of cholesterol conjugated diphenylpolyenes in the group of Dr. Sriram Kanvah Gundimedda.

After her Bachelor studies, Akansha moved to Leiden, Netherlands, to pursue an M.Sc. in Chemistry. During her masters, she was the recipient of Leiden University excellence scholarship (LExS) which covered the tuition fee (minus the statutory fee) of her studies. During this time, she did two different research internships. The first internship was carried out on the synthesis of lanthanoid doped upconverting nanoparticles in the group of Prof. Sylvestre Bonnet at Leiden University. The second internship was carried out on the synthesis of transition metal-oxide based cathode materials for Li ion batteries in the group of Prof. Serena Corr at Glasgow University. For the latter, she also received the Erasmus+ grant for traineeships from EU. It was during this time that her interest in electrochemistry and sustainable energy research was sparked. Upon returning from Glasgow, she did a brief literature survey on electrochemical CO₂ reduction reaction at nanostructured catalysts, under the supervision of Prof. Marc Koper at Leiden University.

This eventually turned into a longer association, both with electrochemistry and with the Koper group. As in 2017, Akansha started her Ph.D. at Leiden University under the supervision of Prof. Marc Koper. This project was supported by Advanced Research Center for Chemical Building Blocks (ARC CBBC) consortium, co-financed by the Netherlands Organization for Scientific Research (NWO) and Shell Global Solutions B.V. The main focus of her Ph.D. was to understand the role of local reaction environment in tuning the activity/selectivity of electrochemical CO₂ reduction reaction and H₂ evolution reaction.

This Ph.D. project led to many interesting results as well as publications, which are presented in this thesis. It also led to many fruitful collaborations, which enriched Akansha, both academically and personally.

During this time, Akansha assisted in teaching the B.Sc. practical courses at Leiden Institute of Chemistry, as well as in the research internships of various B.Sc. level students. She also presented her work at various international conferences, including oral presentations at 72nd Annual ISE meeting, 29th Topical ISE meeting and EcoCat international conference. During this time, she also had the opportunity of attending the SurfCat

summer school in Denmark and the Heraeus seminar conference in Germany.
Following the obtainment of her Ph.D., Akansha will continue her stay in the Koper lab as a post-doctoral researcher.