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Selectivity and competition between the anodic evolution of oxygen and chlorine

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List of Publications

Chapter 2

Vos, J. G.; Koper, M. T. M. Measurement of Competition between Oxygen Evolution and Chlorine Evolution Using Rotating Ring-Disk Electrode Voltammetry. *J. Electroanal. Chem.* 2018, 819 (October), 260–268.

<https://doi.org/10.1016/j.jelechem.2017.10.058>

Chapter 3

Vos, J. G.; Liu, Z.; Speck, F. D.; Perini, N.; Fu, W.; Cherevko, S.; Koper, M. T. M. Selectivity Trends Between Oxygen Evolution and Chlorine Evolution on Iridium-Based Double Perovskites in Acidic Media. *ACS Catal.* 2019, 9 (2), 8561–8574.

<https://doi.org/10.1021/acscatal.9b01159>

Chapter 4

Vos, J. G.; Venugopal, A.; Smith, W.A.; Koper, M. T. M. Competition and Interhalogen Formation During Parallel Electrocatalytic Oxidation of Bromide and Chloride on Pt. Submitted to the *Journal of the Electrochemical Society*, under review (2019).

Chapter 5

Vos, J. G.; Venugopal, A.; Smith, W.A.; Koper, M. T. M. 5. Competition and Selectivity During Parallel Evolution of Bromine, Chlorine and Oxygen on IrO_x Electrodes. To be submitted to the *Journal of Catalysis*, in preparation (2019).

Chapter 6

Vos, J. G.; Wezendonk, T. A.; Jeremiasse, A. W.; Koper, M. T. M. MnO_x/IrO_x as Selective Oxygen Evolution Electrocatalyst in Acidic Chloride Solution. *J. Am. Chem. Soc.* 2018, 140 (32), 10270–10281.

<https://doi.org/10.1021/jacs.8b05382>

Chapter 7

Vos, J. G.; Bhardwaj, A.A.; Jeremiasse, A.W.; Esposito, D.V.; Koper, M. T. M. Modification of Selectivity Between Chlorine and Oxygen Evolution on Iridium-based Anodes and Pt Using SiO_x-Based Buried Interfaces. To be submitted to *ACS Chemistry of Materials*, in preparation (2019).

Chapter 8

Vos, J. G.; Koper, M. T. M. Examination and Prevention of Ring Collection Failure during Gas-Evolving Reactions on a Rotating Ring-Disk Electrode. *J. Electroanal. Chem.* 2019, 850.

<https://doi.org/10.1016/j.jelechem.2019.113363>

Other publications

Bhardwaj, A.; Vos, J. G.; Koper, M. T. M.; Esposito, D. V. Ultrathin Silicon Oxide Overlayers Enable Selective Oxygen Evolution from Acidic and Unbuffered PH-Neutral Seawater. To be submitted to *ACS Energy Letters*, in preparation (2019).

Garcia, A. C.; Kolb, M. J.; van Nierop y Sanchez, C.; Vos, J.; Birdja, Y. Y.; Kwon, Y.; Tremiliosi-Filho, G.; Koper, M. T. M. Strong Impact of Platinum Surface Structure on Primary and Secondary Alcohol Oxidation during Electro-Oxidation of Glycerol. *ACS Catal.* 2016, 6 (7), 4491–4500.

Versluis, F.; Voskuhl, J.; Vos, J.; Friedrich, H.; Ravoo, B. J.; Bomans, P. H. H.; Stuart, M. C. A.; Sommerdijk, N. A. J. M.; Kros, A. Coiled Coil Driven Membrane Fusion between Cyclodextrin Vesicles and Liposomes. *Soft Matter* 2014, 10 (48), 9746–9751.

Arulmozhi, N.; Vos, J. G.; Koper, M. T. M.; Electrocatalytic Hydrogen Evolution and Hypochlorous Acid Reduction on Graphene-Covered Pt(111). Manuscript in preparation (2019).

Curriculum Vitae

Jan Vos was born in the historic village of The Hague, in late 1987. After finishing high school at Christelijk Gymnasium Sorghvliet in The Hague in 2006, he joined the Molecular Science and Technology study program at Leiden University. During his bachelor internship, he studied how lipid liposomes interact and fuse under supervision of dr. Frank Versluis and prof. dr. Alexander Kros, and in his main master internship, he studied the electrochemistry of glycerol oxidation on platinum single crystals under supervision of dr. Youngkook Kwon and prof. dr. Marc Koper within the CASC group, both of which projects resulted in a co-authored scientific publication. During this period, he also studied the electrochemical evolution of oxygen mediated by a cobalt-based molecular complex, under supervision of dr. Konstantin Kotttrup and dr. Dennis Hetterscheid.

After finishing his master studies in 2015, he pursued his PhD studies during 2015-2019 under supervision of prof. dr. Marc Koper. The results of this project, which are presented in this thesis, significantly expanded the fundamental knowledge of how the simultaneous electrochemical evolution of oxygen and chlorine interact while proceeding on metal oxide surfaces. He presented his work on several international conferences, such as during Annual Meetings of the International Society of Electrochemistry in 2016 and 2018, as well as a Topical Meeting of this organization in 2019 concerning electrochemical processes for energy conversion. He also presented during CHAINS (2018), several technical meetings of chlor-alkali and chlorate industry representatives by Nouryon (formerly AkzoNobel), and the ECCM conference in The Hague in 2019. He was awarded the Poster Prize during the 2018 Reedijk symposium within the Leiden Institute of Chemistry. His scientific publication “ $\text{MnO}_x/\text{IrO}_x$ as Selective Oxygen Evolution Electrocatalyst in Acidic Chloride Solution”, which is the basis of Chapter 6 of this thesis, was featured in JACS Spotlights and in a news article in *C₂W*, the magazine of the Royal Netherlands Chemical Society.

Starting in 2019, after finishing his PhD studies, Jan will work with Dennis Hetterscheid within the CASC group on the electrochemical oxygen reduction reaction, focusing on the selective electrosynthesis of hydrogen peroxide using a copper-based molecular complex. In this project, he strives to deepen the understanding of how this complex reduces oxygen to peroxide instead of water, and how to optimize the selectivity of this process.

