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The electrochemical reduction of dioxygen and hydrogen peroxide by molecular copper catalysts

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Curriculum Vitae

Michiel Langerman was born on the 30th of September 1991 in Maastricht, The Netherlands. In 2009, he obtained his VWO diploma from Het Baken Park Lyceum in the city of Almere. After graduating high school, Michiel studied Molecular Science & Technology, a joint bachelor program at the TU Delft and Leiden University. In 2013, he obtained his BSc degree after completing a minor in Advanced Chemistry. During this bachelor he wrote his thesis on photosubstitution reactions of fluorescent thioether ligands on ruthenium polypyridyl complexes. This research was performed in the Metals in Catalysis, Biomimetics & Inorganic Materials (MCBIM) research group at Leiden University under the supervision of Azadeh Bahreman and Prof.dr. Sylvestre Bonnet. Michiel then continued with a MSc degree in Research in Chemistry at Leiden University, with a focus on synthetic and biochemistry. In January 2014 he started his research project on the subject of the targeted drug delivery of photoactive ruthenium anticancer prodrugs, once again in the MCBIM research group, under the supervision of Dr. Bianka Siewert and Prof.dr. Sylvestre Bonnet. The research performed over the next 16 months contributed to two research publications. Michiel obtained his MSc degree in 2015.

In October 2015, Michiel started his PhD at Leiden University, under the guidance of Dr. Dennis Hetterscheid. The research activities took place in both the Metals in Catalysis, Biomimetics & Inorganic Materials (MCBIM) and Catalysis and Surface Chemistry (CASC) research groups. The project focused on the fundamental elucidation of the mechanism of the electrochemical ORR by mononuclear copper catalysts and the design principles of new molecular copper-based ORR catalysts. Results of the studies included in this thesis were presented at several (inter)national conferences, including an oral presentation at the Netherlands Catalysis and Chemistry Conference (NCCC) in 2018, and poster presentations at the HRSMC Symposium (2018), Reedijk Symposium (2019), NCCC (2016, 2017, 2018, 2019), CHAINS (2016, 2019), and the International Symposium on Homogeneous Catalysis (2018) conferences. Michiel completed several professional courses during his PhD, including *Catalysis: An Integrated Approach* organized by the Netherlands Institute for Catalysis Research (NIOK), *Physical Methods in Inorganic Chemistry* and *High Impact Writing* organized by the Holland Research School of Molecular Chemistry (HRSMC), and graduate courses organized by the Leiden University: *Effective Communication*, *Scientific Conduct*, and *Time Management*. Finally, Michiel has had the pleasure to contribute to the broader scientific community

as a referee for the Journal of Catalysis (Elsevier).

During his PhD, Michiel supervised a number of research students during their research projects; two Master, two Bachelor, one HBO Bachelor and two HRSMC short-term research students. Additionally, Michiel assisted in teaching several practical courses, “Basic Practical Skills” and “Organic Chemistry”, for undergraduate Molecular Science & Technology (MST) and Bio-Pharmaceutical Sciences (BFW) students. Additionally, he assisted in the “Chemistry 1”, “Organic Chemistry” and “Inorganic Chemistry” courses. In the summer of 2020, Michiel assisted in the planning of the 2020-2021 academic year for the Leiden Institute of Chemistry at Leiden University, and was responsible for the scheduling of the Life-Science & Technology BSc and MSc (practical) courses in accordance with COVID-19 safety and capacity restrictions.

List of Publications

B. Siewert, M. Langerman, Y. Hontani, J. T. M. Kennis, V. H. S. van Rixel, B. Limburg, M. A. Siegler, V. Talens Saez, R. E. Kieltyka, S. Bonnet; Turning on the red phosphorescence of a [Ru(tpy)(bpy)(Cl)]Cl complex by amide substitution: self-aggregation, toxicity, and cellular localization of an emissive ruthenium-based amphiphile. *Chem. Commun.* **2017**, 53, 11126-11129.

B. Siewert, M. Langerman, A. Pannwitz, S. Bonnet; Synthesis and Avidin Binding of Ruthenium Complexes Functionalized with a Light-Cleavable Free Biotin Moiety. *Eur. J. Inorg. Chem.* **2018**, 4117-4124

M. Langerman, D. G. H. Hetterscheid; Fast Oxygen Reduction Catalyzed by a Copper(II) Tris(2-pyridylmethyl)amine Complex through a Stepwise Mechanism. *Angew. Chem. Int. Ed.* **2019**, 58, 12974-12978.

M. Langerman, D. G. H. Hetterscheid; Mechanistic study of the activation and the electrocatalytic reduction of hydrogen peroxide by Cu-tmpa in neutral aqueous solution. *ChemElectroChem* **2021**, 8, 2783.

M. Langerman, M. van Dorth, D. G. H. Hetterscheid; Dioxygen reduction in acetonitrile: the influence of acid strength on the catalytic reaction. *Manuscript in preparation*.

M. Langerman, H. van de Vijver, M. A. Siegler, and D. G. H. Hetterscheid; On the scaling relation between the reduction potential of copper catalysts and the turnover frequency for the oxygen and hydrogen peroxide reduction reactions. *Manuscript in preparation*.

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