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

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Propositions

accompanying the thesis

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1. To study the catalytic mechanism of a molecular ORR catalyst, it would often be easier to have a slow catalyst rather than a fast catalyst. (Chapter 2)

2. Being able to inhibit the reduction of H_2O_2 catalysed by molecular copper catalysts opens up the possibility to selectively produce H_2O_2 during the ORR. (Chapters 2, 3, and 5)

3. Catalytic pathways for the ORR should be studied under relevant conditions, including the choice of solvent and type of reductant, to avoid generalizing the mechanism. (Chapters 2 and 4)

4. Geometric modifications in the primary coordination environment of copper complexes have a larger effect on the redox characteristics and catalytic ORR and HPRR performance than purely electronic modifications. (Chapter 5)

5. There can be a large difference between the resting state of a molecular complex under catalytic and non-catalytic conditions. One does not necessarily inform on the other. (S. Fukuzumi, H. Kotani, H. R. Lucas, K. Doi, T. Suenobu, R. L. Peterson, K. D. Karlin, *J. Am. Chem. Soc.* **2010**, *132*, 6874-6875, and Chapter 2)

6. Ascribing a molecular character to a heterogenized molecular complex, and thereby invoking molecular mechanisms without ample (in situ) evidence of a molecular structure, should be avoided when studying the performance of electrocatalysts. (M. A. Thorseth, C. S. Letko, T. B. Rauchfuss, A. A. Gewirth, *Inorg. Chem.* **2011**, *50*, 6158-6162.)

7. Despite the best efforts, comparative catalyst benchmarking for homogenous (electro)catalysts is still a difficult task due to the immense variety of reaction conditions used in different studies. (M. L. Pegis, C. F. Wise, D. J. Martin, J. M. Mayer, *Chem. Rev.* **2018**, *118*, 2340-2391.)

8. The interactions between homogeneous electrocatalysts and the electrode material are not well studied, but may have significant enhancing or inhibiting effect on the electrocatalytic reaction.

9. While keeping an eye on the broader context of your research is essential, the continuous push from both funding agencies and scientific journals to valorise academic research leads to the unnecessary framing of scientific results to artificially increase its impact.

10. As an aspiring young scientist, do not let previously published scientific results intimidate you into second guessing your own experimental results.

11. Involuntary “free time” enabled by a global pandemic does not create a conducive environment for the completion of a thesis.

12. To truly call oneself a synthetic chemist, one should have no trouble cooking amazing food or baking delicious bread.