



XXXI B-MRS Meeting 2024
September 29th to October 3rd

PROCEEDINGS

Sociedade Brasileira de Pesquisa em Materiais

Proceedings of the XXII B-MRS Meeting

Santos, SP 2024

Copyright © 2024 para os autores

Conteúdo, revisão textual e gramatical: Resposanbilidade dos respectivos autores.

Todos os direitos reservados 2024

A reprodução não autorizada desta publicação, no todo ou em parte,
constitui violação de direitos autorais (Lei 9.610/98).

ISBN: 978-85-63273-63-5

Selective Bioelectrooxidation of Seawater using Artificial Apo-reconstituted Copper Proteins

Rodrigo Iost¹, Radhakrishnan Venkatkarthick¹, Rafael Neri Prystaj Colombo¹, Thiago Bertaglia², Fabio Henrique Barros de Lima³, Frank Nelson Crespilho³

¹Instituto de Química de São Carlos -USP, ²Instituto de Química de São Carlos -USP (Físico-química), ³Instituto de Química de São Carlos -USP (Físico-Química)

e-mail: rodrigomiost@gmail.com

Seawater is widely considered an abundant renewable resource for to produce molecular hydrogen and oxygen. However, its practical application is hampered due to chlorine-related competing reactions at the anode. Their significance lies in their improved selectivity and stability, as we reported here for copper(II) porphyrins when conjugate with the cavity of the apo-protein myoglobin shell [1,2]. Our strategy showed significant advances for bioelectrooxidation of seawater (pH 7.6), with the artificial Cu(II) protein having onset potential for OER ~10 mV lower compared to copper(II) porphyrins. The data was also supported by the monitoring of the electronic structure of the redox states Cu²⁺/Cu⁺ by in situ XANES absorption spectroscopy as well as the monitoring of the products of reaction by online differential electrochemical mass spectrometry (DEMS). Our approach also demonstrates the capability of abiological reconstituted copper proteins to be designed for the seawater bioelectrooxidation reaction [3].

Acknowledgements: FAPESP, CNPq and CAPES

References:

- [1] Key, H.M.; Dydio, P.; Clark, D.S.; Hartwig, J.F., *Nature*, 534, 534–537 (2016).
- [2] Iost, R. M.; Venkatkarthick, R.; Nascimento, S.Q.; Lima, F.H.B.; Crespilho, F.N. *Chem. Commun.*, 60, 2509-2511 (2024).
- [3] Iost, R. M.; Venkatkarthick, R.; Colombo, R.N.P.; Bertaglia, T.; Lima, F.H.B.; Crespilho, F.N. submitted, (2024).