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O91. Solar electrochemical CO_2 reduction to syngas

Messias, S.[1,2], Paninho, B. A.[1], Nunes, D.[1], Rangel, M. Carmen[3], Nunes, M. V. A.[2], Branco, L. C.[2], Martins, R.[1], Mendes, M. J.[1], Reis-Machado, A. S.[1,2*]

[1] *i3N/CENIMAT, Department of Materials Science, NOVA School of Science and Technology and CEMOP/UNINOVA, Campus de Caparica, 2829-516 Caparica Portugal.*
[2] *LAQV, REQUIMTE, Department of Chemistry, NOVA School of Science and Technology, 2829-516 Caparica Portugal.*
[3] *Laboratório Nacional de Energia e Geologia, Estrada do Paço do Lumiar, 22 Lisboa, 1649-038, Portugal.*

**Email: ams.machado@fct.unl.pt*

The increasing demand for sustainable energy solutions has intensified the focus on technologies that can efficiently convert renewable resources into usable energy while simultaneously addressing CO_2 emissions. Technologies like electrochemical CO_2 conversion are gaining attention, as they enable the storage of renewable energy in the form of valuable chemicals or fuels, supporting both energy sustainability and climate mitigation efforts. Given the crucial role of electrolytes in electrochemical reactions, developing IL-based electrolytes for industrial use and understanding their impact on CO_2 reduction efficiency are key research priorities. Ionic liquids have demonstrated considerable potential for CO production, achieving up to 100% selectivity depending on their structural properties and water content [1]. A significant advance in the field was the first demonstration of a high-pressure electrochemical reactor operating in a liquid phase with an IL-based electrolyte with a design that closely aligns with potential industrial applications [2]. To be sustainable this process requires the use of renewable energy sources, such as solar power, to drive electrochemical reactions. This study focuses on the solar driven co-electrolysis of water and CO_2 to generate syngas (H_2 and CO) using aqueous ionic liquids (ILs) as electrolytes. Porous cathodes synthesized from biopolymers and non-critical materials have exhibited notable activity in syngas generation, underscoring the feasibility of sustainable electrode materials. The performance of these materials will be reported. Thus, this work aims at contributing to scalable, sustainable syngas production methods for future industrial applications supporting global efforts to cut carbon emissions and adopt cleaner energy.

Keywords: Carbon dioxide, (Photo)electrochemistry, Ionic Liquids, Aerogels, Syngas

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