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# Photoelectrochemical conversion of $CO_2$ with perovskite-based materials

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The rise of $CO_2$ in the atmosphere has triggered a series of global changes, posing a serious threat to environmental balance and life on the planet. In response to this, innovative solutions such as photo, electro, or photoelectrochemical reduction (PEC) of $CO_2$ have been explored. These processes harness solar or electrical energy to catalyze the conversion of $CO_2$ into useful chemical products, offering a promising strategy to address climate change. PEC emerges as a cutting-edge technique for this conversion, combining both solar and electrical energy to enhance the efficiency and selectivity of the process. Previous work in our group employed commercial perovskites ($CaTiO_3$) combined with $BiVO_4$ or $WO_3$ for photo-assisted reduction of $CO_2$ [1, 2]. These preliminary experiments established the groundwork for further explorations into alternative materials in the pursuit of advancing solar energy conversion into valuable chemical products.

The aim of this communication is thus the fabrication of different photoanodes including perovskite-based materials for its integration into photoelectrochemical reactors. The photoanodes are evaluated together with a Bi/gas diffusion electrode cathode for the continuous reduction of $CO_2$ and the obtained results, in terms of formate production rates and energy consumption, are compared with the system in the dark. The work covers the physicochemical and photoelectrochemical characterization of the developed surfaces, as well as their evaluation when applied in a filter press reactor operating in continuous mode. The research efforts can be seen as a further step in the development of devices for an efficient conversion of $CO_2$ with water and solar light.

1-Abarca, J. A., Merino-Garcia, I., Díaz-Sainz, G., Perfecto-Irigaray, M., Beobide, G., Irabien, A., & Albo, J. (2024). Fabrication and optimization of perovskite-based photoanodes for solar-driven CO2 photoelectroreduction to formate. Catalysis Today, 429, 114505. https://doi.org/10.1016/J.CATTOD.2023.114505

2-Merino-Garcia, I., Crespo, S., Perfecto-Irigaray, M., Beobide, G., Irabien, A., & Albo, J. (2024). Tailoring multi-layered BiVO4/WO3 photoanodes for an efficient photoelectrochemical gas-phase solar water splitting. Catalysis Today, 432, 114581. https://doi.org/10.1016/J.CATTOD.2024.114581