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Performance and electrochemical impedance spectroscopic assessments of a newly developed photoelectrochemical cell

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Highlights

- A new photoelectrochemical cell is built and tested.
- Copper oxide is deposited on the stainless steel cathode plate.
- EIS measurements are performed and internal losses are determined.
- Concentrated and no-light measurements are comparatively obtained.

Abstract

The present study presents electrochemical impedance spectroscopy (EIS) of a newly developed photoelectrochemical (PEC) cell for hydrogen production in no-light and concentrated light illuminations. The application of EIS analysis indicates the main internal charge transfer resistances which limit the performance of the cells with copper oxide (Cu_2O) as the photocathode. An experimental setup is built to investigate the concentrated light conditions on the cell performance and obtained results are compared with dark conditions. The equivalent electrical circuit is modeled for the developed photoelectrochemical cell and fit the experimental data. Operating at concentrated light conditions increase the effect of mass transfer which reasons lower the Warburg element values under concentrated light measurements. The current results reveal the distribution of the losses occurring in the cell. This study assesses the PEC cell under concentrated light conditions comparatively for understanding the processes occurring at higher concentration levels.

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