

ASSISTANCE OF COUNTER ELECTRODE IN ELECTROCHEMICAL CO₂ REDUCTION TO VALUABLE CARBON PRODUCTS



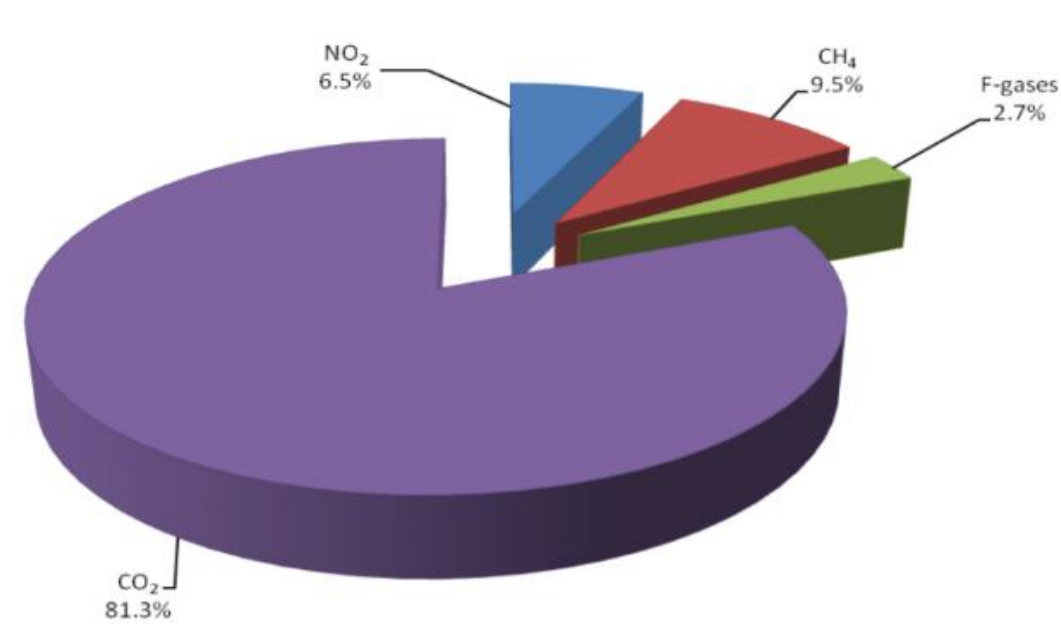
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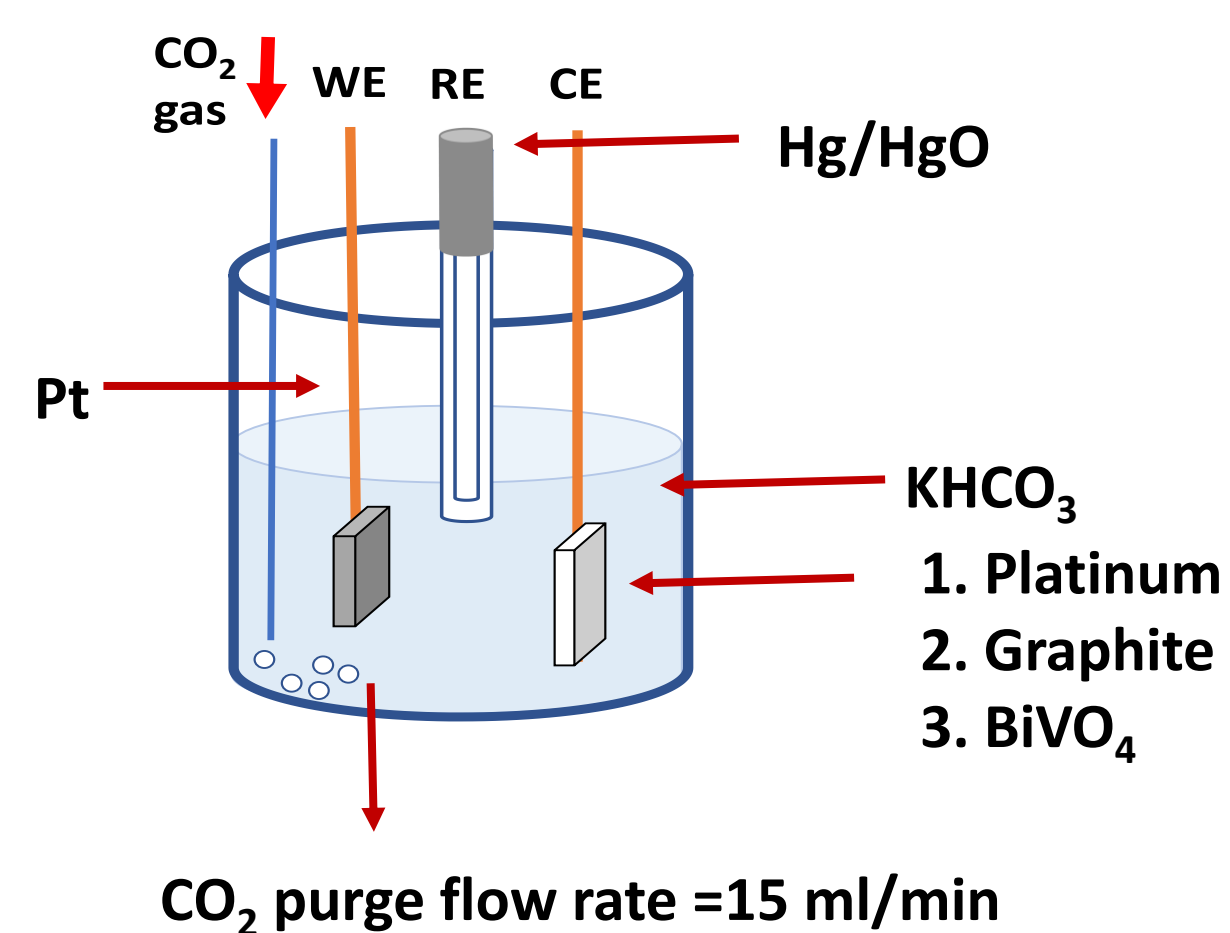
Abstract

In recent years, there has been a colossal rise in the emission of greenhouse gases due to excessive dependence on non-renewable resources of energy¹. The single major component of greenhouse gases is CO₂¹. Due to the adverse effects of CO₂ on the environment, the three main approaches – capturing, storage, and converting it into value-added products are being extensively researched over the past few decades. Electrochemical CO₂ reduction focuses on using renewable energy resources to capture and convert CO₂ into useful chemicals². While evaluating electrochemical CO₂ reduction, various approaches have been taken to improve the reduction efficiency, selectivity, and costs. In all these studies, the largest focus has been on the catalyst used. However, the role of the counter electrode has been considered to be constant and as such there are no significant reports to date on the role that this electrode plays. This work addresses the assistance of counter electrodes in enhancing the production of formic acid which is formed as a result of CO₂ reduction on working electrodes. Initially, variation with counter electrodes (Platinum, Graphite, and BiVO₄) was done by fixing Pt as a working electrode and then switching to a well-known catalyst for CO₂ reduction: Copper. It was discerned that regardless of the working electrode, as long as the counter electrode consisted of BiVO₄, the reaction was found to proceed in a facile and reproducible manner.

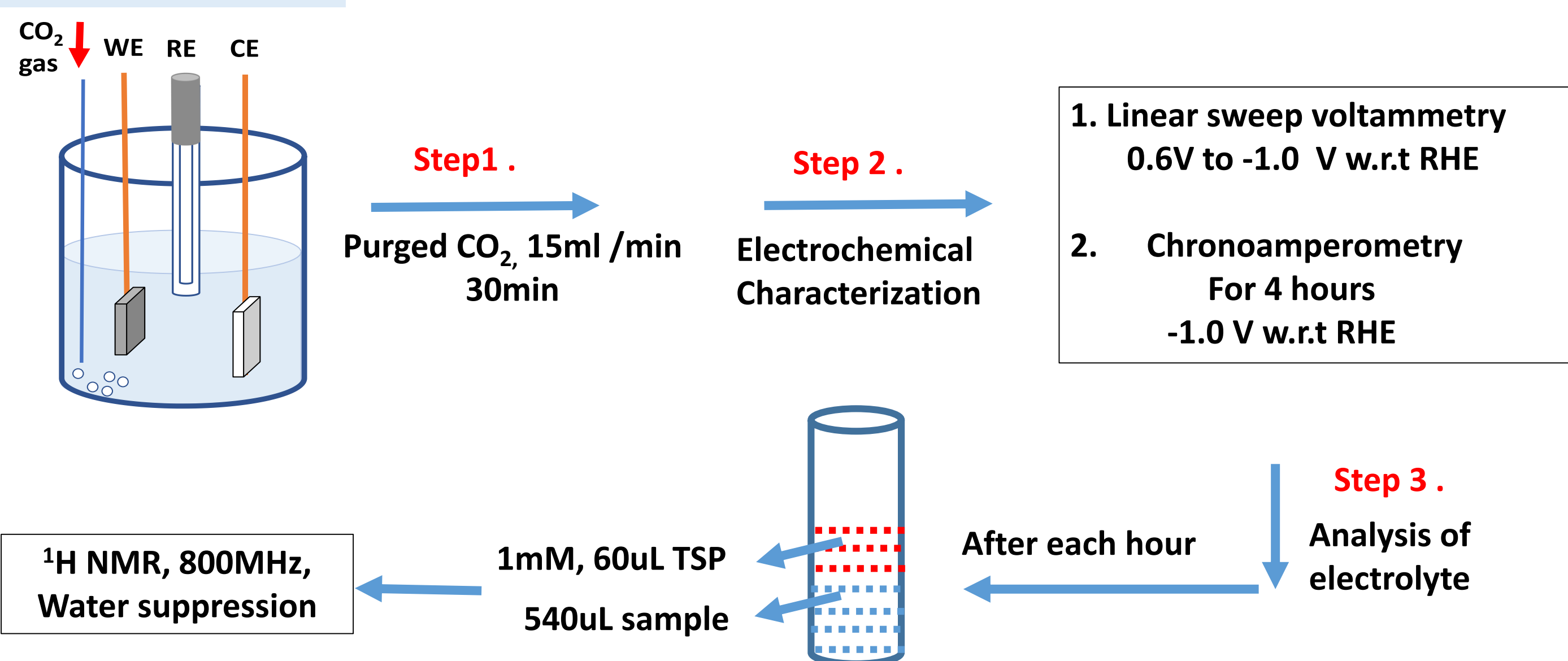
Introduction



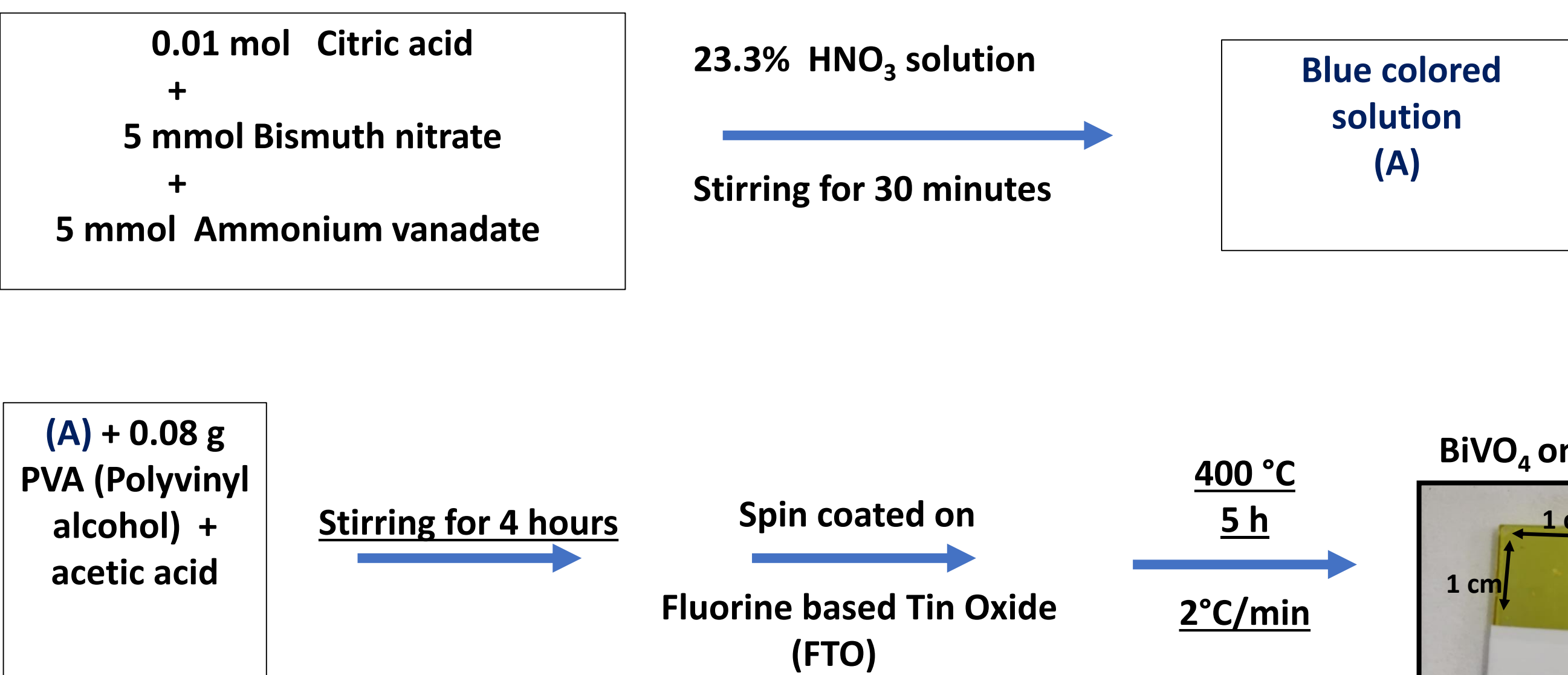
Model System



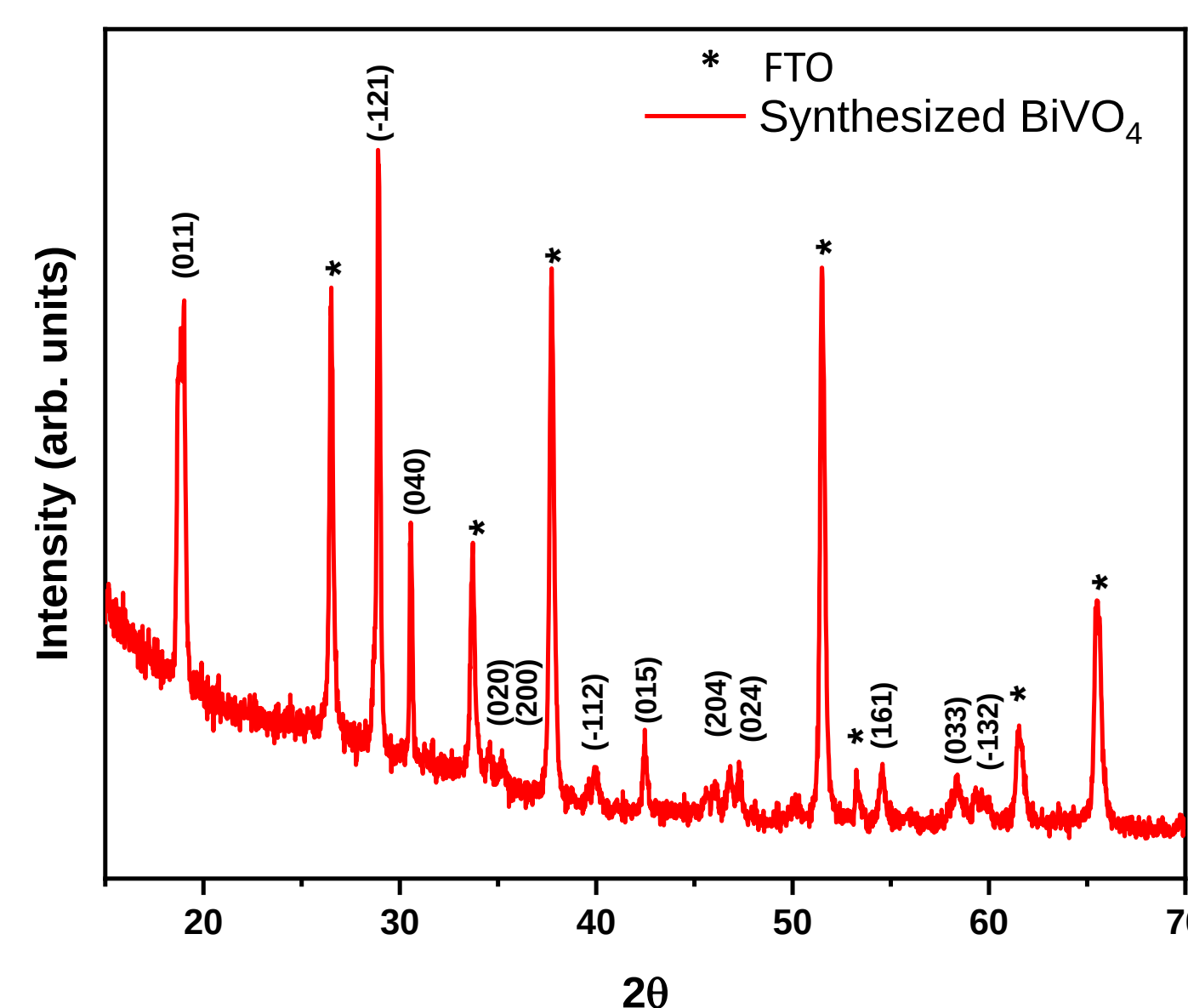
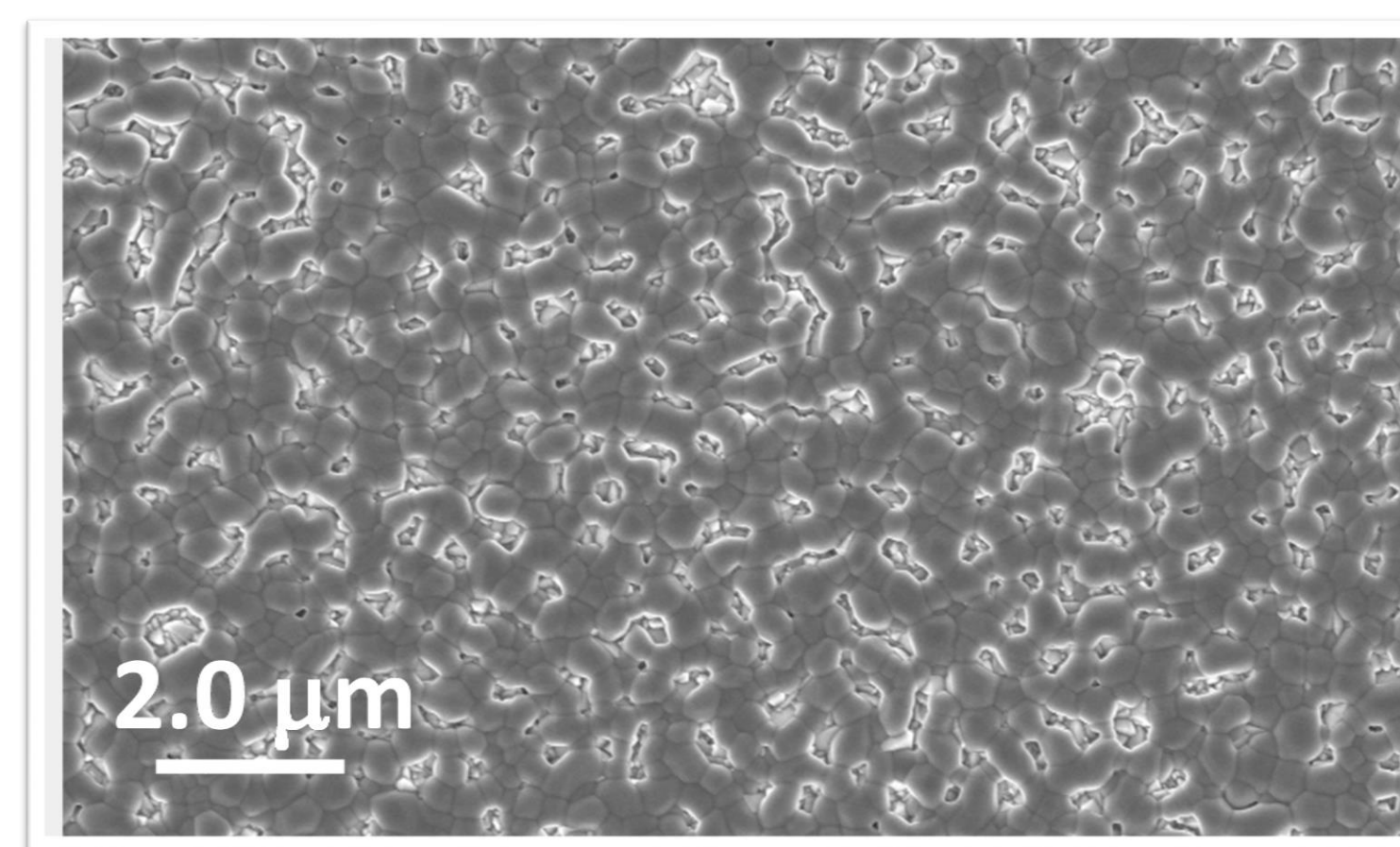
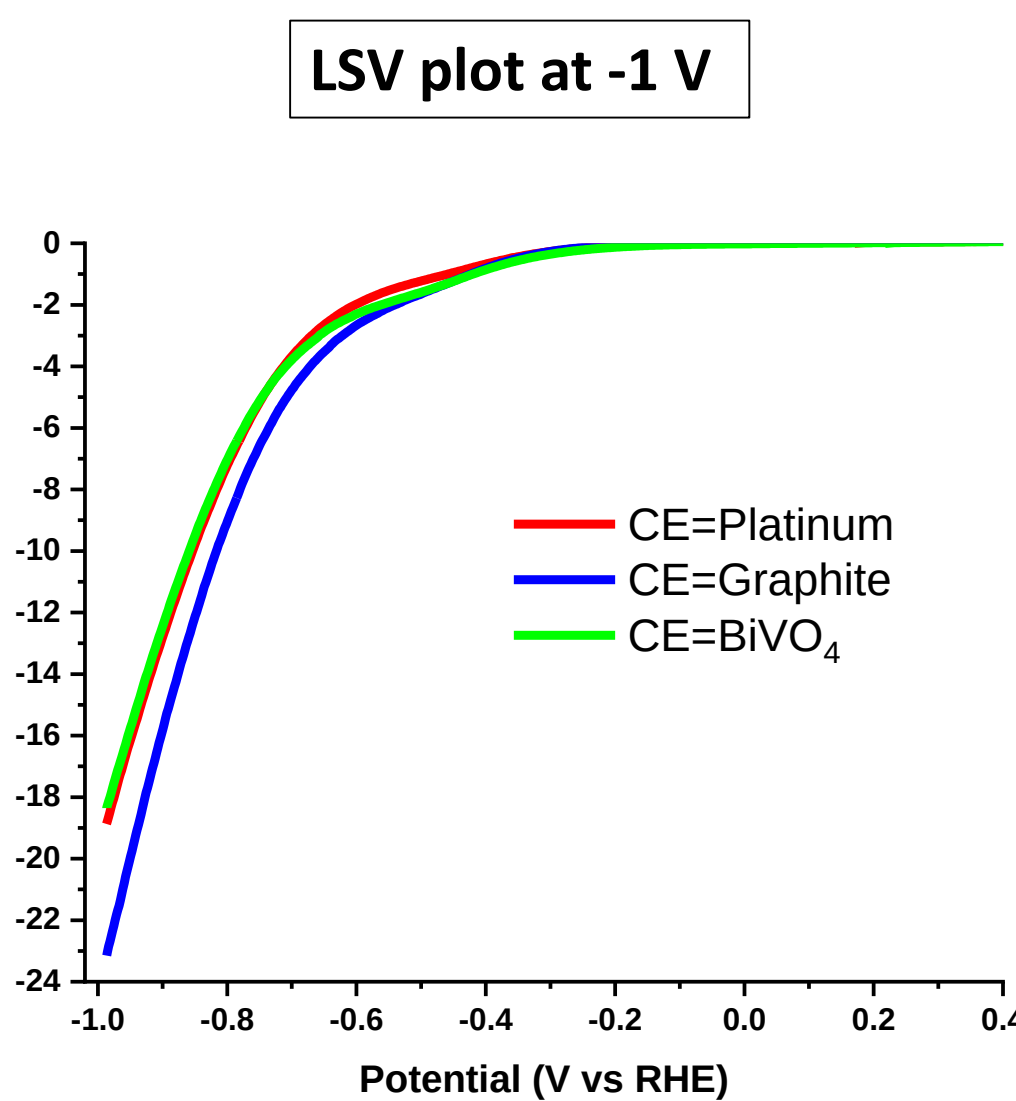
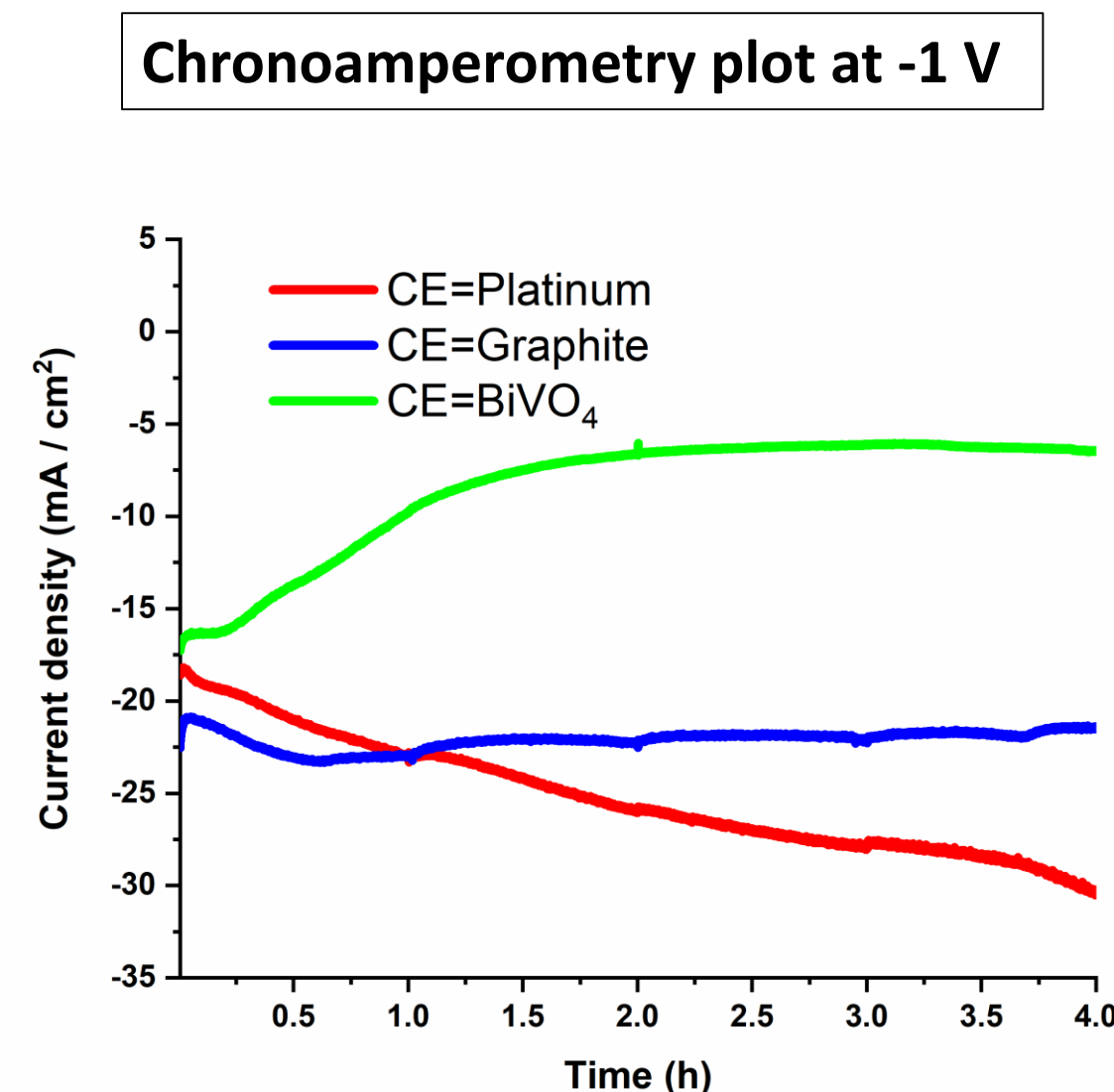
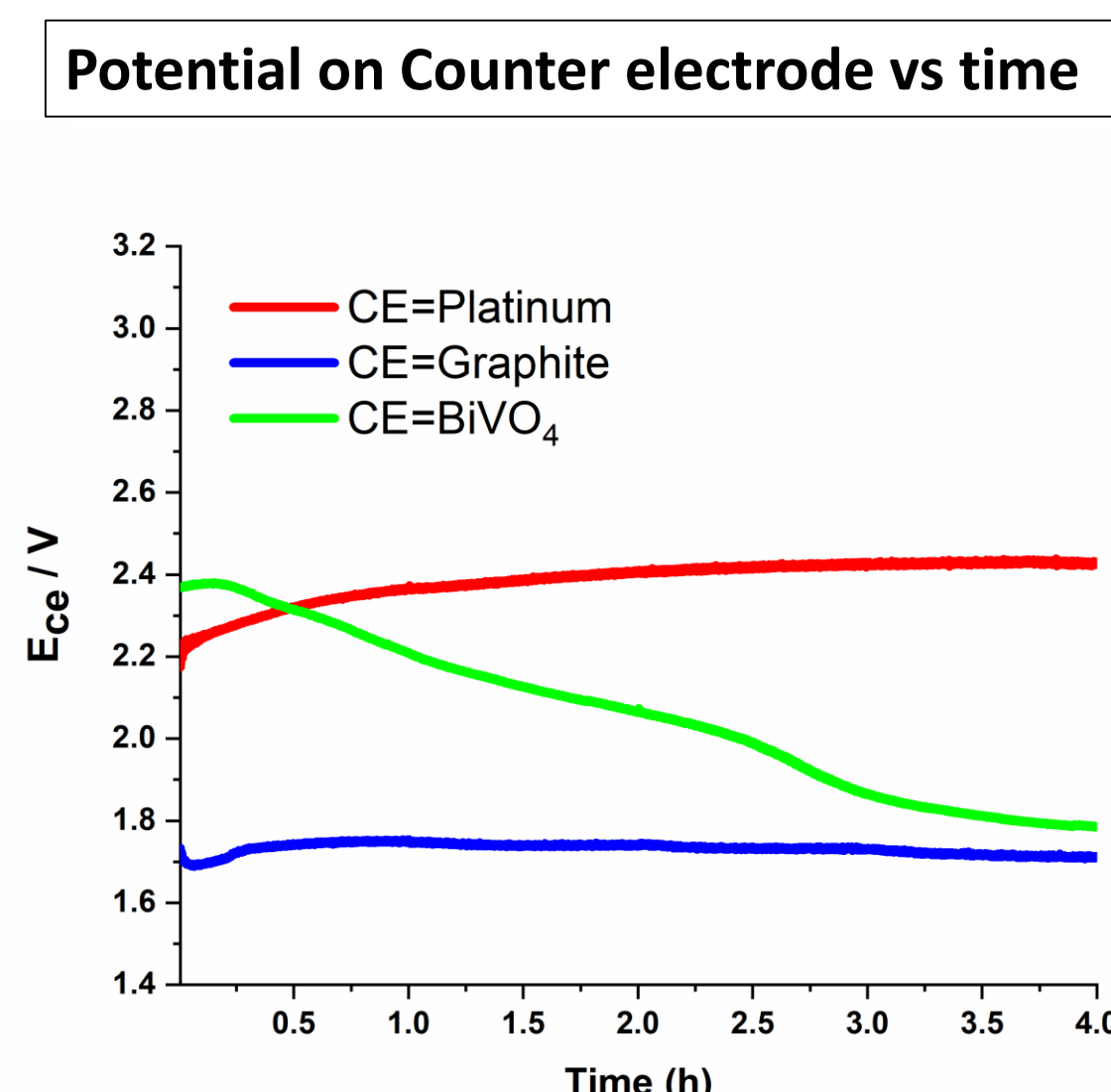
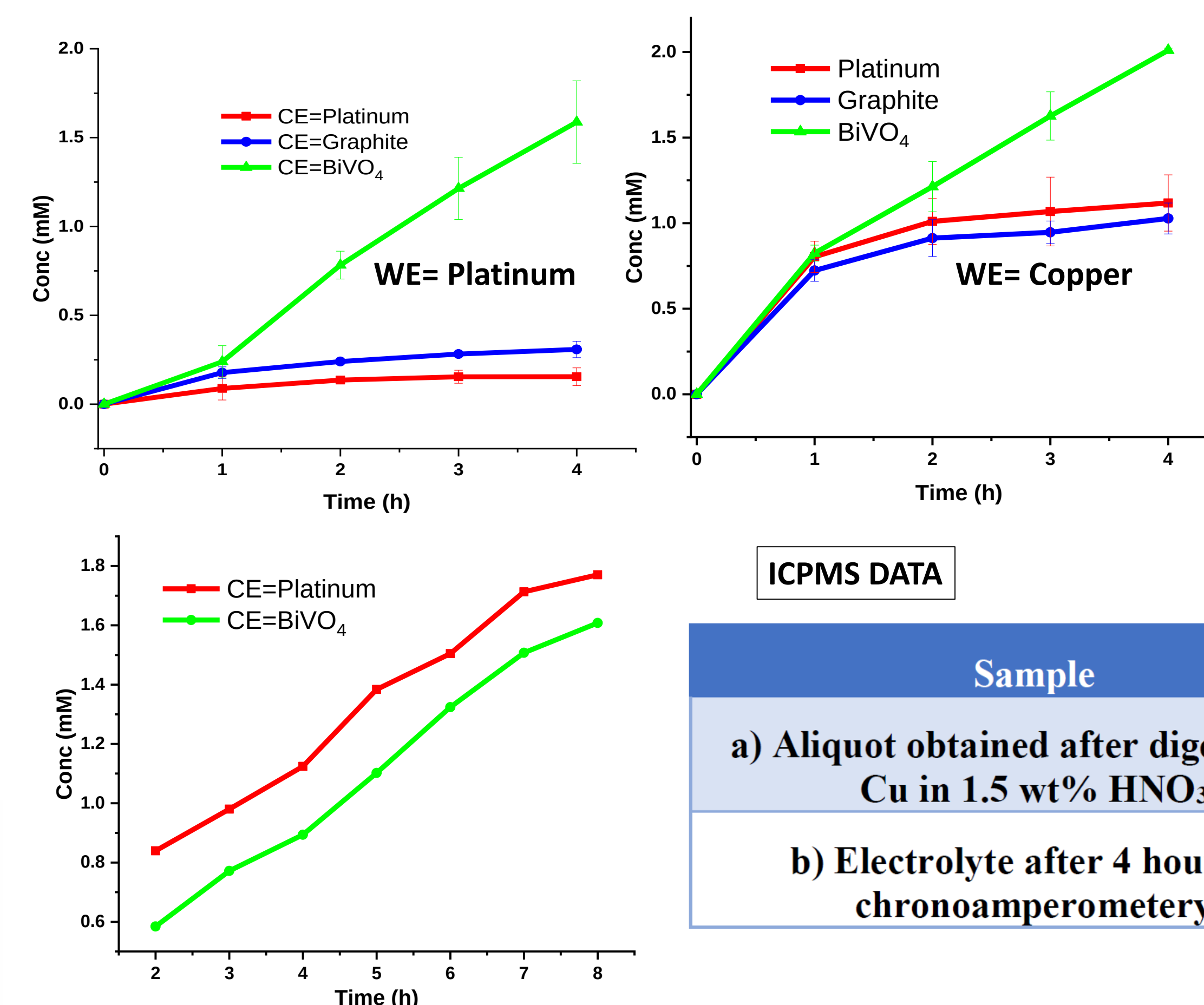
Procedure



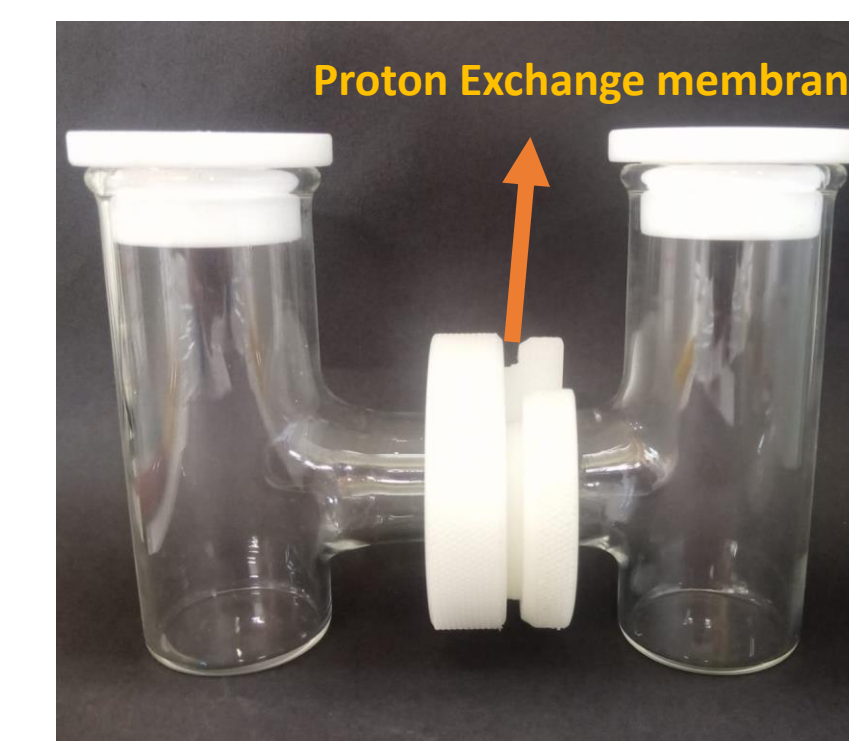
Preparation of BiVO₄



Characterization and Electrochemical measurements



Control Experiment



Observations and Conclusion

- With Pt / Copper as working electrode , production of formic acid follow the trend for counter electrodes, **BiVO₄** >> **Platinum** ≈ **Graphite**
- WE is not actually the same , when **BiVO₄** is used as counter electrode
- Leached BiVO₄ is coming into solution as Bi³⁺ and getting reduced on working electrode and enhancing the production of formic acid

References

- Data from United States Environmental Protection Agency (EPA). 2018. Available online: <https://www.epa.gov/ghgemissions/overview-greenhouse-gases>
- Rosen, J. et al. Electrodeposited Zn Dendrites with Enhanced CO Selectivity for Electrocatalytic CO 2 Reduction. ACS Catal. 5, 4586–4591(2015)

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