



SCAN ME

HYDROPHOBIC THIOL COATINGS FACILITATE A TRIPHASIC INTERFACE FOR CO₂ REDUCTION TO ETHYLENE

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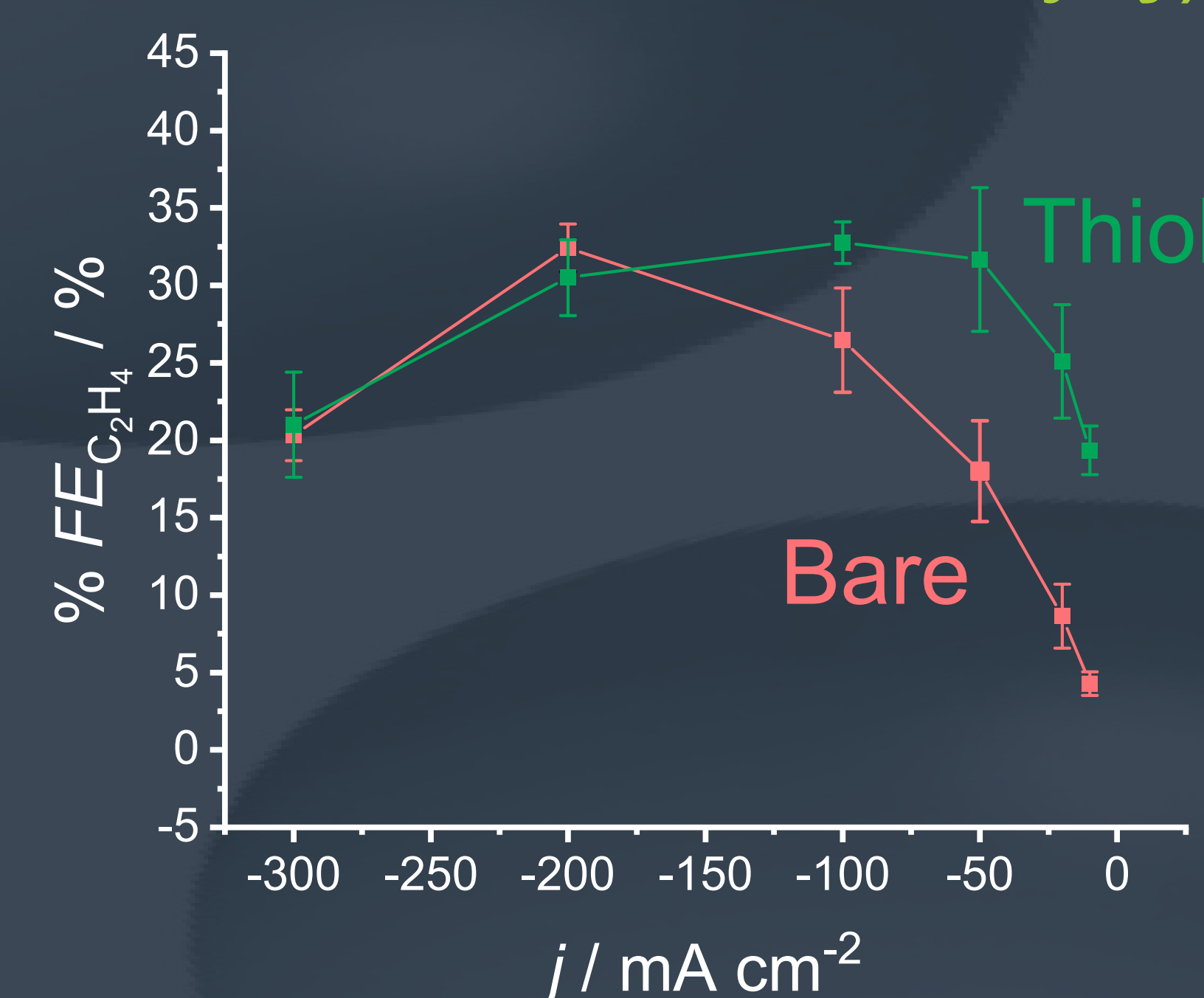
1. Introduction

- CO₂ reduction produces many different products.
- We want to selectively produce ethylene
- CO₂ gas reacts with liquid electrolyte at a solid catalyst
- This triphasic interface is key to fast reaction rates

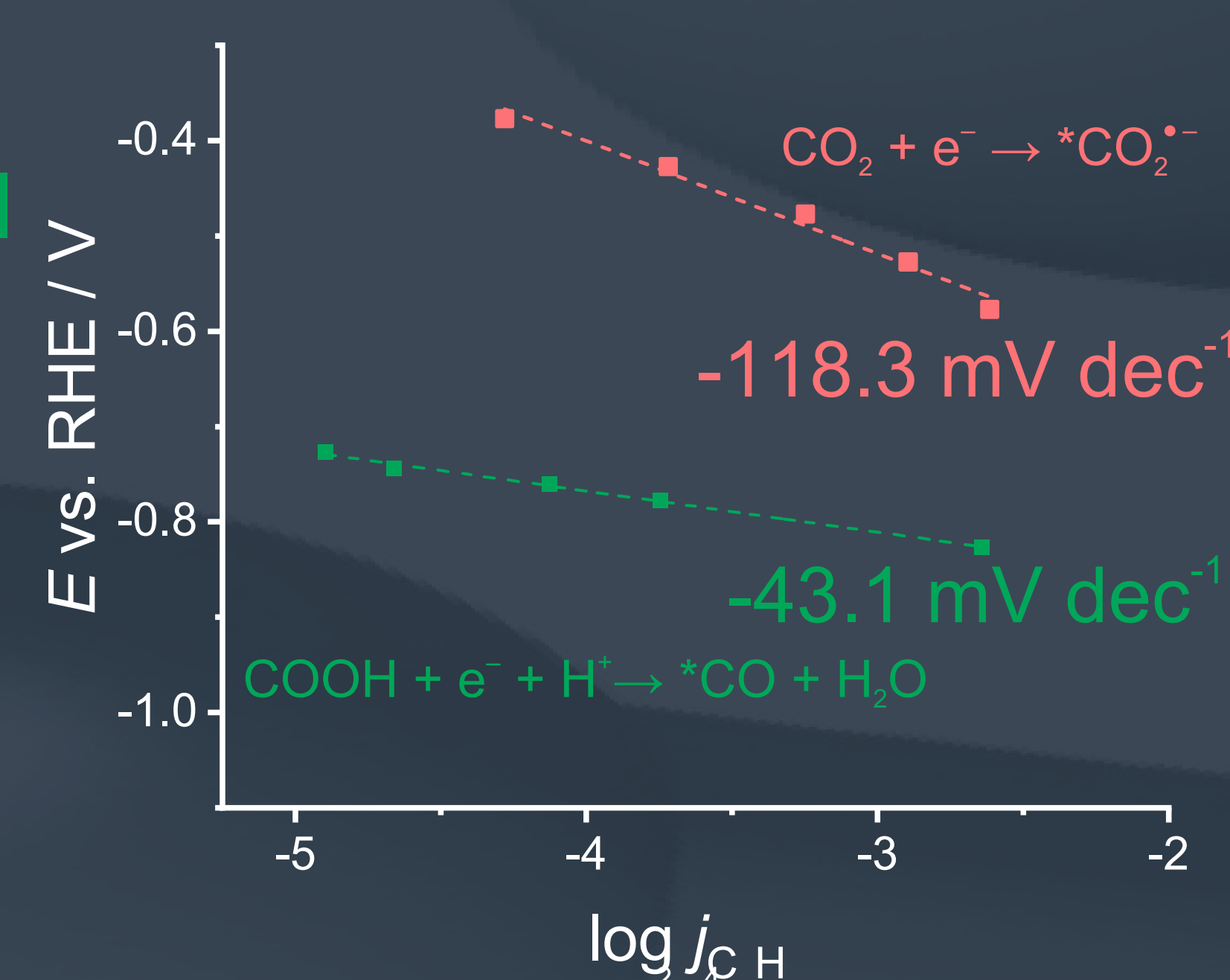
2. The concept

- Porous gas diffusion electrodes (GDEs) give fast CO₂ transport to a triphasic interface
- It is often assumed that GDEs give a triphasic interface but GDE flooding prevents this interface forming
- Long chain thiols adsorb onto copper to repel water from the catalyst surface

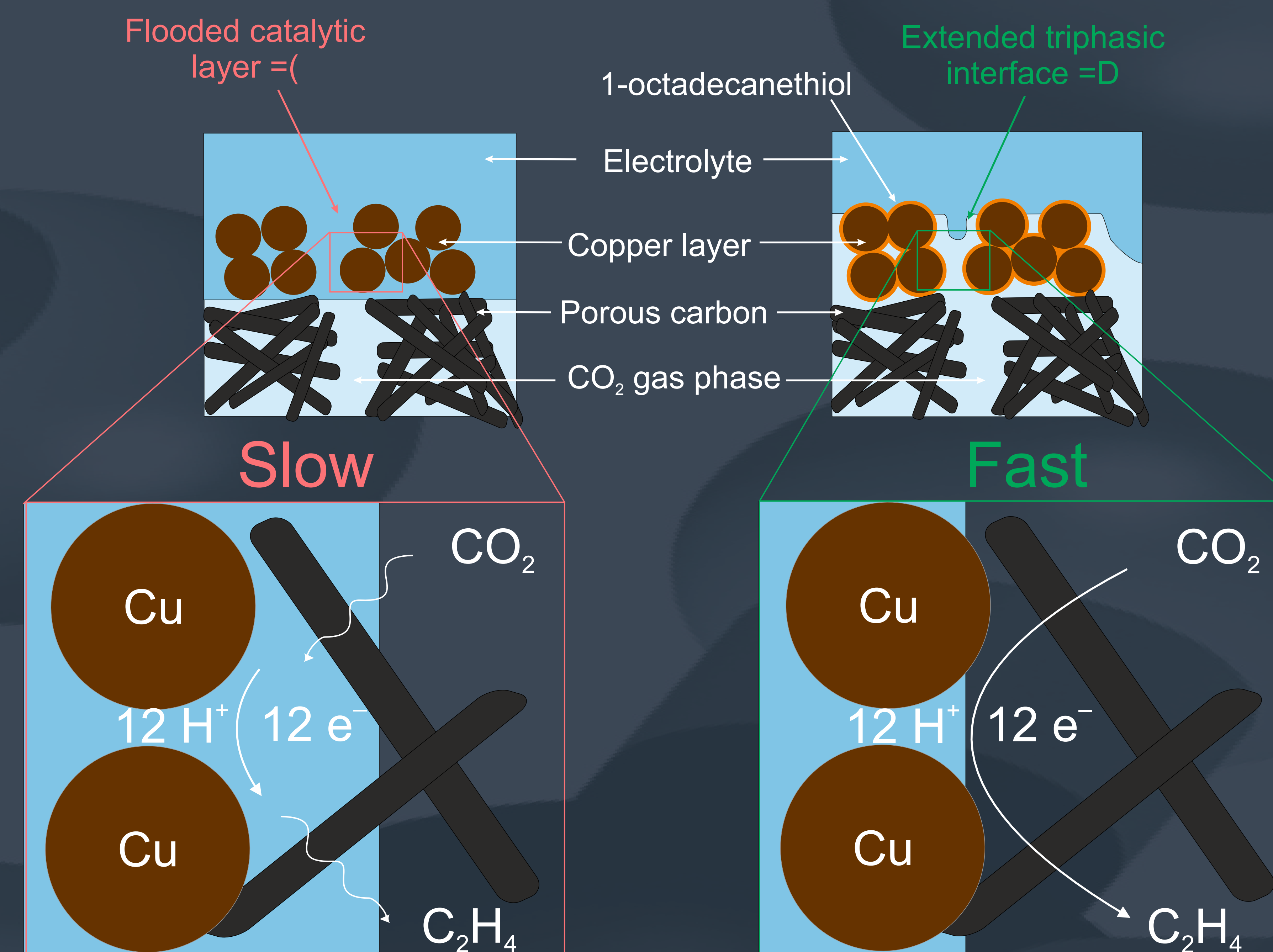
3. Thiol increases C₂H₄ at low current density (*j*)



4. Thiol changes rate determining step (RDS)

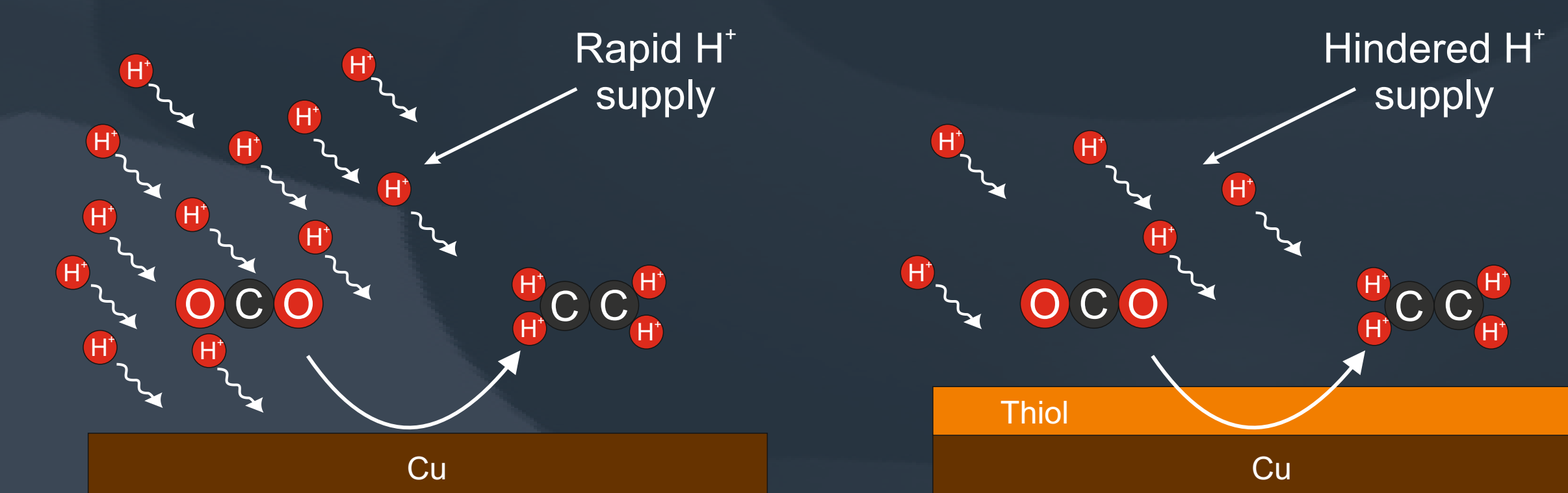


Coating a simple Cu gas diffusion electrode with a hydrophobic layer hinders electrolyte flooding, improving CO₂ reduction to C₂H₄



5. Discussion

- CO₂ reduction to ethylene needs 12 H⁺
- Thiol repels water and limits H⁺ availability
- Low reaction rates show benefits of thiol hindering electrode flooding
- High reaction rates are hindered by lack of H⁺ for the reaction
- Thiol changed the rate determining step from the 1st to the 2nd electron transfer
- Only the 2nd electron transfer is H⁺ dependent.



6. Conclusions

- The hydrophobic thiol increases ethylene production at low current densities, but is limited by decreased proton availability when the reaction rate is faster.
- Supplying protons to the thiol could further improve performance while maintaining the triphasic interface.

7. References

- S. C. Perry et. al; *Faradaic Discuss.* **2021**, 230, 375.
- S. C. Perry et al; *Chemosphere*, **2020**, 248, 125993.
- S. C. Perry; *Electrochemical Carbon Dioxide Reduction*, *De Gruyter (Berlin)*.
- S.C. Perry et al. *Curr. Opin. Electrochem.* **2020**, 20, 88.

