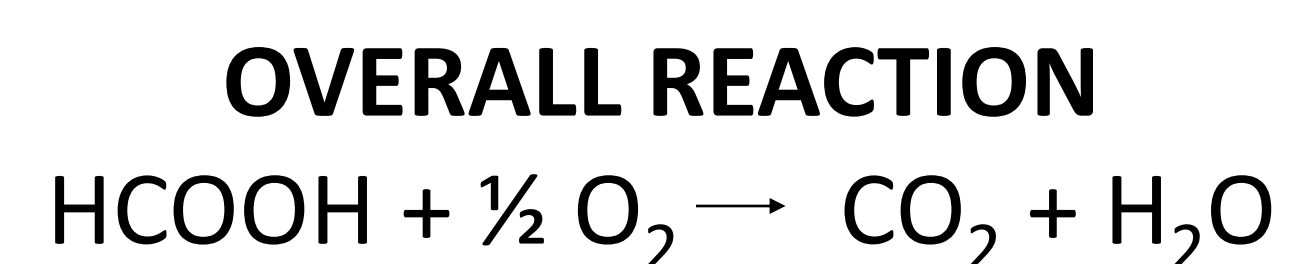
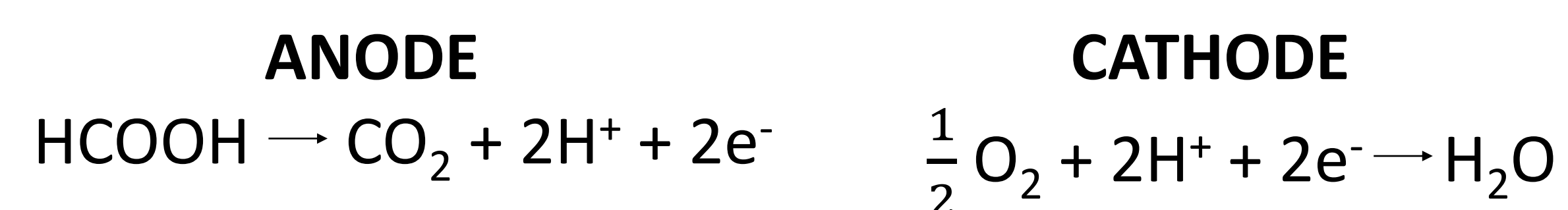


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## Introduction

### Why Direct Formic Acid Fuel Cells?

- Efficient Portable Power
- Low Overpotential
- High Power Density
- Formic Acid is sustainable



## Problem Statement

### Mass Transport Limitations within the Catalyst Layer

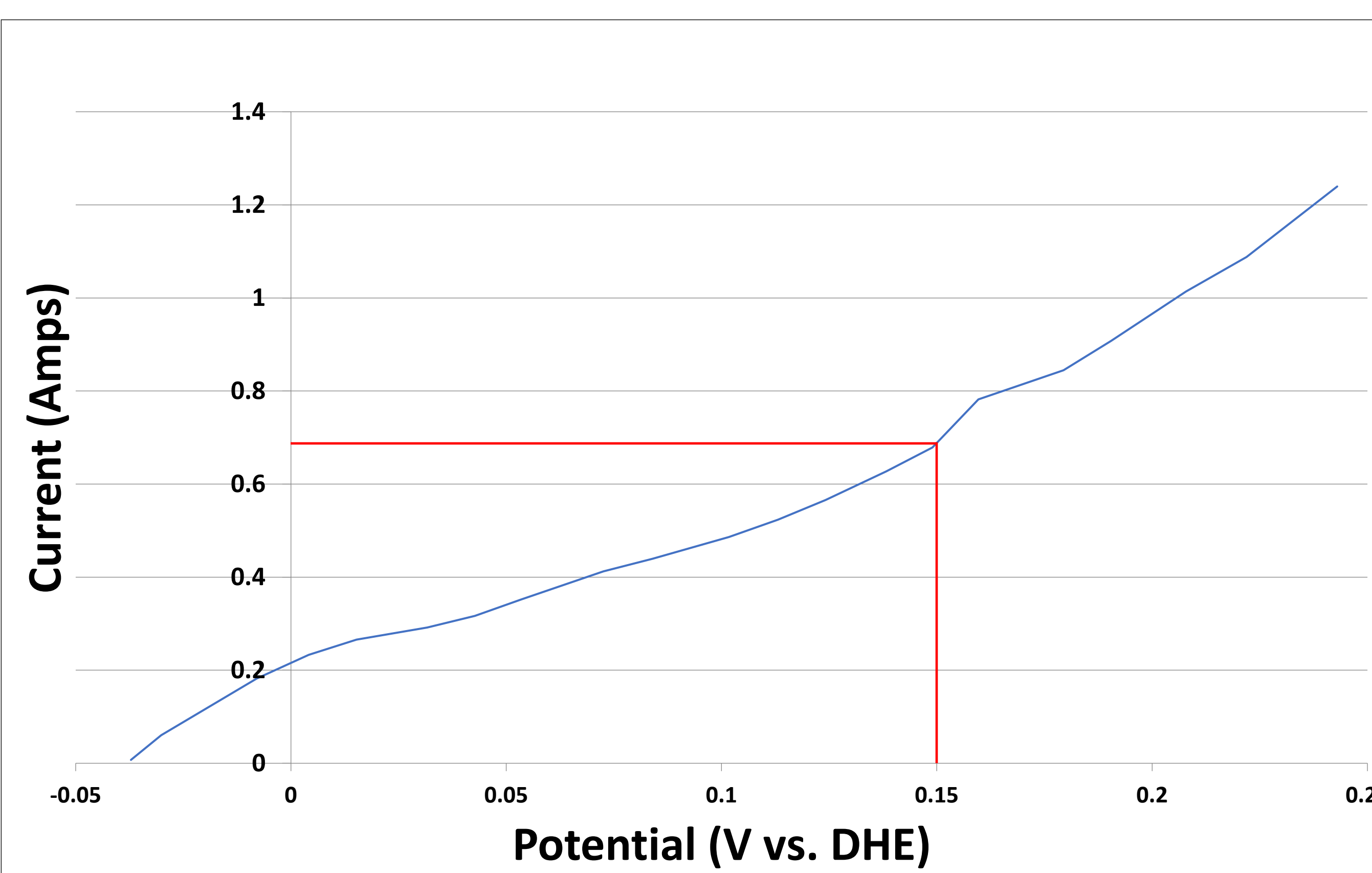
- Mass Transport limits reaction kinetics
- Decreases overall cell performance

### Hypothesis:

#### Pore-former

- Magnesium oxide (MgO) forms ~100 nm pores within catalyst layer
- High-porosity catalyst layer optimizes mass transport
- Increases overall cell performance

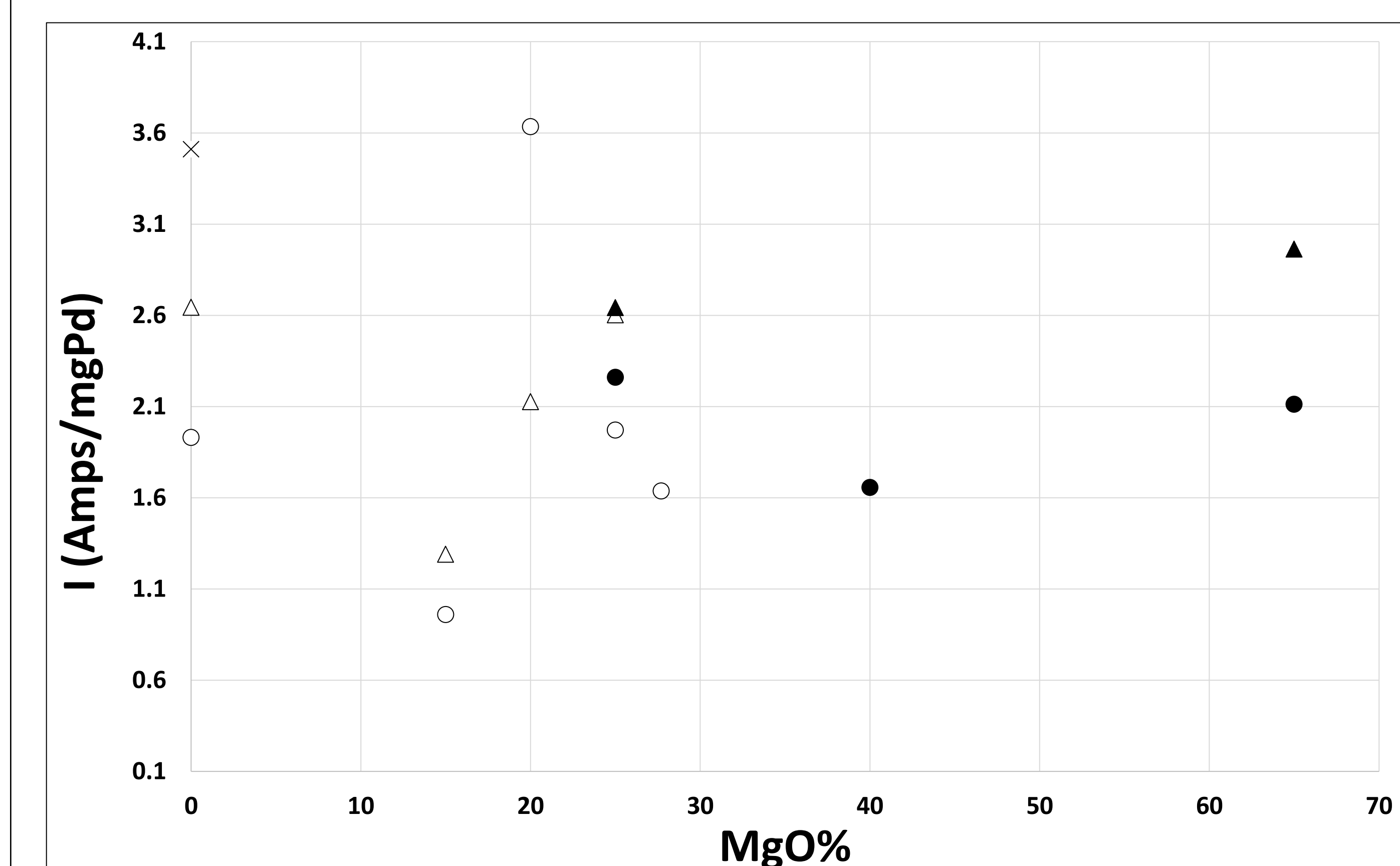
## Results



**Figure 2.** Linear sweep voltammetry of catalyst layer containing 20% MgO. This test monitors cell performance and catalytic activity. Current at 0.15 V indicated by red lines.

### Linear Sweep Voltammetry

- Measured versus Dynamic Hydrogen Electrode (DHE) as the reference electrode
- Monitor cell performance at ~0.15 V
- 0.15 V is a standard operating voltage
- High catalytic activity at 0.15 V
- ~0.68 Amps at 0.15 V



**Figure 3.** Linear sweep voltammetry data of current produced at 0.15 V vs. MgO weight %. The current is normalized with the catalyst loading on the anode. Pre (open-shape) and Post (closed) Nafion (ionomer) MgO additions are shown.

- Higher current produced at ~20% MgO
- Higher catalytic activity due to higher mass transport
- Mass transport may be optimized at ~20% MgO

## Conclusions

- Magnesium oxide pore-former increases catalyst layer mass transport
- Increased electrochemical surface area and catalytic activity

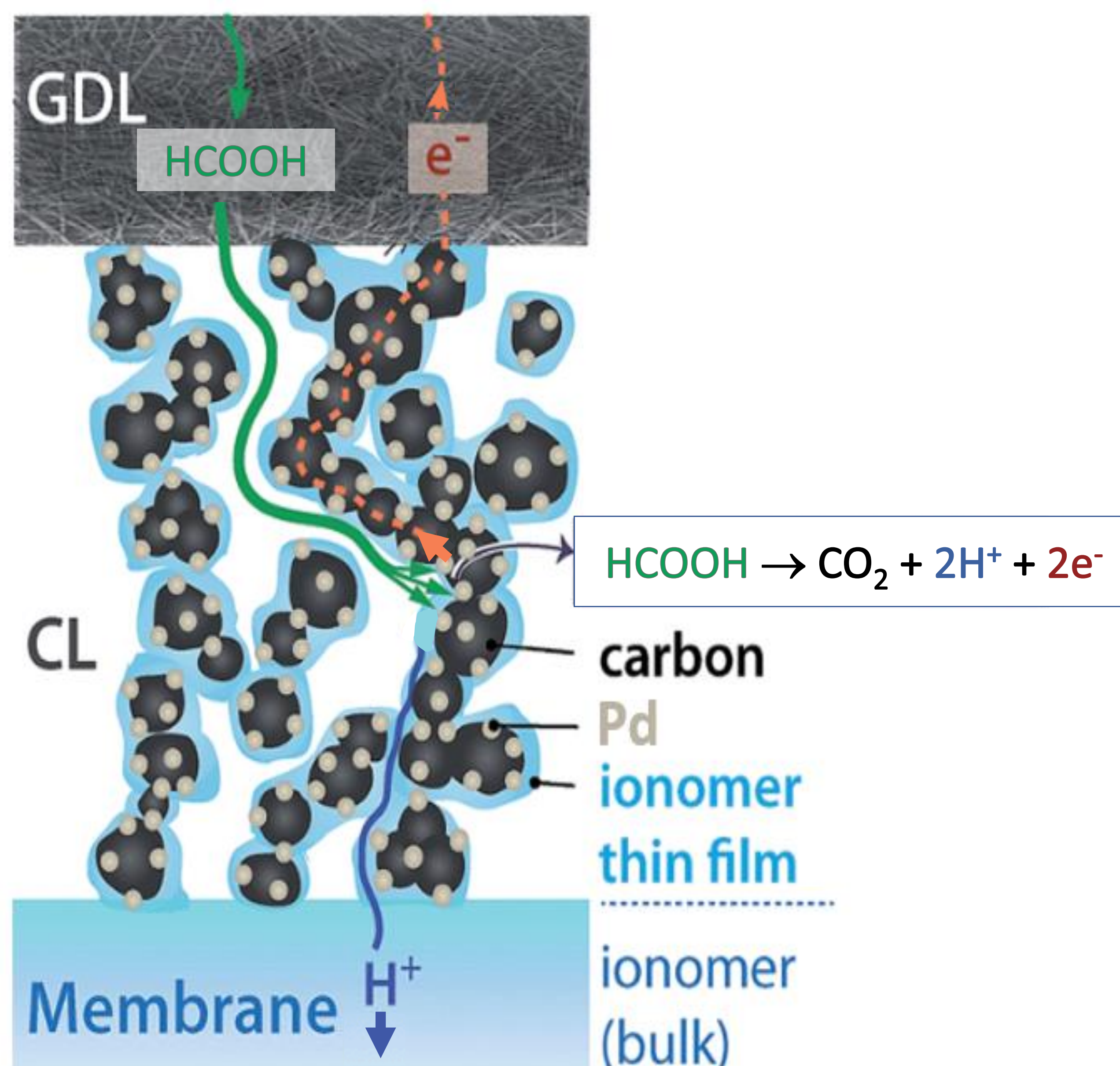
### Future Work:

- Continue testing different catalysts with different MgO %.

## References and Acknowledgments

1. Weber, A. Z.; A. Kusoglu, J. Mater. Chem. A., **2014**, 2, 17207

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**Figure 1.** Mass transport of reactants and products through the catalyst layer<sup>1</sup> (Modified). Increasing pore size will increase mass transport through the catalyst layer.