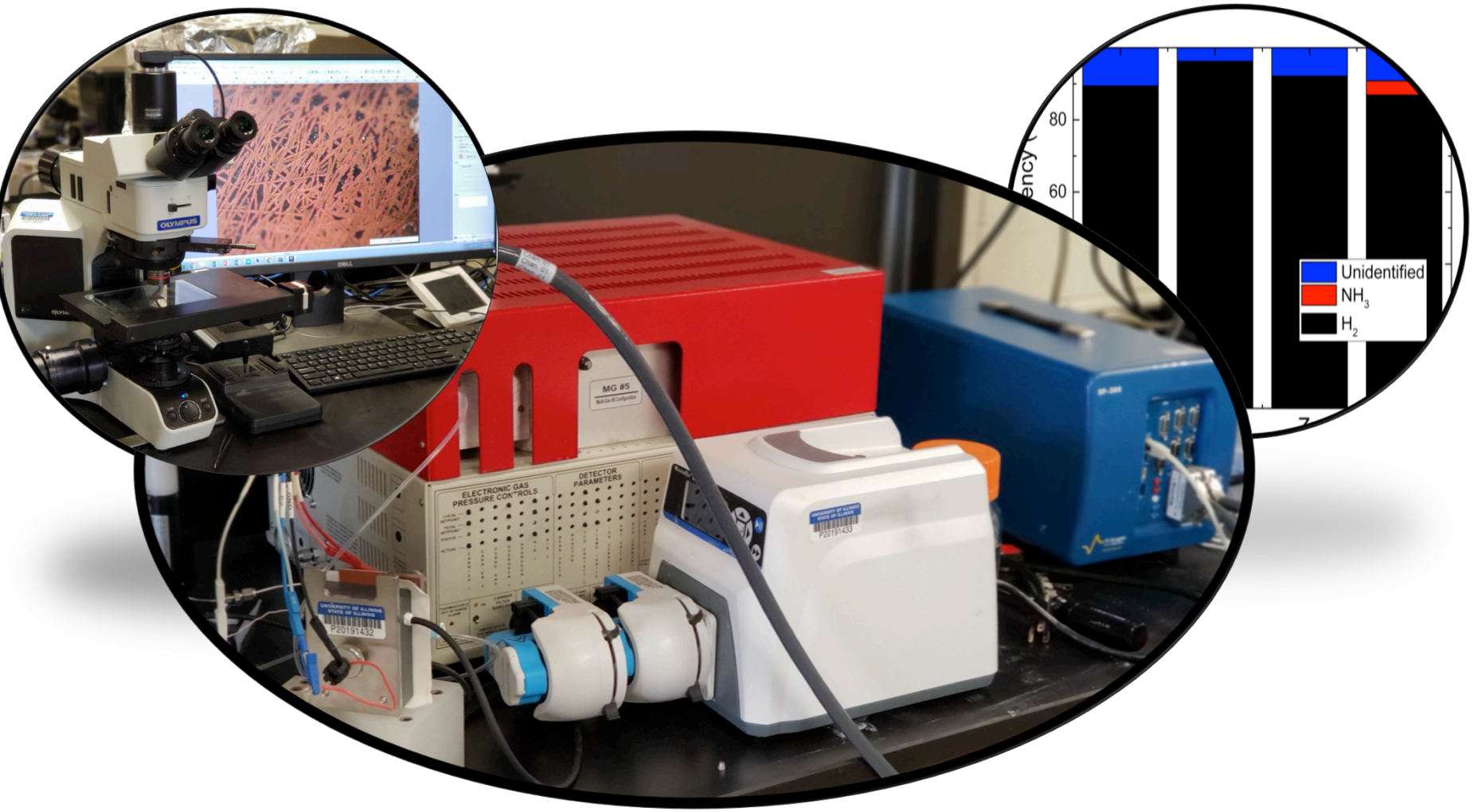


ELECTROCHEMICAL REDUCTION OF NITROGEN TO AMMONIA OVER TRANSITION METALS

Aditya Prajapati, Victoria Smith, Meenesh Singh

Outline

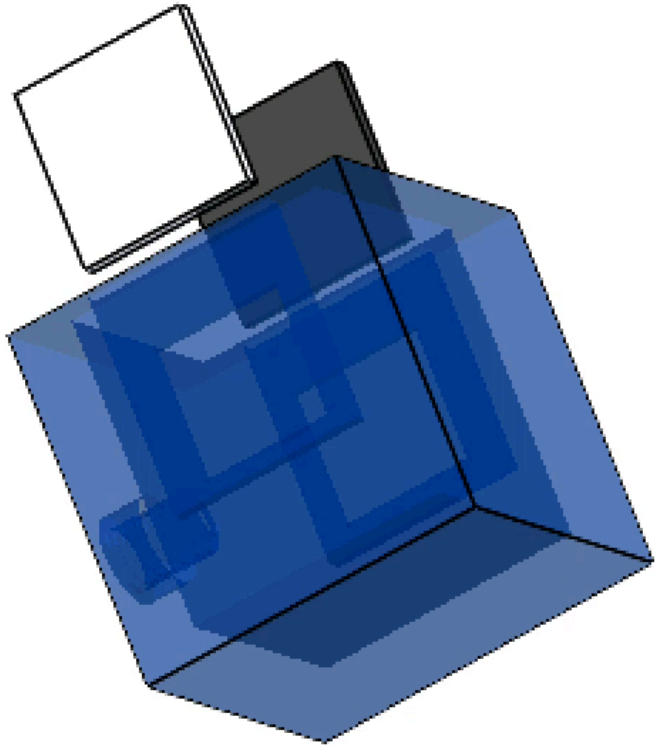
- Objectives
- Experimental Methods
- Results
- Summary and Future Work

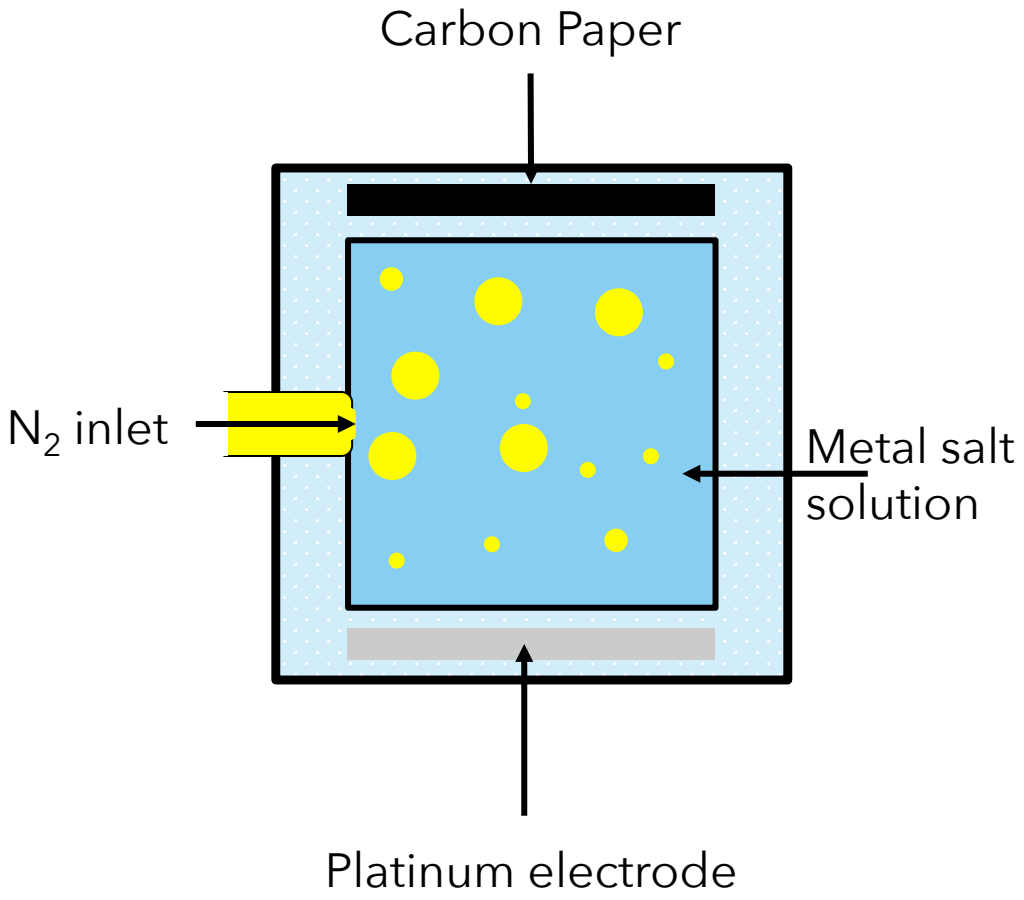
Synthesis of N_2 reduction electrodes

Design and Fabrication of Electrochemical cell

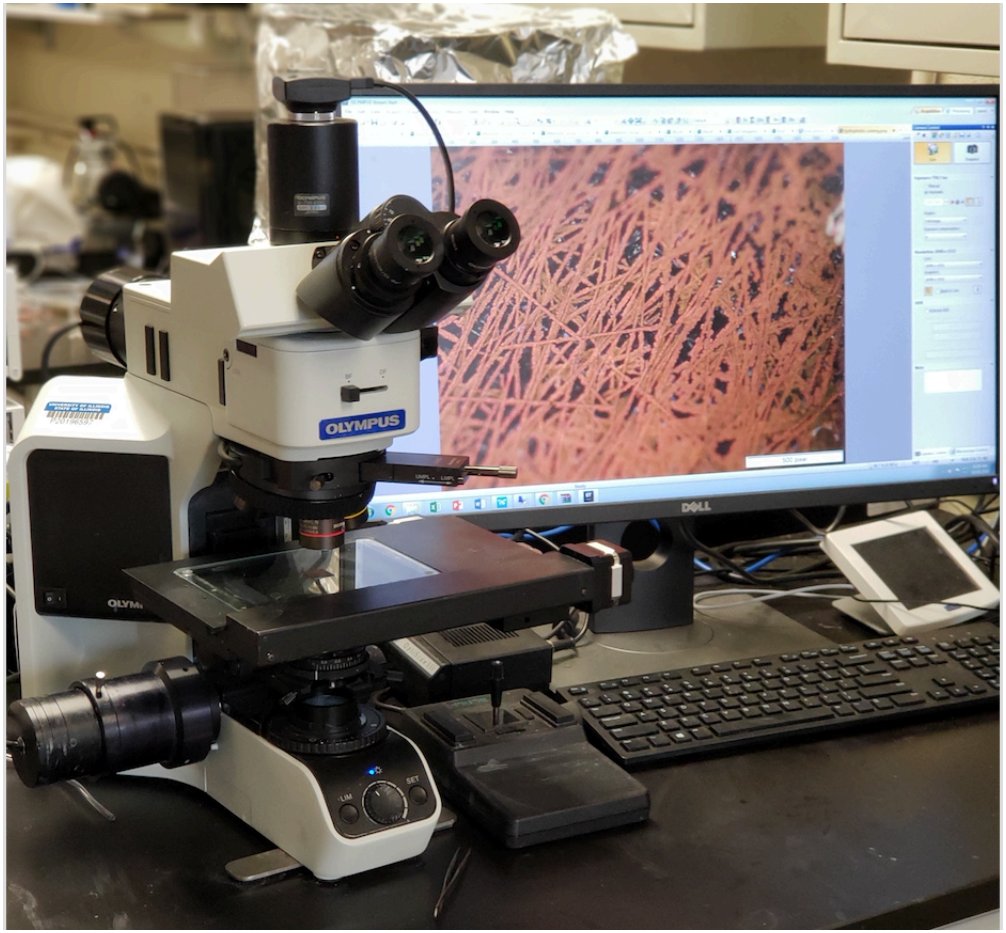
Electrochemical experiments for Nitrogen Reduction over transition metals

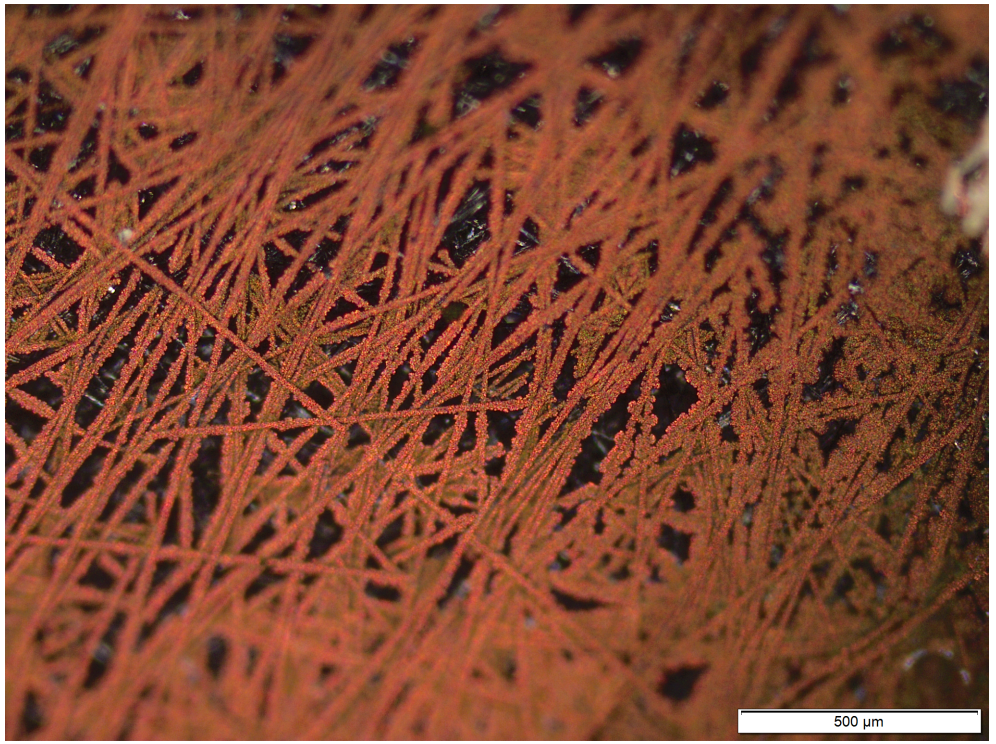
Preparation of Electrocatalyst





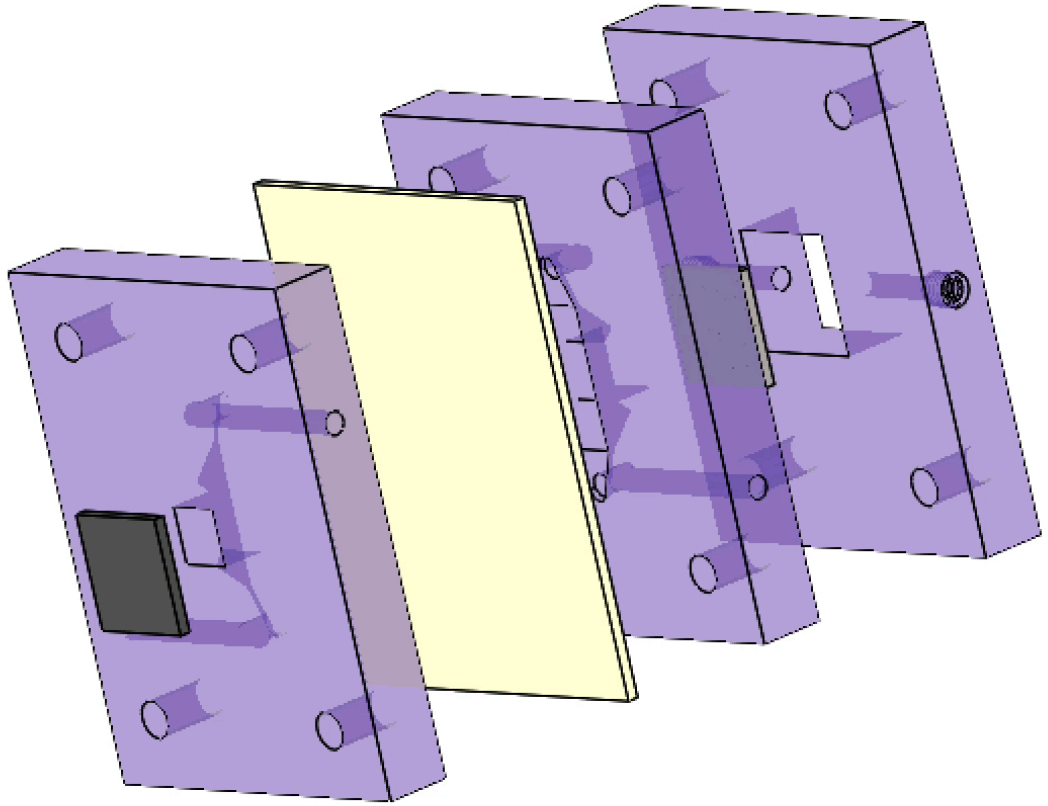
Preparation of Electrocatalyst

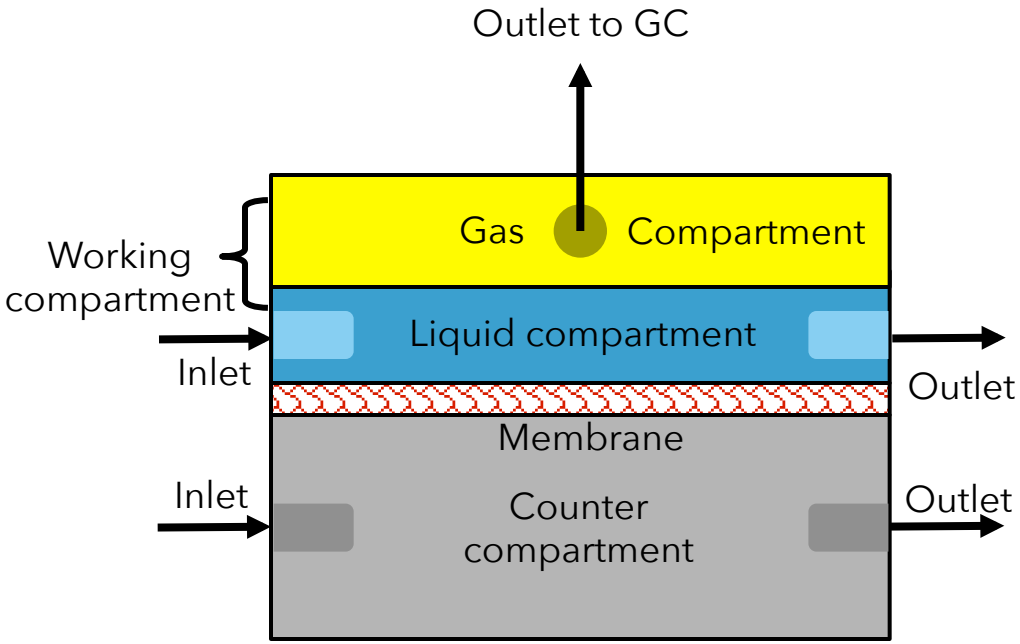




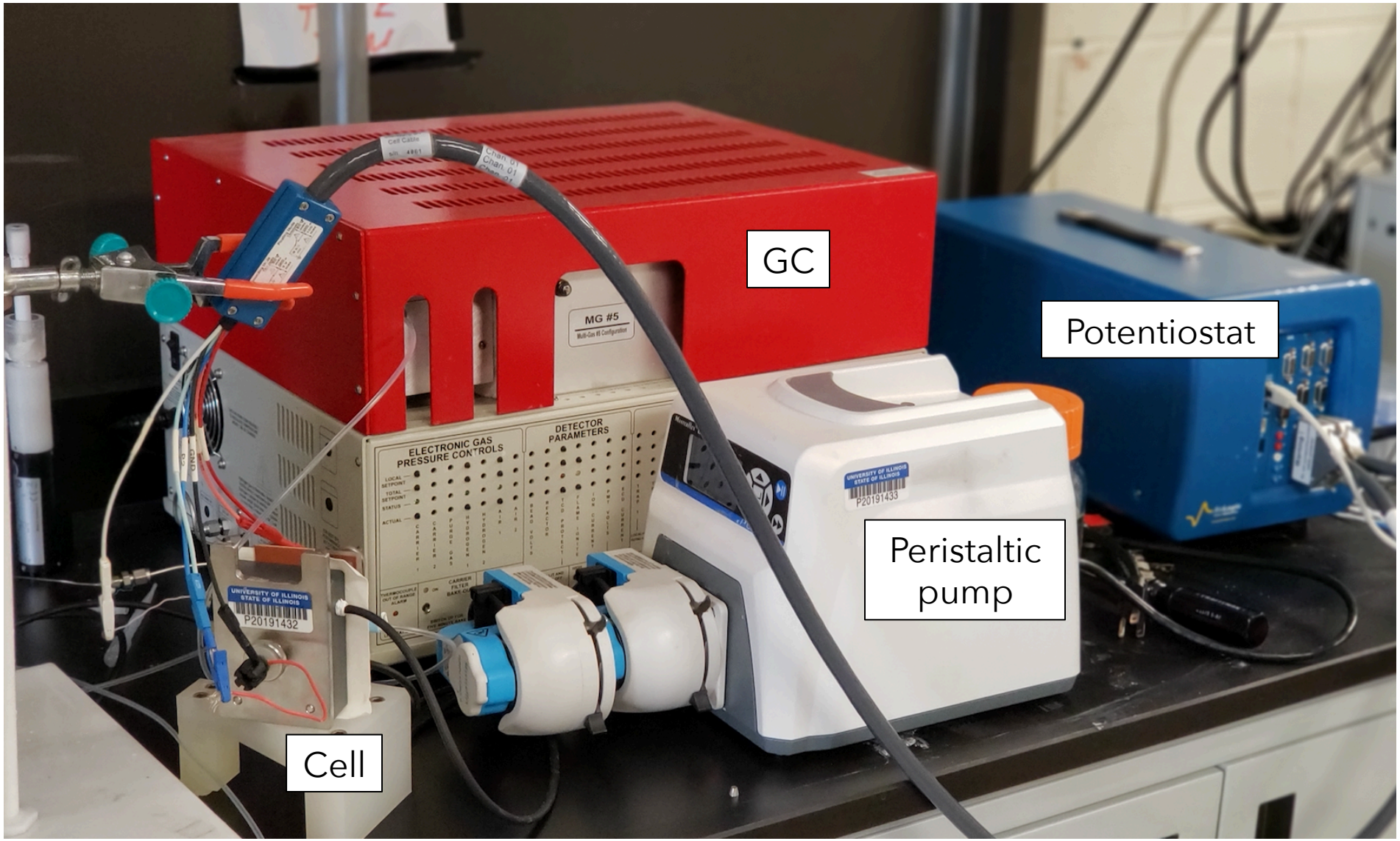
- -2V vs RHE for 30 mins in 0.05M $Cu(NO_3)_2$
- ~25 wt% coating

Design of Electrochemical Cell



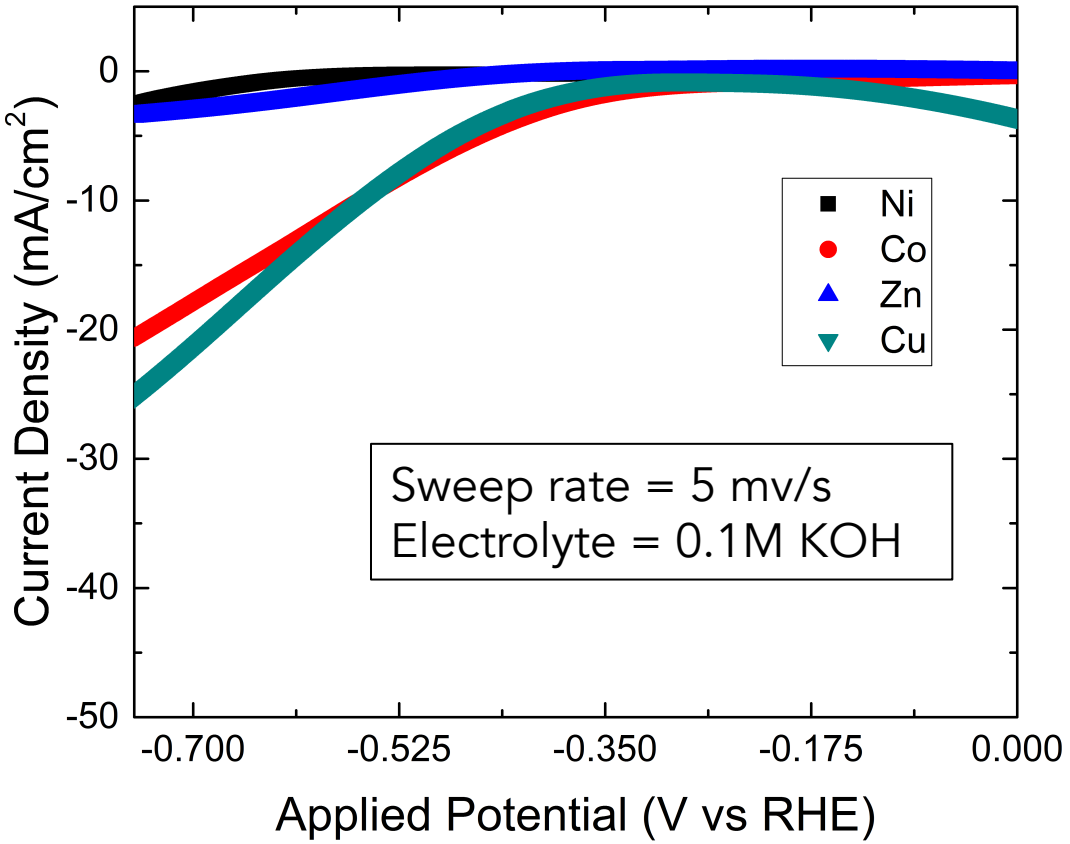


Design of Electrochemical Cell



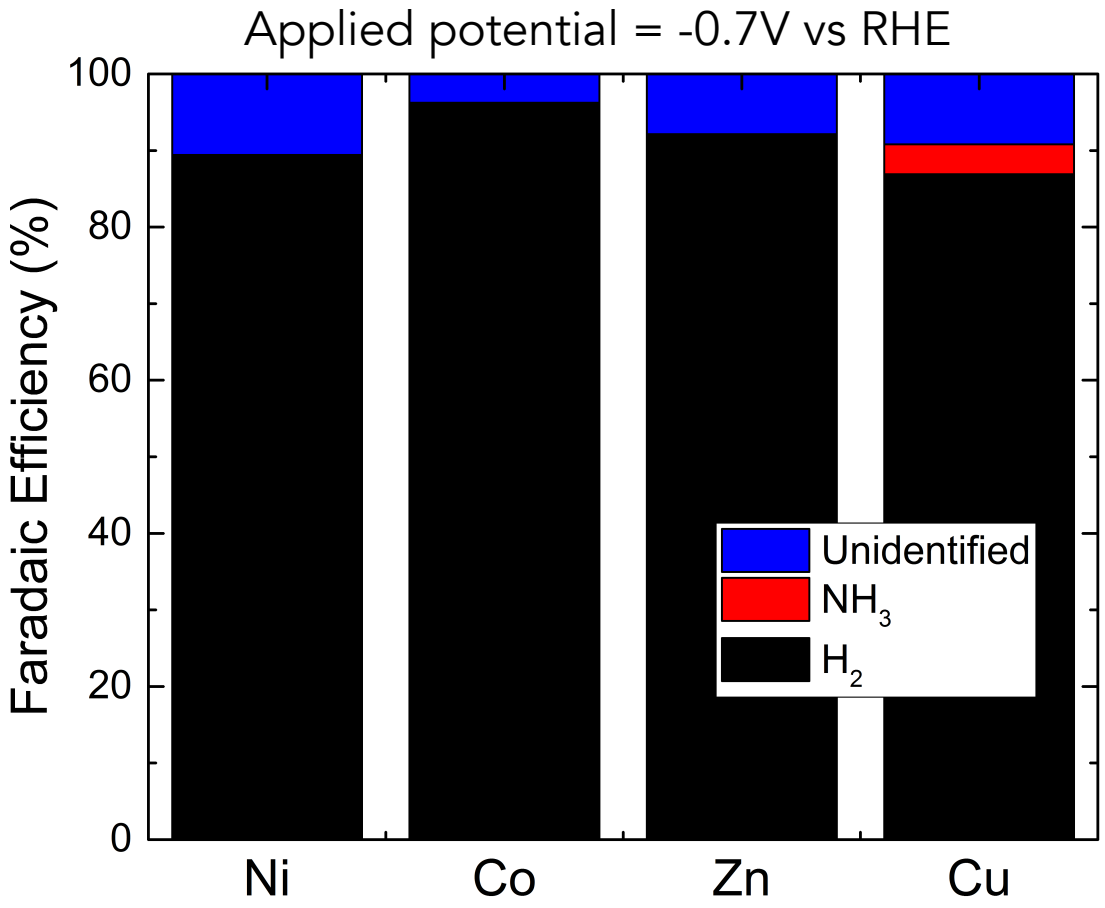
Linear Sweep Voltammetry

- LSVs were performed to observe the activity of the transition metals.
- Zn and Ni show a very low current density when N_2 is sparged in the system
- Cu shows the highest current density at -0.7 V vs RHE
- The potentiostat becomes unstable beyond -0.78V



Faradaic Efficiency

- Product measurement was done at 3 different potentials
  - -0.5 V vs RHE
  - -0.6 V vs RHE
  - -0.7 V vs RHE
- Ni, Co, and Zn showed no activity for N_2 reduction in this operating region.
- NH_3 was detected with in-situ GC analysis at an onset potential of -0.7V with Cu



Summary and Future Work

- A standard cell was designed and fabricated to electrodeposit metals from metal salt solutions on a carbon support
- A flow-cell with the catholyte volume of ~2.5 mL was designed and fabricated to conduct N_2 reduction studies.
- Cu shows activity towards ammonia production with an onset potential of -0.7 V at a Faradaic efficiency of 4%
- Future work:
  - Testing out other transition metals for their activity on N_2 reduction
  - Alloying the active and inactive metals to observe any partial reduction of N_2

Acknowledgements

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THANK YOU