**Introduction**

I have been studying and optimizing the catalytic properties of gold in an ethanol solution, one fuel used in direct alcohol fuel cells. The purpose of my research is to settle the debate in literature that carbon monoxide promotes the oxidation reaction in the fuel cell. A three-electrode mini-cell was used along with cyclic voltammetry to approach this problem.

**Fuel Cells:**
- A fuel cell is an electrochemical device that converts oxidation of an externally injected fuel into electrical energy [1].
- The oxidation of ethanol is given by: 
  \[ CH_3CH_2OH + 3O_2 \rightarrow 2CO_2 + 3H_2O \]
- Carbon monoxide (CO) is believed to be an intermediate product of this oxidation [1,3].

**Three-Electrode Mini-Cell:**
- The purpose of varying the voltage limits in a C.V. is to show how changing the scan window can affect the intensity of oxidation/reduction peaks.

**Background**

**Cyclic Voltammetry (C.V.):**
- Cyclic voltammetry is a plot of current vs. voltage, where the voltage on the working electrode is varied from a lower limit to an upper limit.

**Goals of Research**

- Show how the oxidation and reduction peaks change when the scan window is changed.
- Find origin of cathodic oxidation peak \( I_b \).

**Varying Voltage**

- As seen in figure 3, as the right limit is increased, the reduction peak is also increased in intensity. This is due to the gold electrode being oxidized less, therefore being reduced less.
- The intensity of the cathodic oxidation peak \( I_b \) is due to oxidation of fresh ethanol alone.

**Origin of Oxidation Peak \( I_b \)**

- In order to show that the cathodic oxidation peak \( I_b \) is due to fresh ethanol oxidation, fuel (ethanol) was injected into the cell containing a sodium hydroxide solution at the end of the forward C.V. scan.
- The C.V. was run for 5 cycles before the injection in order to stabilize the system. After the injection, the C.V. was run for 5 more cycles.
- As seen from cycle 6 in this figure, after the fuel was injected, the oxidation peak \( I_b \) was seen. Prior to this peak, no CO was formed because there was no oxidation of the ethanol, only of the gold electrode. This means \( I_b \) is due to oxidation of fresh ethanol alone.

**Conclusion and Future Work**

- \( I_b \) oxidation peak is due to oxidation of fresh ethanol rather than CO.
- In the future our group hopes to continue to develop high performance catalysts, and understand discrepancies between the different catalysts tested.

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**References**