

Electro-chemical CO filter for fuel cell applications

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Introduction

High efficiency and low emissions are making fuel cells a promising source of energy in the future. Proton exchange membrane (PEM) fuel cells have the additional benefit of lower operating temperatures and immobilized electrolyte resulting in cheaper materials cost and less severe corrosion problems [1]. Difficulty in storing hydrogen and the lack of infrastructure to deliver hydrogen, promote the use of onboard reformer to produce hydrogen rich fuels in cars and other stationary fuel cell applications. The reformed fuel, commercially called "reformat" is a mixture of H₂, N₂, CO₂, H₂O and traces of CO, NH₃ and other gases. Even though fuel cells show very good polarization characteristics with pure hydrogen feed the performance loss is massive with fuel containing traces of CO as low as 50 PPM [2-4]. Previous researchers have used different alloying metals like Ru, Rh, and Mo with platinum to improve CO tolerance.

The reformer consists of two major components, the actual reforming reactor and the post treatment stage for reducing the CO concentration through water-gas shift reaction called the partial oxidizer (PROX). The PROX is usually between 5-10 times bigger than the actual reformer and the CO cleanup process is not very efficient. In this study we propose a CO filter based on preferential electrooxidation of CO. This would be comparatively and would have the added benefit of producing electricity. Figure 1 gives a block diagram of this proposed filter.

Experimental

Initial experiments were done to reproduce the results from the literature using PEM electrode rather than using Pt electrodes on liquid electrolytes. Fully assembled fuel cell units consisting with Pt on cathode side and Pt-Ru on the anode side were used as the reactor for the CO oxidation experiments. The working electrode side (either Pt or Pt-Ru) would have a flow of CO/N₂ while the other side, which acts as both counter and reference electrodes has H₂ flow. CO gas (500 PPM in N₂) was bleed in the N₂ flow. The cell was held at open circuit conditions and CO was bleed was switched on for a given duration of time. After the CO bleed was stopped the working electrode side was

purged with N₂. Then the potential was cycled from 0 to 1.1V wrt to DHE.

Figure 2 shows the data from the first cycle of CV's obtained from this experiment for different duration of CO bleed. Experiments with CO/H₂ would be conducted with different electro catalyst like Pt, Ru, Pt-Ru and Mo and the effectiveness and selectivity of oxidizing CO over H₂ would be discussed.

References

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Figures

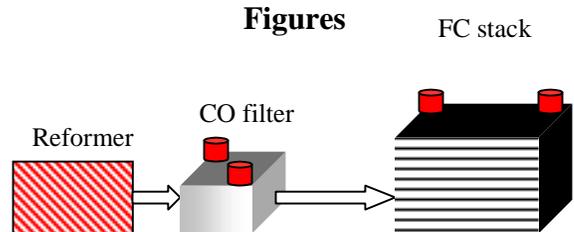
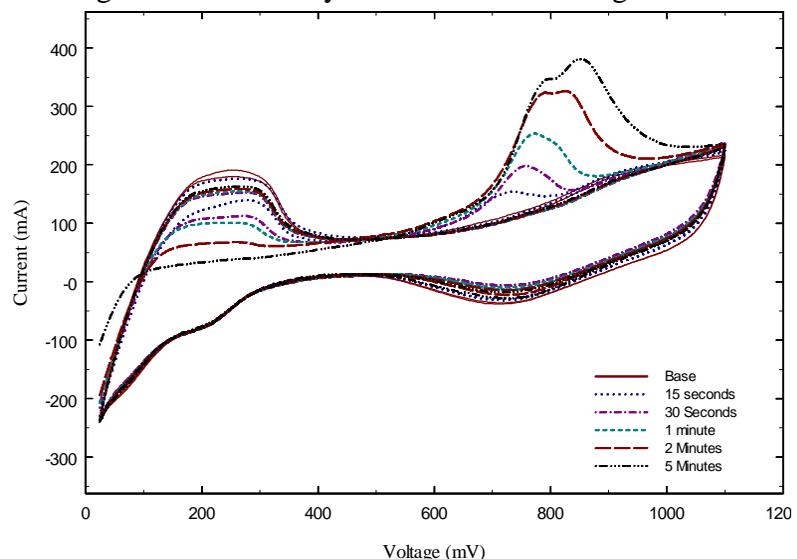


Figure 1. Block Diagram of the electro-chemical CO filter.

Figure 2: First cycle of CV showing the



increasing CO oxidation peak area with increase in the amount of CO passed.