Characterization Studies on Membrane Electrode Assembly (MEA) and Metallic Bipolar Plates for both the Cathode and Anode of PEM Fuel Cells

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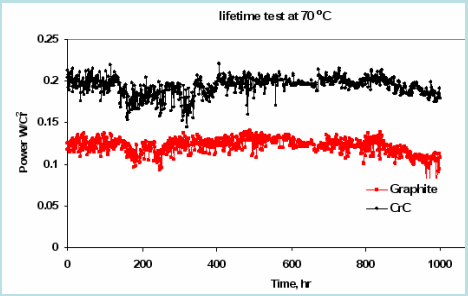
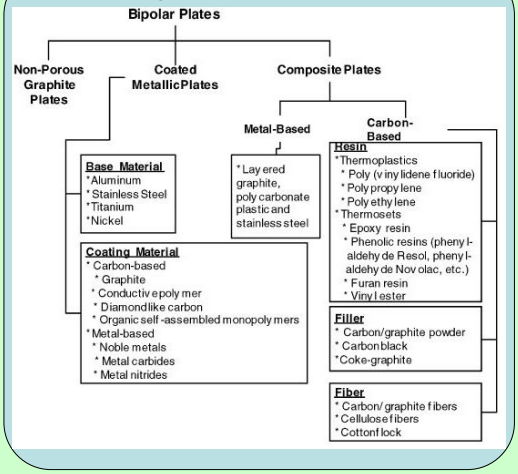
MOTIVATION

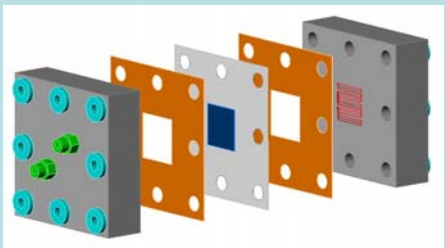
- *In a 1000 hour testing under cyclic loading metallic and graphite composite bipolar plates PEM cells showed steady performances with no power degradation,*
- *The average electric power output from the metallic cell has exceeded considerably that of the graphite.*
- *This is attributed to the fact that both the bulk and interfacial contact resistances (ICR) of the spray coating on the aluminum bipolar plates are considerably lower than graphite composites*
- *Characterization studies were found necessary to optimize performance and enhance durability*

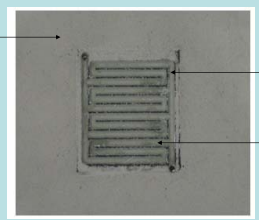


Bipolar Plates Classifications



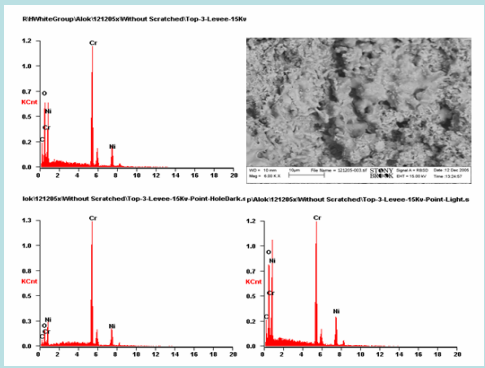
Fuel Cell Assembly



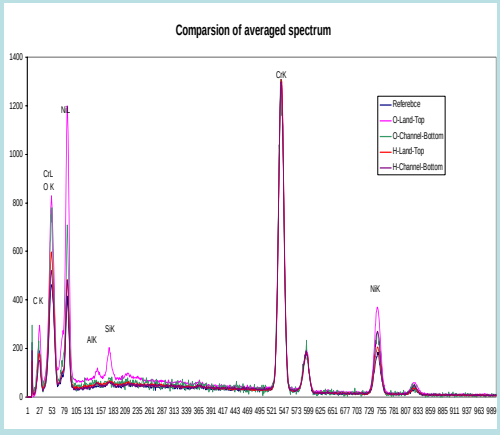


Experimental Setup

Scanning Electron Microscope begins with the electron source, where the free electrons are generated before they travel down the column of the microscope toward the specimen. The surface of a specimen to be examined is scanned with a finely focused electron beam. The interaction of the electron beam with the sample produces many signals. These signals include secondary electrons, backscattered electrons, characteristic x-ray and other photons of various energies. These signals are then detected by detectors and processed to display on a cathode ray tube. The image that appears on the screen represents the surface features of the specimen.

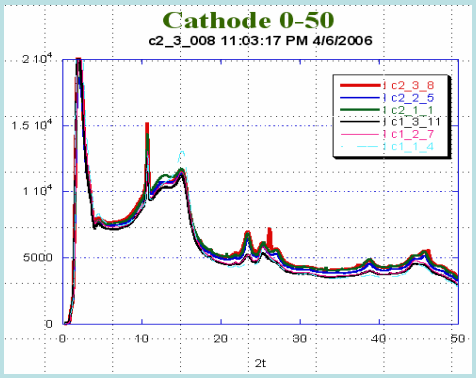


SEM and EDS Results

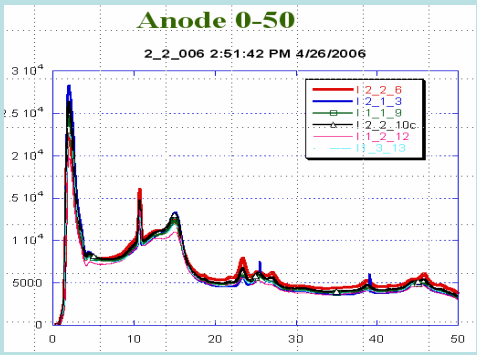


EDS Results Comparison with Reference Point

X-ray Diffraction (XRD) analysis was performed on samples powder scraped from the anode and cathode electrodes of a MEA operated for 1000 hrs in metallic bipolar plates fuel cell. A reference samples were also used as shown below:



Clustering of the catalyst was observed



Clustering of the catalyst was observed

Byproduct water samples were collected after 1000 hours of operation under normal operating conditions to examine for metal desolation. Samples are passed into argon plasma and their emission intensity is measured for each element of interest and compared to the calibration curve to yield a concentration of each element in the sample solution.

Al, Cr, Pt, Fe and Ni, are all < 1ppm each. Carbon less than 0.12%

Conclusions

- Catalyst (Pt) Clustering effect was observed in the XRD
- SEM/EDX results are non-conclusive for zones of anomalies
- Water Analysis showed no loss of Pt, Al, Cr, Fe and Ni, are all at < 1ppm each.
- Sulfur and carbon need to be checked in the water byproduct of fuel cells

AKNOWLEDGMENT

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