Fabrication and Characterisation of Hydrogen Fuel Cell Membrane Electrode Assemblies

M. K. Mathe*, S. Hietkamp, M. Rohwer, R. M. Ndibedi, C. Masuku, T. Masombuka and M. Mothia
Council for Scientific and Industrial Research, CSIR Materials Science and Manufacturing, PO Box 395, Pretoria 0001, South Africa, www.csir.co.za
*kmathe@csir.co.za

INTRODUCTION
Fabrication of Membrane Electrode Assemblies (MEAs) is a key research area that will help in the eventual commercialisation of the Proton-Exchange Membrane Fuel Cell (PEMFC). The main objective is to develop a working fuel cell system with a minimum amount of catalyst loading, whilst maintaining performance and subsequently reduce the cost of fuel cells in general. The effect of isomer content on PEMFC performance was also investigated.

EXPERIMENTAL WORK

MEA Fabrication

1. KPC/Pt
2. [NiRu/C, C(CO)3] 3% in Pt
3. Solution
4. Paint - Gas Diffusion Layer (GD) - carbon cloth
5. Hot press pre-treated Nation 112 and catalyst GDGs
6. Membrane Electrode Assembly (MEA)

- Paint Method
- Air Spray Method

Hot pressing conditions: 110°C, 1.8tons for 3min

RESULTS

Structural Characterisation

- For MEAs 3 and 4 both with approximately similar Pt loadings of 0.3 mg/cm² but different isomer contents of 30% and 3%, results indicated that the overall performance of MEA 4 was higher compared to MEA 3.
- Highest power density of 63 mW/cm² was observed in MEA 3 with a Pt loading of 0.3 mg/cm². Compared with other MEAs of similar isomer content of 30%, it is obvious that MEA 2 Pt loading could be taken as optimal for these MEA fabrication architecture.

CONCLUSION

- Pt supported on carbon gave higher performance than Pt black on carbon cloth. Pt deposition using the paint method showed a poor morphology for electrolyte diffusion.
- XRD results showed presence of Pt metal without any evidence of Prasidite.
- Preliminary CV studies carried out on Pt/C ink in 0.5M H₂SO₄, on a glassy carbon electrode showed original anodic and cathodic peaks. Reasons for this anomaly will be subject for further work which will include detailed electrochemical studies on the relation between performance, isomer and Pt loading.

REFERENCES
2. https://www.csir.co.za/