Electrochemical Atomic Layer Deposition of Pt nanostructures on Carbon Paper and Ni Foam

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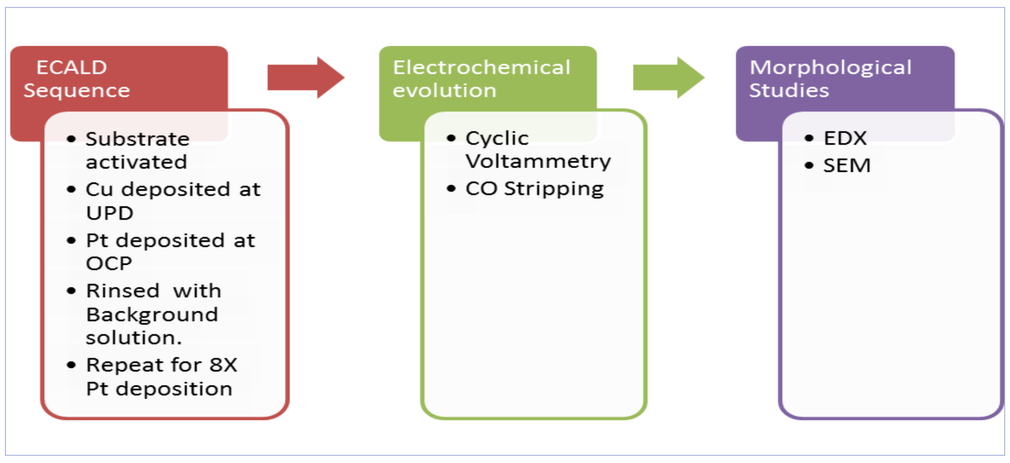
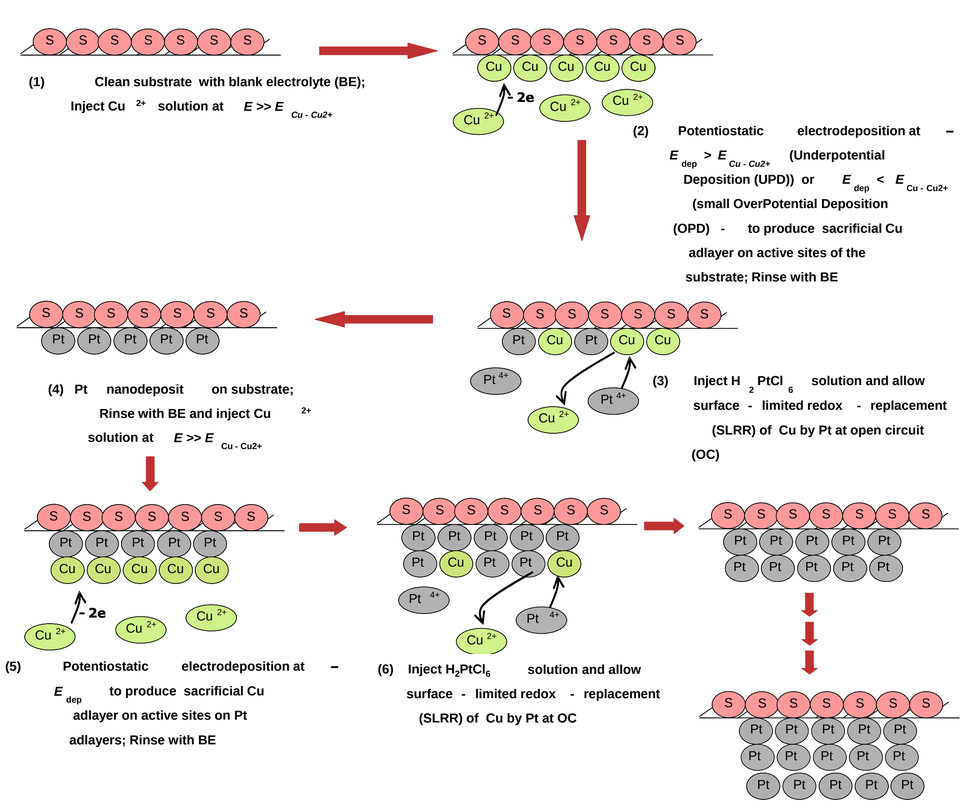
INTRODUCTION

The cost of the platinum catalyst hinders the progress of fuel cells (FCs) into the commercial world[1]. Researchers worldwide are focused on improving the performance of the catalysts, reducing the amount of Pt required and in developing catalysts that are tolerant to alcohol crossover in the direct alcohol fuel cells[2]. Various methods such as conventional physical and chemical, electrodeposition as well as sputtering methods are used in the preparation of catalysts. The electrochemical deposition method is well known for the fabrication of nanostructures catalysts for energy materials[3]. Electrochemical atomic layer deposition (ECALD) method was chosen in this study for the deposition of Pt nanostructures onto FC's gas diffusion layer. This method has several attractive features with respect to the applications in catalyst synthesis such as simplicity in operation, ease of control of the deposition and low cost of fabrication[4]. These features with the aid of a highly conductive substrate could provide a competitive improvement for fuel cells in the power source industry.

EXPERIMENTAL WORK

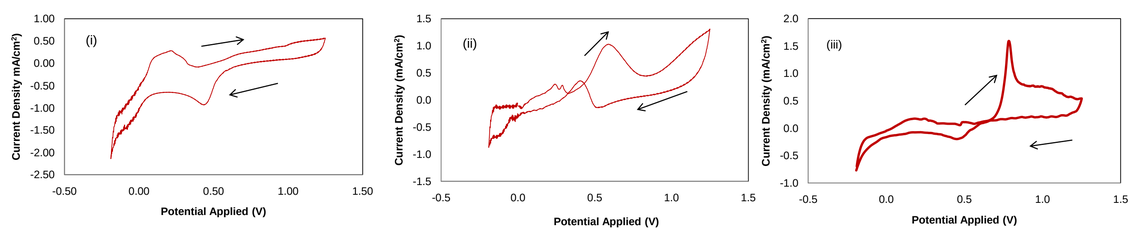


Sequential electrodeposition coupled to Surface-limited Redox-replacement reactions: Synthesis of Pt electrocatalyst

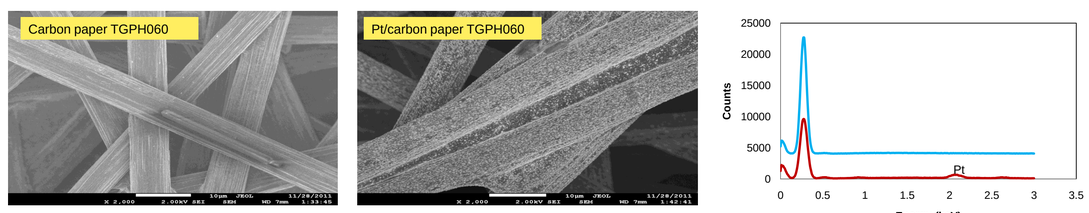


RESULTS AND DISCUSSIONS

Carbon Paper

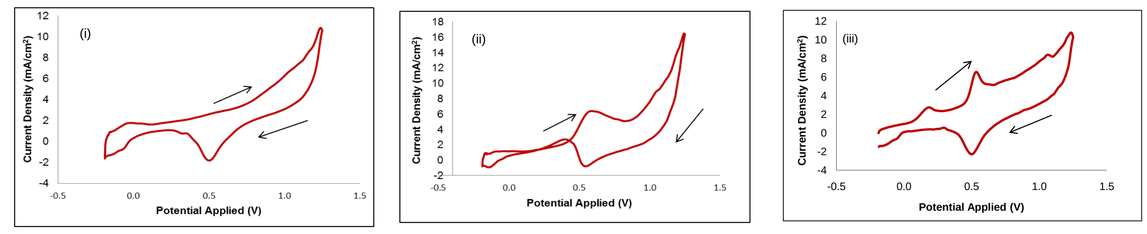


Cyclic voltammograms of Pt on carbon paper at 50 mV/s in (i) 0.1 M $HClO_4$ (ii) 0.1 M $HClO_4$ + 0.1 M Methanol and (iii) 0.1 M $HClO_4$ + CO

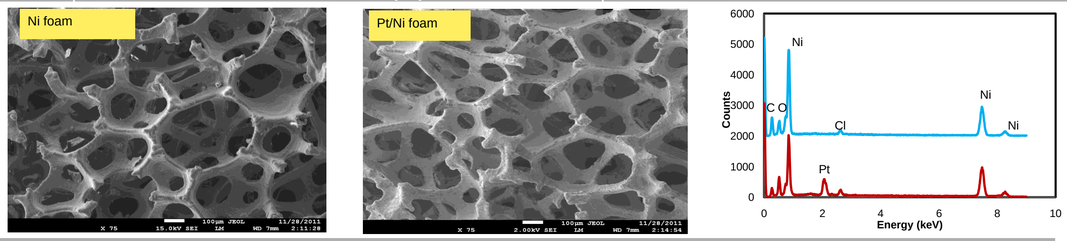


SEM micrographs and EDX Profile of Pt on carbon paper TGPH060

Nickel Foam



Cyclic voltammograms of Pt on Ni foam at 50 mV/s in (i) 0.1 M $HClO_4$ (ii) 0.1 M $HClO_4$ + 0.1 M Methanol and (iii) 0.1 M $HClO_4$ + CO



SEM micrographs and EDX Profile of Pt on Ni foam

CONCLUSIONS and FUTURE WORK

- Preliminary results showed that the sequential electrodeposition of Pt on carbon paper and Ni foam were successful.
- Pt was detected with SEM and confirmed by EDX.
- The sequential electrodeposited Pt on substrates showed the electrochemical activity towards hydrogen, methanol and CO adsorption.
- Fabricate and test MEA's performance in PEMFC.

BIBLIOGRAPHY

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4. Stickney, J. L., Kim, Y.-G., Kim, J. Y., & Vairavapandian, D. (2006). Platinum nanofilm formation by EC-ALE via redox replacement of UDP copper: Studies using in-situ scanning tunneling microscopy. *J.Phys. Chem. B, 110*, 17998-18006.