Journal of Research and Development

Extended Abstract

Environmental chemistry 2020 -A Practical Approach in Glycerol Oxidation for the Development of A Glycerol Fuel Cell- D.F. Quintero Pulido- University of Twente

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Abstract

The research on electrochemical carbon molecule oxidation started in the past years as new electrochemistries were researched for new fuel cells systems and batteries that will line up as backup energy supply and storage systems in off-grid and on-grid microgrids, as modeled by our group at the University of Twente [1-3]. By lining up these two disciplines we hope to support the bridge between new electrochemical systems on one side, (pilot) production with partner companies, prediction, and validation of systems upon implementation in microgrids by our group. The electrochemical oxidation of glycerol in alkaline solution has been studied on gold and gold coated metals (Zn-Au and Cu-Au) by voltammetry and EIS (Electrochemical impedance spectroscopy) for possible use in a new fuel cell as an outlet for the excess glycerol that is produced in the biodiesel industry.

The observations show that the gold surface may change upon cycling by cyclic voltammetry. Besides, the current density shows non-linear behavior with the square root of the scan rate, implying that the reaction is not totally controlled by diffusion. EIS analysis using the EQUIVCRT software revealed that one out of twenty tested equivalent circuits fitted the data well at potentials of -0.05 V,- 0.15 V and -0.25 V vs. Ag/AgCl, identifying resistors and a Warburg element in parallel with the double layer capacitance, the elements are possibly related to the presence of double layers associated with hydroxypyrovate and oxalate ions. The results are consistent with the low-frequency error fitting analysis (10-4), AC Simulink-Matlab fitting responds and the Kronig-Kramers transform test. The tested Zn-Au and Cu-Au electrodes show similar voltammetry behavior as the gold electrode, as witnessed by the results of cycle analysis and also the scan rate analysis. The discharge chronoamperometry test further shows that the Zn-Au electrode and Cu-Au have higher current densities than the gold electrode at a potential of -0.25 V vs. Ag/AgCl (5 mA cm-2, 4.5 mA cm-2, and 3 mA cm-2 respectively).

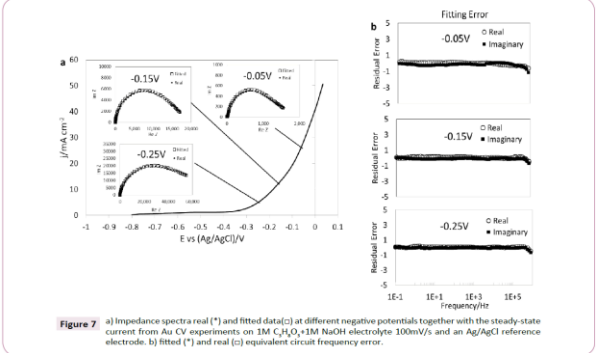

Figure 7 a) Impedance spectra real (*) and fitted data(□) at different negative potentials together with the steady-state current from Au CV experiments on 1M $C_3H_5O_3$-1M NaOH electrolyte 100mV/s and an Ag/AgCl reference electrode. b) fitted (*) and real (□) equivalent circuit frequency error.

This work is partly presented at 8th International Conference on Environmental Chemistry and Engineering September 20-22, 2018 Berlin, Germany.

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