Ain Shams University
Faculty of Science
Chemistry Department

Preparation and characterization of high performance modified electrodes for the energy devices

A Thesis Submitted By

Mahmoud Adel Fawzy Mahmoud El-Jemni

B.Sc. in Chemistry, Faculty of Science
Ain Shams University
2015

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A Thesis
Submitted to Chemistry Department – Faculty of Science - Ain Shams University in Partial Fulfillment for Requirements of The Master's Degree of Science (M. Sc) in Chemistry

By

Mahmoud Adel Fawzy Mahmoud El-Jemni

B.Sc. in Chemistry, Faculty of Science
Ain Shams University
2015

Under Supervision of

Prof. Dr. Hamdy Hassanien Hassan Saleh

Professor of Physical Chemistry, faculty of Science, Ain Shams University

Dr. Mohamed Helmi Alkordi

Associate professor- Joint director for the center of materials science

Dr. Hesham Samir Abdel-Samad

Lecturer of Physical Chemistry, faculty of Science, Ain Shams University

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Chemistry Department

Approval Sheet

By

Mahmoud Adel Fawzy Mahmoud El-Jemni

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This thesis for master's degree has been approved by:

Prof. Dr. Hamdy Hassanien Hassan Saleh

Professor of Physical Chemistry, faculty of Science, Ain Shams University

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Dr. Hesham Samir Abdel-Samad

Lecturer of Physical Chemistry, faculty of Science, Ain Shams University

Head of Chemistry Department
Prof. Dr. Ayman Ayoub Abdel-Shafi

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Ain Shams University
Faculty of Science
Chemistry Department

Student Name: Mahmoud Adel Fawzy Mahmoud El-Jemni

Scientific Degree: M.Sc.

Faculty Name: Faculty of Science – Ain Shams University

Graduation Year: 2015

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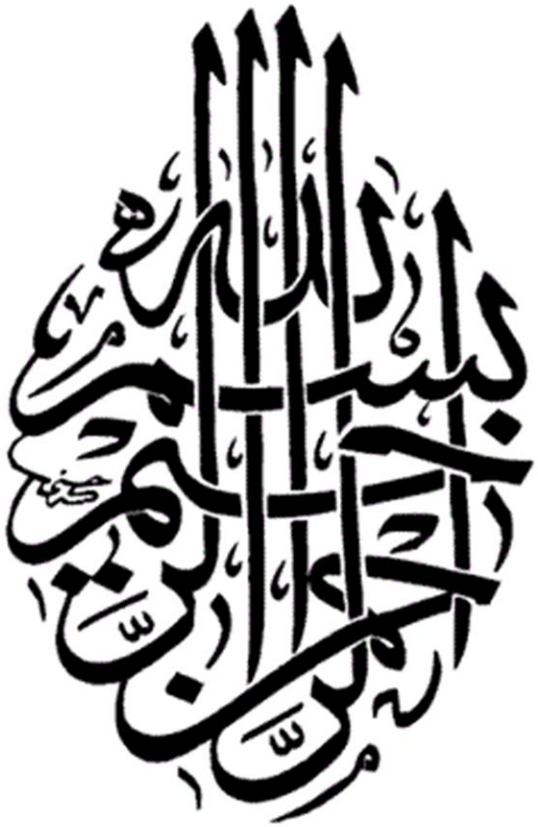
Head of Chemistry Department
Prof. Dr. Ayman Ayoub Abdel-Shafi



{ قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ الْعَلِيمُ الْحَكِيمُ }

صدق الله العظيم

سورة البقرة " آية 32 "

To my Family

To my lovely

daughter "Talia "

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Abstract

In order to effectively utilize renewable energy sources, a great challenge need to be overcome, that is the construction of efficient and cheap electrocatalyst. Such catalyst is central to enable wide scale deployment on commercial scale. Since such the catalyst must maintain both high efficiency and durability. some oxides such as IrO_x are great catalyst for the energy conversion, but it is rare, expensive and have a weak durability. Consequently, in this thesis the fabricate of low cost electrodes (e.g. Cobalt / graphite) electrodes is the main object of the present work. In addition, the study of synergetic effects between the graphitic support and the deposited Co species. Moreover, the effect of the simultaneous reactions during the electrodeposition of cobalt over the graphite surface and their effect on the final Co/G electrode composition.

Different Co/G electrocatalyst electrodes were prepared using electrochemical technique (Chronoamperometry) and a combination between more than one technique (chronoamperometry and cyclic voltammetry) from different baths such as: cobalt chloride bath and Cobalt sulphate bath in absence and presence of complexing agent like citrate ions.

The prepared electrodes demonstrated high activity and stability as anode material for alkaline direct ethanol fuel cell (ADEFC) and as catalyst for the oxygen evolution reaction (*OER*).

Key words: Cobalt, graphite, citrate ions, chronoamperometry, Cyclic Voltammetry (CV), Rotating Ring Disc Electrode (RRDE), Ethanol Oxidation Reaction (EOR), Oxygen Evolution Reaction (*OER)*, Alkaline fuel cells, activation routine.