STUDIES ON THE ELECTROWINNING OF COPPER FROM DILUTE SOLUTIONS

A Thesis

submitted by

ELSAYED MOSTAFA ELSAYED

(B. SC., HONS, 1990, AIN SHAMS UNIVERSITY)

Under the Supervision of

Prof. Dr. Ahmed Mohamed Azzam

Professor of Physical Chemistry
Faculty of Science
Ain Shams University

Prof. Dr. Ahmed ElSaid Saba

Professor of Extractive
Metallurgy and Head of the
Electro metallurgy Laboratory
CMRDI

To

CHEMISTRY DEPARTMENT
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of the degree of Master of
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STUDIES ON THE ELECTROWINNING OF COPPER FROM DILUTE SOLUTIONS

Thesis Advisors

Approved

Prof. Dr. Ahmed Mohamed Azzam

Professor of Physical Chemistry.

Faculty of Science.

Ain Shams University

Prof. Dr. Ahmed Elsaid Saba

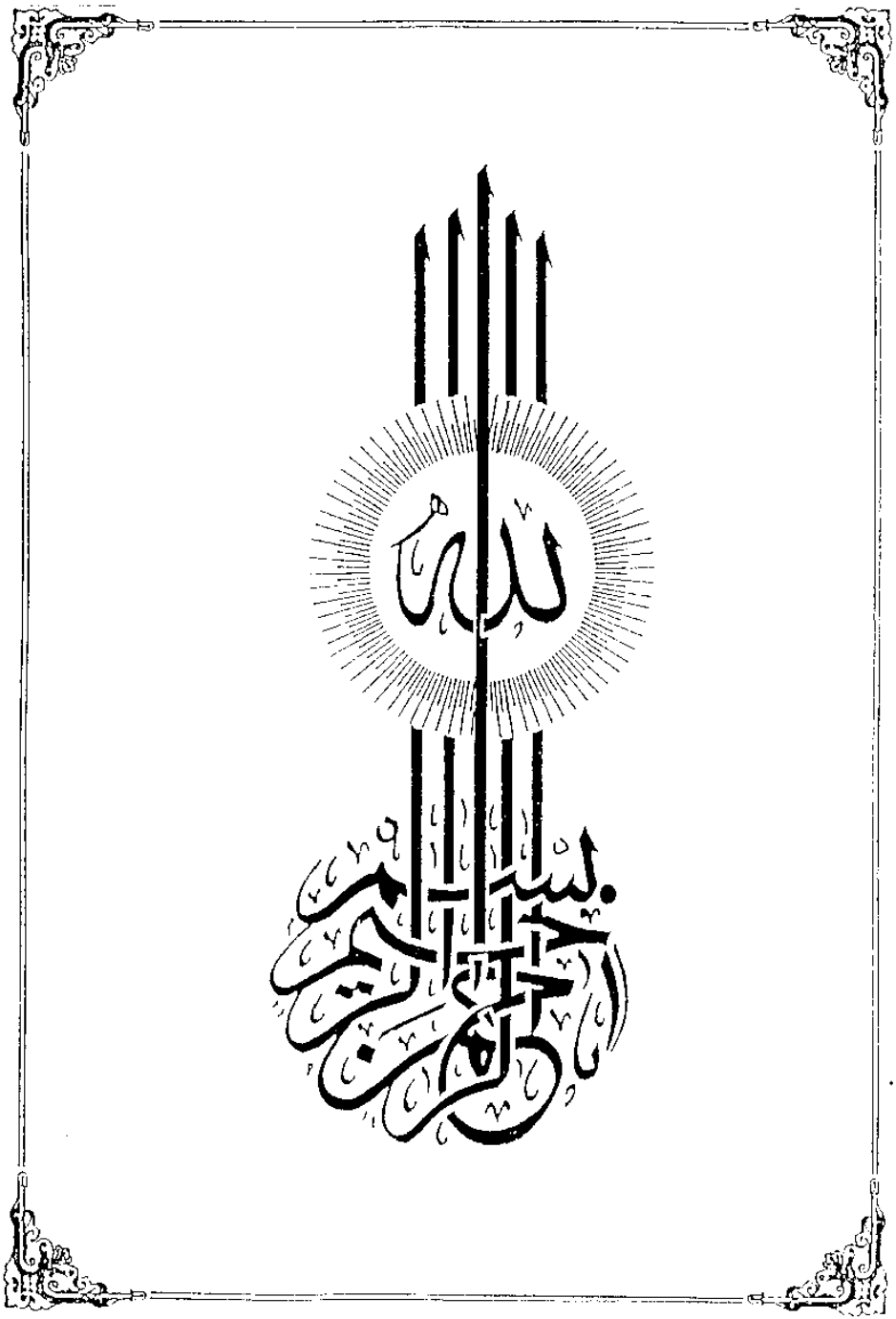
Professor of Extractive Metallurgy

and Head of Electrometallurgy Laboratory.

CMRDI

Prof. Dr. A. F. M. Fahmy

Head of the Chemitsry Dept.



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PREFACE

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The present thesis is submitted to the Faculty of Science. Ain Shams University in Partial fulifillment for the requirements of Master of Science in Chemistry. Beside the research work present in this thesis, the candidate attended ten postgraduate courses for one academic year in the following topics

1 Corrosion Chemistry
2 Electrochemistry
3 Catalysis Chemistry
4 Surface Chemistry
5 Computer
6 Thermodynamics
7 Quantum Mechanics
8 Cement
9 Kinetic of Reaction
10 Physical Polymers

He has succefully passed the final examination of these courses, besides an English language course.

Head of the Department of chemistry

Prof. Dr. A.F. M. Fahmy

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ABSTRACT

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STUDIES ON THE ELECTROWINNING OF COPPER FROM DILUTE SOLUTIONS

ELSAYED MOSTAFA ELSAYED

ELECTROMETALLURGY LABORATORY

CENTRAL METALLURGICAL RESEARCH AND DEVELOPMENT INSTITUTE

Copper electrowinning from dilute solutions continues to attract considerable research efforts. The concentration of the metal ions in these solutions are less than 5 gl^{-1}, which are unsuitable for conventional electrolysis cells. Non conventional cells with relatively large cathodic area are essential.

Fluidized bed electrode (FBE) cell and Swiss–roll (SR) cell have been investigated. The effects of cathodic current densities, initial copper concentrations, free sulphuric acid concentration and rate of flow of the solutions on both the cathodic current efficiency and power consumption were studied. The influence of the initial copper and sulphuric acid concentrations on current efficiency was effective at concentrations less than 0.5 gl^{-1} cupric ions and 5 gl^{-1} H_2SO_4, where a drastic fall in the efficiency was obtained. The effect of the presence of iron and zinc cations on the copper electrowinning process was studied.

Copper could be removed from synthetic and industrial mixtures of Cu Fe Zn sulphate solutions, with no detectable change in the iron and zinc concentration. On the other hand copper was depleted to less than 5 ppm with a current efficiencies more than 65%.

Keywords: Dilute solution, copper electrowinning Fluidized Bed Electrode (FBE) cell, Swiss–roll (SR) cell, cathodic polarization, cell voltage, current efficiency, energy consumption.

LIST OF FIGURES