شبكة المعلومات الجامعية

بسم اللّه الرحمن الرحيم

SALWA AKL

شبكة المعلومات الجامعية

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

SALWA AKL

شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها

علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

SALWA AKL

بعض الوثائق الأصلية تالفة

SALWA AKL

بالرسالة صفحات

لم ترد بالأصل

SALWA AKL

Electrodeposition of Copper Metal In Presence Of Surface Active Substances

A Thesis
Submitted to Faculty of Science Alex. University
For The Degree of M. Sc.
(Chemistry)

Dalia Abd El-Monem Ebrahim
B.Sc(Very Good) 1991

Supervised by

Prof. Dr. A. M. Ahmed
Prof. Of Physical Chemistry
Faculty of science
Alex. University

Prof. Dr. Sh. A.El-Shazly
Prof. Of Physical Chemistry
Faculty of Science
Alex. University

Prof. Dr. Assia A. Taha
Assistant Prof. OF Physical Chemistry

Alexandria University
Faculty of Science
2000

أكاديمية البحث العلمي والتكنولوجيا
المركز القومي للإعلام والتوثيق

شارع التحرير - الدقي
القاهرة ج.م.ع
تليفون ٩٨١٠٩٦

إدارة النشر العلمي

المجلة المصرية للكيميـــاء
البحث رقم (٣٨ / ٩٩)

السيد / د . عبد المنعم محمد أحمد
كلية العلوم - جامعة الأسكندرية - قسم الكيمياء

تحية طيبة وبعد :

أتشرف بالإفادة بأن البحث رقم (٣٧ / ٩٩) المقدم من سيادتكم للنشر فى المجلة المصرية للكيميـــاء بعنوان :

Effect of surfactants on the electrodeposition of copper from acidified $CuSO_4$.

By: A. A. Taha, A. M. Ahmed and Dalia A. Ebrahim .

قد قبل للنشر . وسينشر فى العدد المجلد لسنة ١٩ الذى سيحال للطبع فى القريب العاجل .

و إنى إذ أشكر لسيادتكم كريم تعاونكم أرجو أن تتفضلوا بقبول وافر الاحترام ،

مدير التحرير

المركز القومي للإعلام والتوثيق
الرقم
التاريخ

تحريرا فى / / ١٩٧

بسم الله الرحمن الرحيم

ACKNOWLEDGMENT

The author wishes to express his deep thanks and gratitude to Prof. Dr. Abdel-Moneim M. Ahmed, Professor of Physical Chemistry, Faculty of Science, Alexandria University, for suggesting the topic of this work, for the moral support, careful revision of the manuscript and continuous guidance.

The author wishes to thank Prof. Dr. Sh. A. El-Shazly Prof. of Physical Chemistry, Faculty of Science, Alexandria University, for his valuable help, discussion and encouragement.

The author wishes to thank Prof. Dr. Assia Taha, professor of physical Chemistry, Faculty of Science, Alexandria University,for here valuable help, discussion and encouragement.

Nomenclature:

C_e interfacial concentration, **mol/cm^3**

C_o bulk concentration, **mol/cm^3**.

D diffusion coefficient of the metal ions, **cm^2/sec**.

F faraday's constant = 96489 **coulomb** = 96489 **A.sec**.

Fr Froude number, $Fr = \frac{V^2}{hg}$.

g gravitational acceleration, **cm/sec^2**.

h cathode height, **cm**.

V oxygen gas discharge velocity, **cm/sec**.

Gr Grashoff number, $Gr = \frac{g\alpha(C_o - C_e)l^3}{\nu^2}$.

I applied curtrent, **A**.

i current density, **A/cm^2**.

i_l mean limiting current density averaged over the whole electrode surface, **A/cm^2**

J mass transfer rate excluding migration, **mol/cm^2.sec**.

K equilibrium constant of the adsorption reaction.

k mass transfer coefficient, **cm/sec**.

P atmospheric pressure.

Re Reynolds number, $\mathrm{Re} = \frac{Ul}{\nu}$.

Sc Schmidt number, $Sc = \frac{\nu}{D}$.

Sh Sherwood number, $Sh = \frac{k\,l}{D}$.

T absolute temperature, **K**.

z the number of transferred electrons = 2 in case of Cu2+ ions.

$(\Delta i)_m$ the maximum decrease in the limiting current density, corresponding to full surface coverage.

η the absolute viscosity of solution, $\mathbf{g.cm^{-1}.s^{-1}}$.

θ the degree of surface coverage.

ρ'' the density of bulk solution, $\mathbf{g/cm^3}$.

ρ' the density of the solution at the interface, $\mathbf{g/cm^3}$.

$\Delta\rho = \rho'' - \rho'$, $\mathbf{g/cm^3}$.

Contents

SUMMARY

Summary

The thesis deals with the study of the effect of the SAS on the electrodeposition process in acidified $CuSO_4$ solution and includes three chapters

The first chapter presents a survey on the mass transfer processes, types and shapes of electrodes, and literatures survey on previous work.

The second chapter is devoted for the results change of volt with current obtained by above measurements in absence and in presence of SAS with different concentrations and at different temperatures for cell using copper and lead anodes. The limiting currents, I_l, and the thermodynamic parameters (ΔE, $\Delta \overset{x}{G}$, $\Delta \overset{x}{H}$, $\Delta \tilde{S}$) were calculated.

The third chapter also discusses these results. It was found that Langmuir isotherm was applied and the adsorption parameters were calculated which were found to obey Langmuir adsorption isotherm. Data showed that the addition of SAS decrease the limiting current, and the decrease in limiting current is ranged from 5.7% to 26% for cell using copper anode and from 11.11% to 50% in the case of cell using lead anode depending on the nature of SAS and its concentration and alcohol. It is suggested that the decrease in the limiting current is attributed to adsorption of acid on the copper

surface and increases in the viscosity of the medium as well as the decrease in the diffusivity of Cu^{++}.

It was observed that the inhibitive efficiency of SAS in case of copper node is in the order:

CTAB > Triton X-100 > SDS

It was found that the inhibitive efficiency of SAS in case of lead anode is in the order:

CTAB > Triton X-100 > SDS

and in the case of mixed SAS the order is as follow:

SDS + CTAB > CTAB+ Triton X-100 > SDS + Triton X-100

and in the case of alcohol the order is:

Pentanol > Propanol > Ethanol > Methanol

It was observed that the percentage of inhibition is lower in case of copper anode than in case of lead anode.

The thermodynamic results led to conclude that the rate of adsorption of these SAS was decreased by raising the temperature while above 30°C the desorption was complete indicating that the process is physical adsorption. The negative ΔS values suggest that the organic molecules are ordered in the solution under investigation.