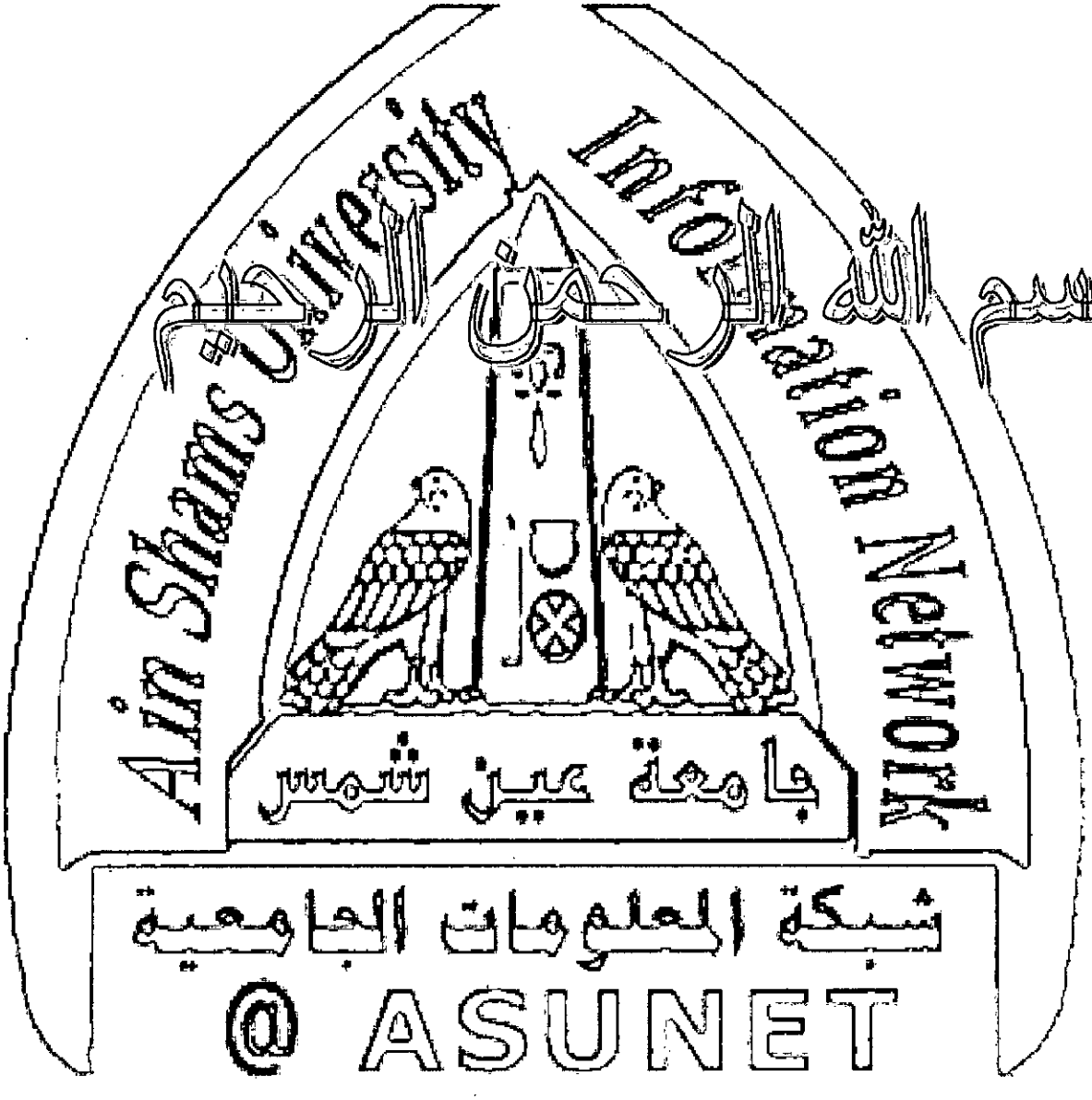
شبكة المعلومات الجامعية

بسم الله الرحمن الرحيم



شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الالكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأفلام قد أعدت دون أية تغيرات

يجب أن

تحفظ هذه الأفلام بعيدا عن الغبار
في درجة حرارة من ١٥-٢٥ مئوية ورطوبة نسبية من ٢٠-٤٠%

To be Kept away from Dust in Dry Cool place of 15-25- c and relative humidity 20-40%

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

بعض الوثائق الأصلية تالفة

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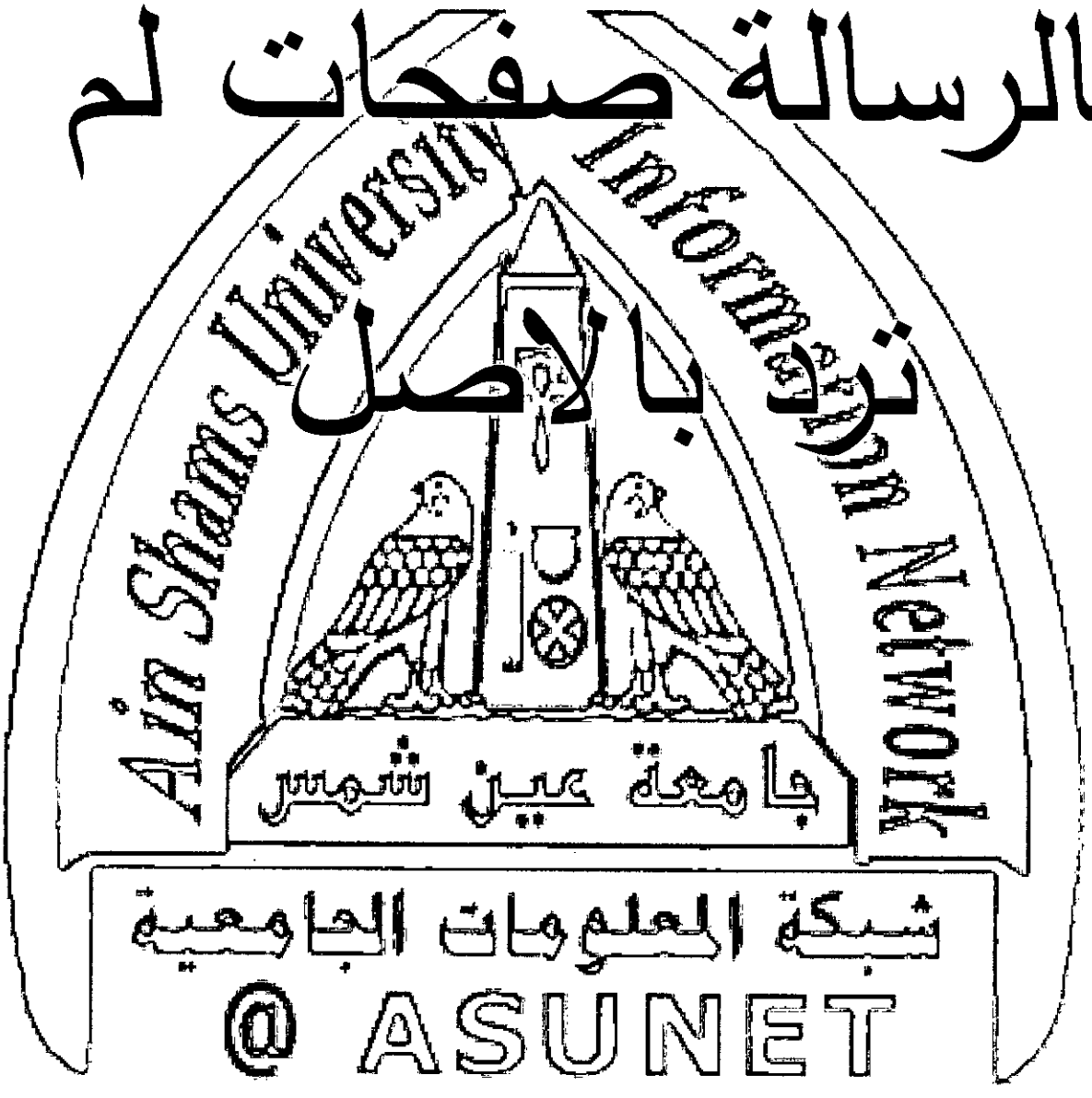

540

RECYCLING OF MILL SCALE WASTE IN STEEL MAKING PROCESS

A THESIS

SUBMITTED TO

CHEMISTRY DEPARTMENT

FACULTY OF SCIENCE –CAIRO UNIVERSITY

BY

RAAFAT MOHAMMED ABDEL WAHAB FARAHAT

B.Sc., MENOUFIYA UNIVERSITY, 1996

IN PARTIAL FULFILLMENT FOR THE REQUIREMENTS OF

THE DEGREE OF MASTER OF SCIENCE

(CHEMISTRY)

2010

APPROVAL SHEET FOR SUBMISSIOM

Title of the M.Sc. thesis:
Recycling of Mill Scale waste in Steel Making Process

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ABSTRACT

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Title of the M.Sc. thesis: Recycling of Mill Scale waste in Steel Making Process

Degree: (Master) thesis, Faculty of Science, Cairo University, 2010

Mill scale is a layer of iron oxides formed on the steel surface due to continuous exposure of hot metal to air. It is one of the by-products produced during steel processing and its generation is about 19-40 kg/ ton of hot rolled product, depending on the process used. The global production of steel during 2008 was 1125 million tons and the mill scale produced was estimated to be around 33 million tons. Mill scale is considered a rich source of iron (up to 74% Fe) with minimal impurities. Extensive research is being carried out for the recovery and utilization of iron oxide from the mill scale. Mill scale is used for magnetic storage, polishing, manufacturing of chemicals as well as pigment and for biomedical applications. The production of sponge iron from mill scale could be considered a highly profitable method of beneficiation. In this study, the reduction of composite pellets produced from mill scale using anthracite coal has been investigated. Laboratory trials were conducted to study the effect of amount of reducing agent, reduction temperature and reduction time on the reduction process. The trial results show possibility to use mill scale as raw material in blast furnace or in direct reduction plants to produce sponge iron containing up to 84% total Fe, 82% metallic Fe and metallization more than 97%.

Recycling of mill scale in electric arc furnace by charging scale/coal mixture into EAF in the charge mix is the highest beneficiation method since it needs no new process. Pilot plant experiments were conducted using a 5Kg submerged electric arc furnace to determine the percent of required reducing agent. Semi industrial trials were also carried out using one 100KVA electric arc furnace (capacity 100 Kg) to investigate the extent of mill scale recycling in EAF steelmaking process. The trial results show possibility to use mill scale in EAF up to 20% of the metallic charge. The best carbon percent for reduction was found to be around 20%.

Key words: sponge iron; mill scale; metallization; steelmaking; electric arc furnace; composite pellets.

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ACKNOWLEDGMENTS

I am deeply grateful to EZZ FLAT STEEL Company for the supporting of this study.

I am deeply grateful to Professor A. Baraka and Professor M. Eissa for their excellent guidance, close supervision and continuous encouragement during the course of this study.

I give my honest thanks to Dr G. Megahed for the guidance and continuous support during the course of this study.

I would like to thank Dr. S. K. Paul and Dr. A. Fathy for revising the thesis and the fruitful discussions during the study.

I would like to thank Mr. Omar Bazaraa for the great assistance and encouragement.

I am extremely appreciative of Mr S. Fadeel, Mr Tarek Latif, Mr Ehab Nabil, Mr. M. Bakry, Mr. A.Kamel, Mr. M. Mekhzangy, Mr. Kamal and Mr. Shaban for their guidance and setting up of the facilities.

I express my deep thankfulness and appreciation to Mr. M.haridy, Mr. M. Kader, Mr. A. Labib, Mr. A. Wahed for their help and for their suggestions in the thesis.

I would also like to thank Mr. A. Ibrahim, Mr. M. Hassan, Mr. A. Zakarya, Mr. E. Arabi, Mr. A. Mohsen, Mr. A.Gamal, Mr. M. Shaban, Mr. M. Labib, Mr. A. Taha, Mr. S. maghrapy, Mr. M. Zohdy, Mr. E. Salah, Mr. W. Raafat, Mr. A. Sayed, Mr. F. Mohamed for their help in setting up of the facilities.

Qualifying Examinations

Beside the work carried out in this thesis the candidate "Raafat Mohammed Abdel Wahab Farahat" passed successfully a qualifying examination for partial fulfillment of the award of M.Sc. degree (2008) in the following courses:

1. Metallurgy
2. X-Ray and Thermal Analysis
3. Catalysis and Colloids
4. Electrochemistry
5. Thermodynamics
6. Statistical Thermodynamics
7. Cyclic Voltammetry
8. Electrode Kinetics
9. Adsorption
10. Quantum Chemistry
11. Nuclear Chemistry
12. Molecular Structure Elucidation
13. Chelatimetry
14. Inorganic Reaction Mechanism
15. Advanced Inorganic Chemistry
16. Advanced Analytical Chemistry
17. Physical Chemistry of Polymers
18. Solar Energy
19. Group Theory
20. German Language

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LIST OF CONTENTS

Subject **Page No**