IN THE NAME OF ALLAH,

THE MERCIFUL AND THE GRACIOUS

Fundamentals of Extractive Metallurgy

Mohamed Ezz El-Dahshan

Professor, Department of Chemical Engineering
College of Engineering, King Saud University

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To my wife

for her support and help during the course of this work, and for her patience during the writing of many other works

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Preface

The Arab countries, in particular the Gulf region, are rich in mineral ore deposits with new deposits being discovered almost daily. It is generally felt that it would be advantageous if the countries could utilize the deposits rather than being solely dependent on income from oil. King Saud University's Department of Chemical Engineering is currently offering two courses in extractive metallurgy.

It is difficult to obtain a suitable student's textbook which covers the full syllabus of the extractive metallurgy courses. Some textbooks on extractive metallurgy for use by students are out of date, as far as facts and figures and literature information are concerned. This is due to the fact that extractive metallurgy of the major metals has developed rapidly in recent years. Also, many books have made a distinction between 'ferrous' and 'non-ferrous' extractive metallurgy which is now meaningless since the same principles are involved.

Traditionally, the teaching of metallurgical engineering has been problem orientated with worked example problems being most useful in the study of the text material. However, despite this, most textbooks give very few useful worked examples, and deal with the technical aspects of the subject rather than with the fundamental basics. Hence, the author aims at compiling this textbook to provide the students with a comprehensive up-to-date source of information, dealing with the very basics of the subject and presenting a liberal number of useful worked examples.

The book is divided into nine chapters, opening with a general introduction to the subject. This is followed by two chapters on metal ores, their properties, and their preliminary physical treatment or "mineral dressing." Chapter four introduces flux, slags, refractories and electrode-making. The next three chapters deal with the basics of the three alternative approaches to metal extraction and refining: pyrometallurgy, hydrometallurgy and electrometallurgy. Pyrometallurgical processes are described in full detail in chapter five followed by hydrometallurgical processes in chapter six, while chapter seven deals with electrometallurgical processes. In chapter eight different outlines are presented of extraction procedures for fourteen metals which are relative to the Kingdom of Saudi Arabia, together with the main methods for their extraction. Chapter nine is the concluding chapter, on the refining of metals for the production of alloys and high purity metals.

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M.E. El-Dahshan