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BOOK REVIEW

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H. Kaesche: Corrosion of metals, Springer-Verlag, Berlin Heidelberg New York, 594 pp (ISBN 3-540-00626-5) EUR149.95/US$159.00

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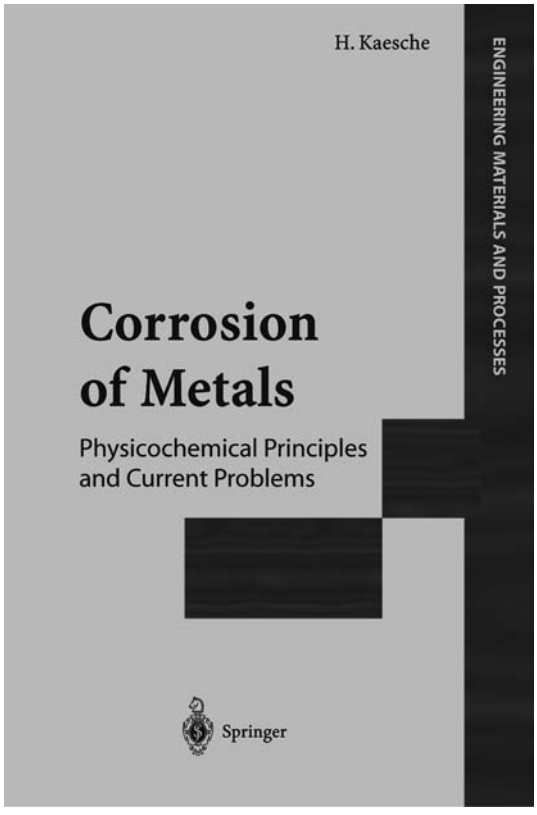

Corrosion can be defined as an unintentional attack on a material through irreversible reactions with environments. Since the Industrial Revolution in the late 18th century, the demand for metals has been drastically increased and as a result, the corrosion of metals has been of main interest to us. Nowadays, we are always faced with various kinds of metallic corrosion phenomena and the cost incurred in preventing or reducing corrosion of metals becomes astronomical.

In *corrosion of metals*, Helmut Kaesche, emeritus Professor of Friedrich-Alexander University of Erlangen-Nürnberg, gives a rich and insightful overview of metallic corrosion to the readers based upon his research works for several decades on passivity, stress corrosion cracking, pitting corrosion and corrosion fatigue of various metal systems. This book covers almost all the subjects on metallic corrosion, but I do not agree that it merely provides encyclopedic coverage of the subject of metallic corrosion. It rather puts more emphasis on the understanding of corrosion problem based upon the background of electrochemistry.

The book begins with basic concepts in corrosion science in the first five chapters. Included are a basic introduction for those scientists and engineers who are not familiar with corrosion, an outline of corrosion reaction chemistry, electrochemical thermodynamics of corrosion, corrosion mechanism in solutions, and finally, electrode kinetics of metals. Chapter 6 discusses the general aspect of uniform corrosion in solutions and the dependence of corrosion rate on pH. In addition, it also offers how to obtain information about corrosion rate from the analysis of current-potential curves to the readers.

The addition of inhibitors has become one of major methods of corrosion prevention and it has experienced many developments for the past few decades. Chapter 7 is concerned with the inhibitors which inhibit corrosion by the adsorption on the active metal surface. The adsorption principles including such adsorption isotherms as Langmuir, Tempkin and Frumkin isotherms are also explained. One way to design a material which meets one's specific purpose is to make an alloy by mixing two or more dissimilar metals. Selective dissolution and dealloying which can occur in the alloy system are treated in Chap. 8. Chapter 9 is devoted to rusting of iron and steel, in particular, atmospheric

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corrosion, which is of considerable economic importance from the practical point of view.

While passivity of metals is very important for corrosion protection, the local breakdown of the passivating film brings about unexpected localised corrosion such as pitting corrosion, intercrystalline corrosion or stress corrosion cracking. Chapter 10 focuses on the general aspect of passivity for various metal systems. The following chapters cover the various forms of corrosion such as galvanic corrosion (Chap. 11), pitting corrosion (Chap. 12), intercrystalline and intracrystalline corrosion (Chap. 13), hydrogen embrittlement (Chap. 14), stress corrosion cracking (Chap. 15) and corrosion fatigue (Chap. 16). By providing the relevant references and presenting many useful examples for each form of corrosion, this book helps the readers to understand the practical corrosion problems based upon the principles of electrochemistry.

The readers may want to know what changes have been made to this book compared to the previous second edition (German edition). As the author mentioned in preface, some sections are added to trace the new developments of corrosion research works. In Chap. 3, the sections on the equilibrium electrode potential and the calculation of elevated-temperature Gibbs free energy are added. In Chap. 6, the dependence of corrosion rates on temperature is additionally treated based upon chemical thermodynamics. Uniform dissolution, selective dissolution and dealloying in homogeneous alloys are demonstrated in new Chap. 8. In Chaps. 10, 12 and 15, the latest information on passivity, pitting corrosion and stress corrosion cracking for various metal systems, respectively, are supplemented.

Appendix is also very informative; it deals with anodic and cathodic protection, which is of major importance in the practical viewpoint. To give a better understanding of the dependence of metal corrosion on the diffusion of dissolved species in Chap. 5, stress corrosion cracking in Chap. 15 and corrosion fatigue in Chap. 16 to the readers, mass transport by diffusion and application of fracture mechanism are also discussed in detail. Finally, sections on electrochemical impedance spectroscopy and noise spectroscopy which are very useful techniques for studying corrosion phenomena, are added.

On the whole, this book is well balanced between the practical and theoretical viewpoints on metallic corrosion. Taking into account lots of relevant references and practical examples this book provides, I think that it is a mine of information relating to corrosion. From this book, one may expect to find solutions for the mitigation of corrosion problems. Of course, this book can satisfy his or her desires for them in some measure. However, in my opinion, it is most important for the readers to develop the competence to deal with the practical corrosion problems faced by them in the field through this book.

There is no doubt that it is not easy work for one author to publish a revised and enlarged edition to cover new developments of corrosion science and engineering after the previous edition. For publication, a deep insight about the whole field of corrosion science and engineering as well as a considerable amount of effort expended on compiling relevant reports and reviews are demanded from the author. In this respect, I can affirm that Professor Helmut Kaesche is the very man for the author. With Kaesche's research works on the field of corrosion science and engineering, his great deal of effort devoted to publish this book will be appreciated by the readers.