



# Corrosion and Materials Selection

A Guide for the  
Chemical and Petroleum  
Industries

Alireza Bahadori



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A Guide for the Chemical  
and Petroleum Industries

Alireza Bahadori

*School of Environment, Science and Engineering,  
Southern Cross University, Australia*

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# **Corrosion and Materials Selection**



*Dedicated to the loving memory  
of my parents, grandparents,  
and to all who contributed  
so much to my work  
over the years*



# About the Author

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# Preface

Metallic corrosion is costly. Several billion dollars annually in the USA, and about one-third of that is noted as *avoidable corrosion*, a cost that could be eliminated if proper corrosion protection methods were in place.

Today, there are a great deal of construction materials available, varying from metallic to non-metallic. There are also a large number of factors to be taken into consideration when selecting a material for a given application.

Factors that influence corrosion consideration in material selection are distinct from those that interact in a more complex fashion. For example, “application” influences selection because the type of process, and the variables during operation etc., will define whether a material can be used for the intended purpose or not. On the other hand mechanical and metallurgical properties are not uniquely defined for all environments. For example, if the material is to be used at low temperature then embrittlement can be a serious problem.

These considerations have a direct influence on corrosion consideration in material selection. However, when there is discrepancy amongst sections of this book, or between this and other disciplines regarding selection of materials, other priorities, such as client preference, in-house experience, and specific industry standards, should also be observed.

This book covers corrosion considerations in the selection of materials specifically used in the oil, gas, chemical and petrochemical industries. It provides the necessary tools for the design stage of a system, in order to avoid or minimize corrosion hazards technically, economically and safely during the designed life of such a system. Proper corrosion control of structures and units is most effectively and economically begun during the design stage.

Various forms of corrosion and prevention methods are discussed in this book.

It also deals with the control of corrosive environments by inhibitors, general requirements for the petroleum and chemical industries, and utility systems such as cooling water, boiler water systems etc.

Finally it deals with monitoring internal corrosion. It provides guidance for on-line monitoring of internal corrosion in plants associated with the oil, gas and chemical industries, and guidance on laboratory monitoring and evaluation of corrosion inhibitors. The book also covers experiments on the corrosion behaviour of high-alloy tubular materials in inhibited acidizing conditions.

Metallic corrosion is costly. However, the cost of corrosion is not just financial. Beyond the huge direct outlay of funds to repair and/or replace corroded and/or decaying structures are the indirect costs (natural resources, potential hazards, and lost opportunities). When a project is constructed with a material not able to survive its environment for the length of the designed life, natural resources are needlessly consumed to continually repair and maintain the structure. Wasting natural resources is a direct contradiction of the growing need for sustainable development to benefit future generations.

In addition to the waste of natural resources, facilities that cannot sustain their environment can lead to hazardous situations. Accidents caused by corroded structures can lead to huge safety concerns, loss of life and resources, and more. One failed pipeline, bridge collapse, or other catastrophe is one too many, and leads to huge indirect costs (more traffic delays, loss of business, etc.) and public outcry. Depending on which market sector (industrial, infrastructure, commercial, etc.) is being considered, these indirect costs may be as high as five to ten times the direct cost.

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