

PREFACE TO THE 3RD EDITION

In this 3rd edition, the authors have included information about recent developments, such as the degradation of medical implant materials and provided some photographic illustrations of corrosion and surface coating technologies. A new feature of the 3rd edition is the inclusion of study questions with solutions. The purpose of the book remains the same, to provide a comprehensive view of subjects that are traditionally treated as separate, i.e. the various forms of materials degradation and protective coatings technologies. While the established subjects of aqueous electrode theory for corrosion and mechanical causes for wear are given adequate coverage in this book, less familiar problems such as liquid metal corrosion are also covered. An applied approach to the problem of materials degradation is offered to help engineering students to appreciate the significance of materials degradation. The wide variety of materials degradation that is found in practice, e.g. damage to polymer and ceramics is discussed here to enable students to recognize potential materials degradation problems in any given situation. The evaluation of the financial benefits of materials degradation control is extended in this 3rd edition with a quantitative treatment of the costs and benefits.

In industry, materials degradation of components and equipment comes in the form of wear caused by materials processing and handling, corrosion from process chemicals and natural water and fracture from fatigue and shock loading. In some industries, thermal and radiation damage may also be significant. In the absence of premature technical or economic obsolescence, the lifetime of any mechanical device is determined by which is the faster process, wear, corrosion or fracture. Engineering students therefore need a comprehensive view of corrosion, wear, fracture and their preventive technologies. In most courses on corrosion, electrode theory has been emphasized at the expense of detailed discussion of painting and other important coatings. Most practicing engineers need to know more about polymeric coatings and their effective use than the fine details of electrode theory. This book on materials degradation

(or corrosion, wear and fracture) and its control is intended to help students to achieve a balanced knowledge of materials degradation and how to control it. They should then be able to either solve basic problems in materials or interact effectively with specialists. The lack of awareness of materials degradation by many engineers belies its importance. It has been known for an engineer to replace a zinc sacrificial anode with a stainless steel anode because the zinc anode required frequent replacement. As a consequence of this action, a large mineral processing tank became severely corroded necessitating replacement.

The authors aim to provide the reader with a readable and generously illustrated guide as to what is materials degradation and how it can be controlled. The nature of corrosion, wear and fracture is first described. Methods of materials conservation are then discussed and followed by examples of actual applications. The book is intended for final year students of an undergraduate mechanical or materials engineering course. Postgraduate students and professional engineers may also find the book useful.