

CONTENTS

	Page
PREFACE TO FIRST EDITION	ix
PREFACE TO SECOND EDITION	xi
SYMBOLS AND ABBREVIATIONS	xiii
CHAPTER 1 METALS IN EQUILIBRIUM	
1.1 Chemical free energy and activation energy	1
1.2 Electrical potential, electrical energy and electrochemical free energy	4
1.3 Metal dissolution	4
1.4 The electrical double layer at a metal electrode	7
1.5 The single potential of an electrode	9
1.6 The electrochemical series	13
1.7 Exchange current density	14
1.8 The zero-charge potential	16
1.9 The source of e.m. in a cell	21
Problems	26
CHAPTER 2 DEPARTURES FROM EQUILIBRIUM	
2.1 Activation overpotential and the Tafel relationship	28
2.2 The activated state	30
2.3 The influence of specific adsorption on the overpotential	33
2.4 Concentration overpotential	35
2.5 The influence of concentration on exchange current density	38
2.6 Resistance overpotential	40
2.7 The influence of complexants	41
2.8 Metal surfaces	43
Problems	46
CHAPTER 3 ELECTROCHEMICAL CORROSION	
3.1 Spontaneous anodic and cathodic reactions	48
3.2 Corrosion of polyelectrode systems	53
3.3 Some common cathodic processes	55
3.4 The influence of pH	67
3.5 Galvanic attack	68
3.6 Chemical plating	71
Problems	73
CHAPTER 4 SURFACE FILMS	
4.1 Hydrolysed ions and surface films	75
4.2 Potential-pH diagrams	80
4.3 The active-passive transition	86
4.4 Passivation by oxidizing acids	90
4.5 Film repair and breakdown	91
4.6 The influence of alloying and heat treatment	99
Problems	104
CHAPTER 5 ELECTROPOLISHING AND BRIGHT ELECTRODEPOSITION	
5.1 Random processes	106
5.2 Electropolishing	112
5.3 Cation stability and electrodeposition	118
5.4 Growth morphology of electrodeposits	125
5.5 Stress in electrodeposits	133
Problems	136

CHAPTER 6 CORROSION PREVENTION	
6.1 Classification of protection methods	138
6.2 Kinetic methods	139
6.3 Thermodynamic methods	152
Problems	159
CHAPTER 7 THE INFLUENCE OF STRESS	
7.1 Introduction	161
7.2 Fracture mechanics	162
7.3 Stress-corrosion cracking	167
7.4 Theories of stress-corrosion cracking	173
7.5 Corrosion fatigue	182
7.6 Conclusion	183
Problems	184
Appendix 1. Elementary Valency Theory	185
Appendix 2. Metal Deformation	189
REFERENCES	192
AUTHOR INDEX	199
SUBJECT INDEX	203