

## CONTENTS

	Page
<b>FOREWORD</b>	<b>ix</b>
<b>ACKNOWLEDGMENTS</b>	<b>xi</b>
<b>1. BASIC INFORMATION</b>	<b>1</b>
General	1
Some fundamental data	4
Electrical properties of metal compounds	15
Diffusion	29
Oxidation rates	35
Dependence on gas pressure	45
Dependence on temperature	49
Texture and orientation of surface layers	53
Pores, cracks and blisters	64
<b>2. MECHANISM</b>	<b>70</b>
Thin films	71
Scales	82
Parabolic oxidation	82
Non-uniform scales	96
Survey of mechanisms	101
Formation of mechanisms	101
Oxidation of iron	108
Oxidation of alloys	114
Uniform scales	115
Alloys forming ionic oxidation layers	115
Semiconduction oxidation layers	117
Alloys with noble metals	120
Composite scales	126
Double oxides in the scale	133
Internal oxidation	137
<b>3. EXPERIMENTAL METHODS</b>	<b>143</b>
Metallic materials	143
Purity	143
Surface conditions	147
The gaseous phase	154
Gas rates	155
Impurities	155
Ionization	157
Methods for examination of oxidation products	158
Electron diffraction	158
X-ray diffraction	161
Metallography	163
Stripping for oxide films and chemical analysis	166
Methods of measurement	168
Gravimetric method	168
Manometric method	173
Volumetric method	178
Electrometric method	179
Optical methods	182
Interference	182
Polarized light	190
Transparency	194
Other methods	194

Radioactive isotopes	194
Electrical resistance	195
Thickness of stripped films	195
Vacuum fusion	197
Microscopic and fracture sections	198
Decomposition of steam	198
Linear temperature increase procedure	199
Intermittent life tests	201
<b>4. EXPERIMENTAL RESULTS</b>	<b>205</b>
Reaction with oxygen and nitrogen	205
Alkali metals	207
Beryllium	207
Magnesium	208
Magnesium alloys	209
Calcium	211
Barium	211
Lanthanum	211
Cerium	211
Thorium	212
Uranium	213
Titanium	213
Titanium alloys	215
Zirconium	215
Zirconium alloys	217
Hafnium	217
Vanadium	218
Niobium and tantalum	219
Niobium alloys	220
Tantalum alloys	222
Chromium	222
Molybdenum	225
Tungsten	227
Molybdenum and tungsten alloys	228
Manganese	230
Rhenium	230
Iron and steel	230
Alloys of iron	231
Cobalt	240
Cobalt alloys	242
Nickel	243
Nickel alloys	244
Platinum metals	248
Copper	249
Copper alloys	249
Silver	253
Zinc	253
Zinc alloys	254
Cadmium	255
Aluminium	256
Aluminium alloys	257
Thallium	258
Silicon	258
Germanium	259
Tin	259
Lead	260
Lead alloys	261
Antimony	262
Hard metals	262
Oxidation by gases other than oxygen and nitrogen	265

Water vapour	266
Lithium	266
Magnesium	267
Calcium	267
Strontium and barium	268
Thorium	268
Uranium	269
Titanium	270
Zirconium	270
Tungsten	270
Iron	270
Nickel	271
Copper	271
Zinc	272
Aluminium	272
Carbon-containing gases	272
Sulphur-containing gases	273
Chlorine	278
Catastrophic oxidation	278
Protection of metallic surfaces	289
<b>REFERENCES</b>	<b>289</b>
<b>AUTHOR INDEX</b>	<b>307</b>
<b>SUBJECT INDEX.</b>	<b>316</b>