CONTENS

PREFACE

	LIST OF SYMBOLS	XI
	INTRODUCTION	
	FUNDAMENTAL PROPERTIES OF METALS AND ALLOYS	5
	RELATIONSHIPS BETWEEN STRUCTURE, TECHNOLOGY AND PROPERTIES	
	A BRIEF REVIEW OF NON-FERROUS METALS AND ALLOYS	15
4.1	Types of alloys in routine production	16
4.2	Standard types of non-ferrous products	21 24
	PHYSICAL PROPERTIES	27
5.1	Electrical conductivity	28
5.1.1	Metals and alloys for electrical conductors	33
5.1.1.1	Silver and its alloys	34
5.1.1.2	Copper and its alloys	35
5.1.1.3	Aluminium and its alloys	41
5.1.2	Resistance metals and alloys	44
5.1.2.1	Precision resistor materials	45
5.1.2.2	Heating resistor materials.	47
5.1.3	Superconductivity	50
5.2	Thermoelectric effects	56
5.3	Thermal conductivity	61
5.3.1	Thermal conductivities of metals and alloys	65
5.4	Thermal expansion	70
5.4.1	Thermal expansions of metals and alloys	74
5.5	Specific heat	81
5.6	Magnetic properties	85
5.6.1	Hysteresis loops	92
5.6.2	Magnetic anisotropy	94
5.6.3	Magnetostriction effects	95
5.6.4	Metals and alloys with exploitable magnetic properties	97
5.7	Moduli of elasticity	107
5.8	Melting point	113
5.8.1	Low-melting alloys	115
5.8.2	Eutectic alloys	118
5.8.3	Alloys with narrow and with wide solidification ranges	119
5.9	Density	12
5.10	Radiation damage	12:
5.11	Propagation of elastic waves	13
5.11.1	Propagation of sound waves	13

5.11.2	Internal damping	136
5.12	Vapour tension .	139
	References	140
6	MECHANICAL PROPERTIES	142
6.1	Strength	143
6.1.1	Strengthening	145
6.1.1.1	Strengthening by plastic deformation	145
6.1.1.2	Strengthening by grain and subgrain boundaries.	152
6.1.1.3	Strengthening by alloying	156
6.1.1.4	Precipitation strengthening	161
6.1.1.5	Dispersion strengthening	168
6.1.1.6	Strengthening by spinodal decomposition	175
6.1.1.7	Strengthening of two-phase systems	177
6.1.1.8	Strengthening by means of fibres	181
6.1.1.9	Combined strengthening procedures	187
6.1.2	Low-strength metals and alloys	195
6.1.3	Medium-strength metals and alloys	197
6.1.3.1	Zinc and its wrought alloys	197
6.1.3.2	Magnesium and its wrought alloys	199
6.1.3.3	Aluminium and its wrought alloys	200
6.1.3.4	Copper and its wrought alloys	207
6.1.4	Higher-strength metals and alloys	215
6.1.4.1	Nickel and its wrought alloys	217
6.1.4.2	Titanium and its alloys	220
6.2	Strength at low temperatures	222
6.3	· · · · · · · · · · · · · · · · · · ·	230
	Metals and alloys for elevated service temperatures	234
6.4	Spring temper.	234
6.5	Elogation	
6.6	Toughness	243
6.7	Hardness	246
	References	249
7	BEHAVIOUR OF STRUCTURAL MATERIALS UNDER LOAD	251
7.1	Fracture mechanics	253
7.1.1	Model of ductile fracture	260
7.1.2	Fracture toughness in materials of construction	263
7.2	Fatigue processes	265
7.2.1	The substance of fatigue processes	266
7.2.1	Fatigue resistance in materials of construction	276
7.2.2	Creep	282
7.3.1	Relaxation	291
	Creep-resistant materials	292
7.3.2		304
	References	304
8	TECHNOLOGICAL PROPERTIES	306
8.1	Casting characteristics	307
8.2	Hot formability	324
8.2.1	Forging	325
8.2.1.1	Selection of alloys for forging	328
8.2.2	Superplasticity	333

8.3	Cold formability	337
8.3.1	Blanking of sheet metal.	338
8.3.2	Bending	339
8.3.3	Forming of sheet metal.	341
8.3.4	Deep drawing	342
8.4	Weldability	348
8.5	Soldering and brazing .	356
8.6	Machinability	360
8.7	The shape memory effect	365
	References	368
9	SURFACE PROPERTIES	369
9.1	Electrical contact properties	370
9.1.1	Contact materials	372
9.2	Friction properties	377
9.2.1	Materials for plain bearings	380
9.2.1.1	Non-ferrous bearing metals and alloys	383
9.2.2	Friction materials	386
9.3	Optical properties	388
9.4	Electron emission	391
9.4.1	Thermal emission	391
9.4.2	Secondary emission	393
9.5.	Sparking	395
9.6	Surface wear	396
9.6.1	Abrasion	397
9.6.2	Erosion	399
9.6.3	Cavitation	401
9.6.4	Vibrational wear	402
9.7	Surface finishes	403
9.7.1	Anodic oxidation	404
9.7.2	Electrolytic plating	408
9.7.3	Cladding	411
9.7.4	Vapour condensation	412
	References	414
10	CHEMICAL PROPERTIES	415
10.1	Oxidation	415
10.3.1	Oxidation resistance in metals and alloys	421
10.2	Internal oxidation	426
10.3	Corrosion	428
10.3.1	Behaviour of metals and alloys in corrosive environments	434
10.4	Selection of metals and alloys for corrosive environments	438
10.4.1	Water	439
10.4.2	Acids	440
10.4.3	Hydroxides	444
10.4.4	Solutions of halogen salts	445
10.4.5	Solutions of other salts	446
10.4.6	Molten metals	449
10.5.	Corrosion under stress	450
10.6.	Health hazards presented by metals	453
	References	456

COMBINATIONS OF PROPERTIES	458
CONCLUSION	467
SUBJECT INDEX	471