

CONTENTS

Preface	<i>page</i> v
Sir Nevill Mott	xi
Publications of Professor N. F. Mott	xiii
1 Electronic structure of metals, by VOLKER HEINE	1
1.1 <i>Pseudism</i>	1
1.2 <i>Band-structure calculations</i>	9
1.3 <i>Analysis of N.F.E. band structures</i>	17
1.4 <i>Transition and noble metals</i>	25
1.5 <i>Other electronic properties of N.F.E. metals</i>	34
1.6 <i>Cohesion and structure</i>	41
1.7 <i>Landau quasi-particles</i>	55
2 Electronic structure: the experimental results, by D. SHOENBERG	62
2.1 <i>Experimental methods</i>	63
2.2 <i>Magnetic phenomena</i>	64
2.2.1 <i>de Haas-van Alphen and allied effects</i>	65
2.2.2 <i>Azbel'-Kaner cyclotron resonance</i>	67
2.2.3 <i>Size effects</i>	69
2.2.4 <i>Magneto-acoustic effect ('geometric resonance')</i>	71
2.2.5 <i>Galvanomagnetic effects</i>	72
2.2.6 <i>Miscellaneous magnetic effects</i>	72
2.3 <i>Non-magnetic phenomena</i>	75
2.3.1 <i>Anomalous skin effect</i>	75
2.3.2 <i>Positron annihilation</i>	76
2.3.3 <i>Compton effect</i>	77
2.3.4 <i>Kohn effect</i>	77
2.4 <i>Summary and comparison of methods</i>	78
2.5 <i>The derivation of a Fermi surface from geometrical data</i>	80
2.6 <i>The alkalis</i>	83
2.7 <i>The noble metals</i>	89
2.8 <i>'Simple' polyvalent metals</i>	97
2.8.1 <i>Aluminium</i>	97
2.8.2 <i>Lead</i>	103
2.8.3 <i>The divalent hexagonal metals</i>	104

2.9	<i>Bismuth</i>	page 109
2.10	<i>Transition metals</i>	111
3	Metallic electrons in a magnetic field, by A. B. PIPPARD	113
3.1	<i>Introduction</i>	113
3.2	<i>The free electron</i>	114
3.3	<i>The Bloch electron</i>	118
3.4	<i>Spin-orbit interaction</i>	126
3.5	<i>Magnetic breakdown</i>	129
3.6	<i>Green's function analysis of density of states</i>	139
3.7	<i>Level broadening</i>	142
3.8	<i>Magnetic properties of the conduction electron assembly</i>	145
3.8.1	<i>Introduction</i>	145
3.8.2	<i>Elementary evaluation of Ω</i>	146
3.8.3	<i>The oscillatory diamagnetism</i>	149
3.8.4	<i>The steady diamagnetism</i>	150
3.8.5	<i>Exact formal methods</i>	152
3.8.6	<i>The de Haas-van Alphen effect</i>	152
3.9	<i>The Shoenberg effect</i>	154
3.10	<i>Transport</i>	161
4	Transport properties: surface and size effects, by R. G. CHAMBERS	175
4.1	<i>Introduction</i>	175
4.2	<i>Internal scattering and surface scattering</i>	176
4.3	<i>D.C. size effects, $H = 0$</i>	185
4.4	<i>D.C. size effects, $H \neq 0$</i>	189
4.5	<i>The anomalous skin effect</i>	198
4.6	<i>Cyclotron resonance</i>	209
4.7	<i>A.K.C.R. line-shapes, polarization effects, tipping effects</i>	223
4.8	<i>R.F. size effects</i>	231
4.9	<i>Some propagating modes</i>	241
5	The ordinary transport properties of metals, by J. M. ZIMAN	250
5.1	<i>Electron-phonon interaction: Bloch formulation</i>	251
5.2	<i>Rigid ions and portable pseudo-potentials</i>	253
5.3	<i>Screening the electron-phonon interaction</i>	256

CONTENTS

ix

5.4	<i>Vacancy scattering</i>	<i>page</i> 259
5.5	<i>Impurities</i>	262
5.6	<i>Extended imperfections: stacking faults and dislocations</i>	264
5.7	<i>The Boltzmann equation: 'ideal' resistivity</i>	268
5.8	<i>Heat conduction by electrons</i>	273
5.9	<i>Thermo-electric power: phonon drag</i>	275
5.10	<i>Thermo-electric power at high temperatures: anisotropy of τ</i>	278
5.11	<i>Impurity and imperfection scattering</i>	281
6	Electronic transport properties of liquid metals, by T. E. FABER	282
6.1	<i>Some simple facts . . .</i>	282
6.2	<i>. . . and simple theories</i>	283
6.3	<i>The N.F.E. model</i>	287
6.4	<i>Corrections to Ziman's theory</i>	291
6.5	<i>Calculation of the resistivity</i>	296
6.6	<i>Derivatives of the resistivity</i>	300
6.7	<i>Extension of Ziman's theory to liquid alloys</i>	306
6.8	<i>The effect of a magnetic field</i>	311
6.9	<i>The optical properties</i>	312
6.10	<i>Conclusions</i>	315
7	Experimental studies of the structures of metals and alloys, by P. J. BROWN and W. H. TAYLOR	317
7.1	<i>Introduction</i>	317
7.2	<i>Stability of alloy structures</i>	318
	7.2.1 <i>Atomic size</i>	318
	7.2.2 <i>The e/A ratio</i>	319
	7.2.3 <i>Electrochemical effects</i>	319
7.3	<i>Alloy chemistry</i>	319
	7.3.1 <i>Alloys of transition metals with B subgroup metals</i>	320
	7.3.2 <i>Alloys of two transition metals</i>	321
	7.3.3 <i>Long-range order</i>	321
7.4	<i>Magnetic structures</i>	323
	7.4.1 <i>Examples of ordered structures</i>	324
	7.4.2 <i>Systematic study of magnetic moments</i>	330
7.5	<i>Electron configuration</i>	331
	7.5.1 <i>Total electron density distribution</i>	331
	7.5.2 <i>Spin density distribution</i>	334

8	Transition metals. Electronic structure of the <i>d</i> -band. Its role in the crystalline and magnetic structures, by J. FRIEDEL	page 340
8.1	<i>Band structure of pure transitional metals</i>	340
8.1.1	<i>Band structure versus localized states</i>	340
8.1.2	<i>The Hartree band picture; 'd-band' versus 'virtual d-levels'</i>	343
8.1.3	<i>d-band in tight binding</i>	345
8.1.4	<i>Width of the d-band</i>	348
8.1.5	<i>Possible splitting of the d-band</i>	350
8.1.6	<i>Density of states of the d-band</i>	352
8.1.7	<i>Form of the Fermi surface in crystals</i>	357
8.1.8	<i>sd-mixing—the case of noble metals</i>	358
8.2	<i>Cohesion and lattice structures in transitional metals</i>	361
8.2.1	<i>Cohesive energy of transitional metals, latent heats of phase changes</i>	361
8.2.2	<i>Energy of distortion</i>	364
8.2.3	<i>Elastic constants. Phonon dispersion curves. Meta- stability of lattice structures</i>	365
8.2.4	<i>Electron-electron correlations</i>	370
8.3	<i>Magnetism of transitional metals</i>	373
8.3.1	<i>Spin dependence of correlation effects in narrow bands</i>	373
8.3.2	<i>Stability and couplings of small magnetic moments at 0 °K</i>	379
8.3.3	<i>Large magnetic moments at 0 °K</i>	387
8.3.4	<i>Magnetism at finite temperatures</i>	392
8.3.5	<i>Effect of spin-orbit coupling on magnetism</i>	403
	Author index and bibliography	409
	Subject index	425