

	Introductory material	
1	Fe oxides and Fe-Me-O compounds (R.A. Lefever)	1
1.0	Introduction	1
1.0.1	Arrangement of tables and figures	1
1.0.2	General remarks	1
1.0.3	List of symbols and abbreviations	2
1.1	Fe oxides	3
1.1.1	Wüstite Fe_xO and wüstite with substitutions	3
1.1.1.1	References for 1.1.1	7
1.1.2	Hematite $\alpha\text{-Fe}_2\text{O}_3$ and hematite with substitutions	8
1.1.2.1	References for 1.1.2	16
1.1.3	Maghemite $\gamma\text{-Fe}_2\text{O}_3$	18
1.1.3.1	References for 1.1.3	20
1.2	Fe-Me-O compounds	21
1.2.1	References for 1.2	38
2	Compounds with lanthanide and actinide elements of some special structure types (F. Holtzberg, T.R. McGuire, S. Methfessel)	41
2.0	Preface	41
2.1	Rare earth compounds with elements of group V (N, P, As, Sb, Bi)	44
2.1.0	Introduction	44
2.1.1	NaCl-type compounds	46
2.1.1.1	Crystallographic, magnetic, and electrical properties of NaCl-type compounds	47
2.1.1.2	Molecular field exchange parameters J_1 and J_2	51
2.1.2	Crystallographic, magnetic, and electrical properties of compounds with inverted Th_3P_4 - structure	61
2.1.3	Crystallographic, magnetic, and electrical properties of compounds with miscellaneous structures	61
2.2	Rare earth compounds with elements of group VI (O, S, Se, Te)	64
2.2.0	Introduction	64
2.2.1	NaCl-type compounds	66
2.2.1.1	Crystallographic, magnetic, optical, and electrical properties of compounds with divalent rare earth elements	67
2.2.1.2	Exchange constants, hyperfine fields, anisotropies, and pressure dependence of Curie temperature in Eu chalcogenides	70
2.2.1.3	Crystallographic, magnetic, optical, and electrical properties of compounds with trivalent rare earth elements	71
2.2.1.4	Crystallographic, magnetic, and electrical properties of ternary systems with NaCl-type structure	86
2.2.2	Th_3P_4 -type compounds	89
2.2.2.1	Crystallographic, magnetic, electrical, and optical properties of compounds with Th_3P_4 - type structure	90
2.2.2.2	Crystallographic, magnetic, and electrical properties of ternary compounds with Th_3P_4 - type structure	94

2.2.3	Crystallographic, magnetic, and electrical properties of trivalent oxides with Mn_2O_3 structure	94
2.2.4	Crystallographic, magnetic, and electrical properties of miscellaneous compounds	99
2.3	References for 2.1 and 2.2	105
2.4	Actinide compounds with elements of group V (N, P, As, Sb, Bi)	110
2.4.0	Introduction	110
2.4.1	Crystallographic, magnetic, and electrical properties of NaCl-type compounds	111
2.4.2	Crystallographic, magnetic, and electrical properties of compounds with miscellaneous structures	114
2.5	Actinide compounds with elements of group VI (O, S, Se, Te)	116
2.5.0	Introduction	116
2.5.1	Crystallographic, magnetic, and electrical properties of NaCl-type compounds	117
2.5.2	Crystallographic, magnetic, and electrical properties of compounds with miscellaneous structures	120
2.6	References for 2.4 and 2.5	125
3	Crystallographic and magnetic properties of perovskite and perovskite-related compounds (J.B. Goodenough, M. Longo)	126
3.0	Introduction	126
3.0.1	General remarks	126
3.0.2	Symbols and units used in tables and figures	129
3.1	Descriptions of stoichiometric ABX_3 and $\text{M}^{\text{c}}\text{XM}^{\text{f}}_3$ structures	131
3.1.1	The ideal perovskite structure	131
3.1.2	The influence of relative ionic sizes	132
3.1.2.1	Tolerance factor	132
3.1.2.2	O-orthorhombic structure	134
3.1.2.3	Rhombohedral structures	135
3.1.3	The influence of localized-electron ordering	136
3.1.3.1	Crystal-field theory	136
3.1.3.2	Jahn-Teller distortions	140
3.1.3.3	Spin-orbit coupling	141
3.1.4	The influence of collective-electron ordering	142
3.1.4.1	Band theory	142
3.1.4.2	Distortions due to B-X bonding	142
3.1.4.3	Distortions due to core polarization: Pb^{2+} and Bi^{3+}	144
3.1.4.4	Competitive phases	145
3.1.5	Structures encountered with ordered B, B' cations	146
3.1.5.1	Same B atom	146
3.1.5.2	Different B atoms	146
3.1.5.3	Complex alloys $\text{A}_2\text{BB}'\text{X}_6$ where $\text{B} = \text{M}_{13}$ $\text{B}' = \text{M}_6$	147
3.1.6	First-order magnetic transition in $\text{M}^{\text{c}}\text{XM}^{\text{f}}_3$ perovskites	147
3.1.7	Data: Crystallographic properties of compounds with perovskite or perovskite-related structure	148
3.2	Descriptions of perovskite-related structures	190
3.2.1	A-cation vacancies	190
3.2.1.1	No A cations	190
3.2.1.2	The bronze structures	190
3.2.2	Anion-deficient compounds	191
3.2.2.1	Compounds ABX_{3-x}	191
3.2.2.2	Alloys $\text{M}^{\text{c}}\text{X}_{1-x}\text{M}^{\text{f}}_3$	192

3.2.2.3	Shear structures []BO _{3-x}	192
3.2.3	Structures deficient in B cations	192
3.2.3.1	Bismuth compounds	192
3.2.3.2	Hexagonal A _n B _{n-1} X _{3n} structures	193
3.2.3.3	AX·(ABX ₃) _n structures	193
3.2.4	Data: Crystallographic properties of non-ABX ₃ compounds with perovskite-related structure	193
3.3	Magnetic order: localized electrons	207
3.3.1	Phenomenological exchange Hamiltonian	207
3.3.2	Microscopic models	208
3.3.2.1	Isotropic superexchange	208
3.3.2.2	Double exchange	211
3.3.2.3	Anisotropic superexchange	212
3.3.3	Weak ferromagnetism	212
3.3.3.1	Definition	212
3.3.3.2	Anisotropy considerations	212
3.3.3.3	Antisymmetric superexchange	213
3.3.4	Data: Magnetic properties of perovskite and perovskite-related compounds	214
3.4	Localized versus collective electrons	255
3.4.1	Introduction	255
3.4.2	Integral n _i	255
3.4.2.1	Construction of an electronic phase diagram	255
3.4.2.2	Distinguishing physical properties imparted by different electronic phases	256
3.4.3	Nonintegral n _i = 1 ± c	259
3.4.4	Energy diagrams for ABX ₃ perovskites	261
3.5	The M ^c XM ^f ₃ alloys	263
3.5.1	Discussion of results	263
3.5.2	Data: Magnetic and crystallographic properties of M ^c XM ^f ₃ or M ₃ M'X, and Cr ₂₃ C ₆ compounds (Tab. 9)	266
3.5.2.1	Crystallographic properties (Tab. 9a)	266
3.5.2.2	Magnetic properties (Tab. 9b)	269
3.6	References	275
4	Yttrium and rare earth iron garnets (D.L. Huber)	315
4.0	Introduction	315
4.0.1	General remarks	315
4.0.2	List of symbols	317
4.1	Spontaneous magnetic moments	319
	A. Yttrium and rare earth iron garnets	319
	B. Substituted iron garnets	320
4.2	Magnetic susceptibility data	323
	A. Static paramagnetic susceptibility above the ordering temperature	323
	B. Magnetic susceptibility of below the Curie temperature	324
	C. Permeability spectra	325
4.3	Molecular field constants and exchange integrals in yttrium and rare earth iron garnets	326
	A. Yttrium iron garnet	326
	B. Rare earth ions in the iron garnet	326
	C. Volume dependence of the molecular field constants	327
4.4	Crystallographic and structural data	327

	A. The locations of ions in the unit cell of the garnet lattice	327
	B. Oxygen and thermal parameters of yttrium iron garnet	328
	C. Interionic spacings and angles in yttrium iron garnet	328
	D. Lattice parameters and densities of garnet systems	329
4.5	Gyromagnetic ratios	330
	A. Effective and apparent g-factors of ferrimagnetic garnets	330
4.6	Magnetocrystalline anisotropy and field for resonance	331
	A. Anisotropy constants from torque measurements	331
	B. Anisotropy constants from ferrimagnetic resonance experiments	331
	C. Effect of rare earth impurities on the field for resonance in YIG at low temperatures	332
	D. Anisotropy peaks	334
	E. Dynamic shift	334
4.7	Ferrimagnetic loss parameters	335
	A. Small signal ferrimagnetic resonance linewidths	335
	B. High power effects	339
4.8	Relaxation mechanisms for rare earth ions in the iron garnets	340
	A. Theory	340
	B. Comparison with experiment	340
4.9	Spin wave spectra of the iron garnets	341
	A. Spin wave spectrum of YIG	341
	B. Spin wave lifetimes in YIG	341
	C. Spin wave spectra of the rare earths iron garnets	342
	D. Exchange stiffness of lutecium iron garnet	342
4.10	Optical properties of magnetic garnets	342
	A. Absorption coefficients of yttrium and rare earth iron garnets	342
	B. Faraday rotation in yttrium and rare earth iron garnets	344
	C. Refractive index of YIG	345
4.11	Mechanical and magnetomechanical properties of magnetic garnets	345
	A. Elastic properties of garnets	345
	B. Magnetoelastic properties of the iron garnets	346
4.12	Thermal properties of the iron garnets	348
	A. Specific heat of YIG	348
	B. Specific heat of the rare earth iron garnets	349
	C. Thermal conductivity of YIG	351
4.13	Nuclear magnetic resonance in the iron garnets	351
	A. Resonance frequencies ω of Fe^{57} in yttrium, lutecium, and rare earth iron garnets	351
	B. Quadrupole coupling constants of Fe^{57} in yttrium, lutecium, and rare earth iron garnets	352
	C. Nuclear relaxation of Fe^{57} in YIG	352
4.14	Crystal field parameters for the rare earth sites	353
4.15	Miscellaneous properties of magnetic garnets	353
	A. Electrical resistivity of YIG	353
	B. Magnetostatic modes in YIG	353
	C. Behavior of YIG near the critical point	354
4.16	References	354
4.17	Literature 1966 - 1969 (W. Gräper)	360

Magnetic and Other Properties of Oxides and Related
Compounds

Goodenough, J.B.; Gräper, W.; Holtzberg, F.; Huber, D.L.;
Lefever, R.A.; Longo, J.M.; McGuire, T.R.; Methfessel, S.
1970, 367 p., Hardcover
ISBN: 978-3-540-04898-5