

Table of contents

Magnetic Properties of Free Radicals

Subvolume D: Nitroxide Radicals and Nitroxide Based High-Spin Systems

I Introduction

I	General introduction [H. Fischer]	1
A	Definition and substances	1
B	Magnetic properties	1
C	Arrangements of the tables	3
D	Monographs, reviews and important conference proceedings	4

II Data

12	Nitroxide radicals and polynitroxides [A. Alberti]	7
12.1	Introduction	7
12.1.1	General remarks	7
12.1.2	Classifications	7
12.1.3	Abbreviations and acronyms	8
12.1.4	Summary table.	9
12.2	Acyclic nitroxides	10
12.2.1	Alkyl nitroxides	10
12.2.2	Dialkyl nitroxides	12
12.2.2.1	Methyl <i>prim</i> -alkyl nitroxides	12
12.2.2.2	Methyl <i>sec</i> -alkyl nitroxides	12
12.2.2.3	Methyl <i>tert</i> -alkyl nitroxides	13
12.2.2.4	Di- <i>prim</i> -alkyl nitroxides	14
12.2.2.5	<i>prim</i> -Alkyl <i>sec</i> -alkyl nitroxides	16
12.2.2.6	<i>prim</i> -Alkyl <i>tert</i> -alkyl nitroxides.	19
12.2.2.6.1	<i>prim</i> -Alkyl <i>tert</i> -butyl nitroxides.	19
12.2.2.6.2	<i>prim</i> -Alkyl <i>tert</i> -polyfluoroalkyl nitroxides	23
12.2.2.6.3	<i>prim</i> -Alkyl other <i>tert</i> -alkyl nitroxides.	24
12.2.2.7	Di- <i>sec</i> -alkyl nitroxides	24
12.2.2.8	<i>sec</i> -Alkyl <i>tert</i> -alkyl nitroxides	27
12.2.2.8.1	Acyclic <i>sec</i> -alkyl <i>tert</i> -butyl nitroxides [^t BuN(O•)CH(XR ¹)R ² with X = Carbon]	27
12.2.2.8.2	Acyclic <i>sec</i> -alkyl <i>tert</i> -butyl nitroxides [^t BuN(O•)CH(XR ¹)R ² with X = Nitrogen] . . .	81
12.2.2.8.3	Acyclic <i>sec</i> -alkyl <i>tert</i> -butyl nitroxides [^t BuN(O•)CH(XR ¹)R ² with X = Oxygen]	86
12.2.2.8.4	Acyclic <i>sec</i> -alkyl <i>tert</i> -butyl nitroxides [^t BuN(O•)CH(XR ¹)R ² with X = Halogen]. . . .	105
12.2.2.8.5	Acyclic <i>sec</i> -alkyl <i>tert</i> -butyl nitroxides [^t BuN(O•)CH(XR ¹)R ² with X = Phosphorus, Sulphur, Silicon]	106
12.2.2.8.6	Five-membered cyclic <i>sec</i> -alkyl <i>tert</i> -butyl nitroxides	109
12.2.2.8.7	Six-membered cyclic <i>sec</i> -alkyl <i>tert</i> -butyl nitroxides	112
12.2.2.8.8	<i>sec</i> -Alkyl other <i>tert</i> -alkyl nitroxides	124

12.2.2.9	Di- <i>tert</i> -alkyl nitroxides	137
12.2.2.9.1	<i>tert</i> -Butyl acyclic- <i>tert</i> -alkyl nitroxides	137
12.2.2.9.2	<i>tert</i> -Butyl cyclic <i>tert</i> -alkyl nitroxides	142
12.2.2.9.3	Other di- <i>tert</i> -alkyl nitroxides	146
12.2.3	Aryl nitroxides	151
12.2.4	Aryl alkyl nitroxides	154
12.2.4.1	Aryl methyl nitroxides	154
12.2.4.2	Aryl <i>prim</i> -alkyl nitroxides	155
12.2.4.3	Aryl <i>sec</i> -alkyl nitroxides	167
12.2.4.3.1	Aryl acyclic- <i>sec</i> -alkyl nitroxides [ArN(O [•])CH(XR ¹)R ² with X = Carbon].	167
12.2.4.3.2	Aryl acyclic- <i>sec</i> -alkyl nitroxides [ArN(O [•])CH(XR ¹)R ² with X = Nitrogen].	180
12.2.4.3.3	Aryl acyclic- <i>sec</i> -alkyl nitroxides [ArN(O [•])CH(XR ¹)R ² with X = Oxygen]	185
12.2.4.3.4	Aryl acyclic- <i>sec</i> -alkyl nitroxides [ArN(O [•])CH(XR ¹)R ² with X = Phosphorus, Sulphur, Silicon]	186
12.2.4.3.5	Aryl cyclic- <i>sec</i> -alkyl nitroxides	188
12.2.4.4	Aryl <i>tert</i> -alkyl nitroxides	190
12.2.4.4.1	Aryl <i>tert</i> -butyl nitroxides	190
12.2.4.4.2	Aryl other <i>tert</i> -alkyl nitroxides	197
12.2.5	Diaryl nitroxides.	209
12.2.6	Heteroaryl alkyl nitroxides	216
12.2.7	Heteroaryl aryl nitroxides	218
12.2.8	Acyl nitroxides	222
12.2.8.1	Acyl alkyl nitroxides and acyl aryl nitroxides	222
12.2.8.2	Benzoyl alkyl nitroxides	226
12.2.8.3	2-(<i>N</i> -Methylpyrrolyl)carbonyl polyfluoroalkyl nitroxides	228
12.2.8.4	Aminocarbonyl, halocarbonyl, oxycarbonyl hydro, alkyl and aryl nitroxides	237
12.2.9	Vinyl and iminyl nitroxides	238
12.2.10	Amino and nitroso nitroxides	241
12.2.10.1	Alkyl amino nitroxides and alkyl nitroso nitroxides	241
12.2.10.2	Aryl amino nitroxides and aryl nitroso nitroxides	243
12.2.11	Azoxy nitroxides	247
12.2.12	Oxynitroxides	248
12.2.12.1	Hydroxynitroxides	248
12.2.12.2	Alkoxy nitroxides	248
12.2.12.2.1	Alkoxy alkyl nitroxides	248
12.2.12.2.2	Alkoxy aryl nitroxides	253
12.2.12.3	Boroxynitroxides	256
12.2.12.4	Silyloxy-, germyloxy- and phosphoxynitroxides	261
12.2.13	Phosphonitroxides.	265
12.2.14	Silylnitroxides	267
12.2.15	Thionitroxides	268
12.2.15.1	Alkyl thionitroxides	268
12.2.15.2	Aryl thionitroxides	270
12.2.15.3	Dithionitroxides	272
12.3	Cyclic nitroxides	273
12.3.1	Pyrrolidinyl- <i>N</i> -oxyls	273
12.3.1.1	Monosubstituted pyrrolidinyl- <i>N</i> -oxyls	273
12.3.1.2	2,2-Disubstituted pyrrolidinyl- <i>N</i> -oxyls	273
12.3.1.3	Trisubstituted pyrrolidinyl- <i>N</i> -oxyls	276
12.3.1.3.1	2,2,3-Trisubstituted pyrrolidinyl- <i>N</i> -oxyls	276
12.3.1.3.2	2,2,4-Trisubstituted pyrrolidinyl- <i>N</i> -oxyl	277

12.3.1.3.3	2,2,5-Trisubstituted pyrrolidinyl- <i>N</i> -oxyl	278
12.3.1.3.3.1	5-XR-Substituted 2,2-dimethylpyrrolidine- <i>N</i> -oxyls [X = Carbon]	278
12.3.1.3.3.2	5-XR-Substituted 2,2-dimethylpyrrolidine- <i>N</i> -oxyls [X = Nitrogen]	287
12.3.1.3.3.3	5-XR-Substituted 2,2-dimethylpyrrolidine- <i>N</i> -oxyls [X = Oxygen]	290
12.3.1.3.3.4	5-XR-Substituted 2,2-dimethylpyrrolidine- <i>N</i> -oxyls [X = Phosphorus]	298
12.3.1.3.3.5	5-XR-Substituted 2,2-dimethylpyrrolidine- <i>N</i> -oxyls [X = Sulphur]	298
12.3.1.3.3.6	5-Substituted 2-methyl,2-(dialkoxyphosphoryl)pyrrolidine- <i>N</i> -oxyls	301
12.3.1.3.3.7	Other 2,2,5-trisubstituted pyrrolidine- <i>N</i> -oxyls	306
12.3.1.4	Tetrasubstituted pyrrolidine- <i>N</i> -oxyls	320
12.3.1.4.1	3,5-Disubstituted 2,2-dimethylpyrrolidine- <i>N</i> -oxyls	320
12.3.1.4.2	4,5-Disubstituted 2,2-dimethylpyrrolidine- <i>N</i> -oxyls	321
12.3.1.4.3	5-Substituted 2,4-diphenyl-2-methylpyrrolidine- <i>N</i> -oxyls	325
12.3.1.4.4	5,5-Disubstituted 2,2-dimethylpyrrolidine- <i>N</i> -oxyls	328
12.3.1.4.5	Other 2,2,5,5-tetrasubstituted pyrrolidine- <i>N</i> -oxyls	343
12.3.1.5	Pentasubstituted pyrrolidine- <i>N</i> -oxyls	346
12.3.1.5.1	5-Substituted 2,2,4,4-tetramethylpyrrolidine- <i>N</i> -oxyls	346
12.3.1.5.2	3-Substituted 2,2,5,5-tetramethylpyrrolidine- <i>N</i> -oxyls	347
12.3.1.5.3	4-Substituted 2-(dialkoxyphosphoryl)-2,5,5-trimethylpyrrolidine- <i>N</i> -oxyls	352
12.3.1.5.4	Other 2,2,4,5,5-pentasubstituted pyrrolidine- <i>N</i> -oxyls	354
12.3.1.6	Hexasubstituted pyrrolidine- <i>N</i> -oxyls	354
12.3.1.6.1	3,4-Disubstituted 2,2,5,5-tetramethylpyrrolidine- <i>N</i> -oxyls	354
12.3.1.6.2	2,4,5-Trisubstituted 3,3,5-trimethylpyrrolidine- <i>N</i> -oxyls	355
12.3.1.6.3	2,4-Disubstituted 3,5-di(spirocyclohexyl)pyrrolidine- <i>N</i> -oxyls	357
12.3.1.6.4	2,2-Disubstituted 3,3,5,5-tetramethylpyrrolidine- <i>N</i> -oxyls	357
12.3.1.7	Fused-ring pyrrolidine- <i>N</i> -oxyls	359
12.3.2	Pyrrolinyl- <i>N</i> -oxyls	362
12.3.2.1	2-Pyrrolinyl- <i>N</i> -oxyls	362
12.3.2.2	3-Pyrrolinyl- <i>N</i> -oxyls	362
12.3.3	Pyrrolyl- <i>N</i> -oxyls	374
12.3.4	3-Pyrazolinyl-2-oxyls	374
12.3.5	3-Imidazolidinyl-1-oxyls	375
12.3.6	2-Imidazolinyl- <i>N</i> -oxyls and 2-imidazolinyl- <i>N</i> -oxyls 3-oxide	382
12.3.7	3-Imidazolinyl- <i>N</i> -oxyls and 3-imidazolinyl- <i>N</i> -oxyls 3-oxide	397
12.3.8	3-Oxazolidinyl- <i>N</i> -oxyls	407
12.3.9	Piperidinyl- <i>N</i> -oxyls	415
12.3.9.1	6-Substituted 2,2-dimethylpiperidinyl- <i>N</i> -oxyls	415
12.3.9.2	2,6-Disubstituted 2,6-dimethylpiperidinyl- <i>N</i> -oxyls	416
12.3.9.3	4-Substituted 2,2,6,6-tetramethylpiperidinyl- <i>N</i> -oxyls	417
12.3.9.4	4-Vinyl- 2,2,6,6-tetramethylpiperidinyl- <i>N</i> -oxyls	434
12.3.9.5	4-Imino-2,2,6,6-tetramethylpiperidinyl- <i>N</i> -oxyls	435
12.3.9.6	4-Carbonyl-2,2,6,6-tetramethylpiperidinyl- <i>N</i> -oxyls	435
12.3.9.7	3,4-Disubstituted-2,2,6,6-tetramethylpiperidinyl- <i>N</i> -oxyls	437
12.3.9.8	4,4-Disubstituted-2,2,6,6-tetramethylpiperidinyl- <i>N</i> -oxyls	439
12.3.9.9	Decasubstituted piperidinyl- <i>N</i> -oxyls	442
12.3.10	Tetrahydropyridinyl- <i>N</i> -oxyls	443
12.3.11	Tetrahydropyrazine-4-oxide-1-oxyls	443
12.3.12	Phenoxaziliny- <i>N</i> -oxyls and phenothiaziliny- <i>N</i> -oxyls	445
12.3.13	Isoindolinyl- <i>N</i> -oxyls	447
12.3.14	Indolinyl- <i>N</i> -oxyls, indolinonyl- <i>N</i> -oxyls and indoliminy- <i>N</i> -oxyls	452
12.3.15	Miscellaneous fused-rings nitroxides	462
12.3.16	Polycyclic nitroxides	469
12.3.17	Cyclic and polycyclic acylnitroxides	471

12.3.18	Cyclic iminylnitroxides	474
12.3.19	Other cyclic nitroxides	474
12.4	Cyclic oxynitroxides	476
12.5	Polynitroxides	478
12.5.1	Bisnitroxides	478
12.5.1.1	Bis(dialkylnitroxides)	478
12.5.1.2	Bis(alkyl-arylnitroxides)	478
12.5.1.3	Bis(alkyl-acylnitroxides)	483
12.5.1.4	3-Imidazolidinyl bisnitroxides	484
12.5.1.5	Bis(2,2,5,5-tetramethylpyrrolidinyl- <i>N</i> -oxyl)	485
12.5.1.6	Bis(2,2,5,5-tetramethylpyrrolinyl- <i>N</i> -oxyl)	485
12.5.1.7	Bis(3-imidazolinyl- <i>N</i> -oxyls) and bis(3-imidazolinyl- <i>N</i> -oxyls 3-oxide)	490
12.5.1.8	Bis(2,2,6,6-tetramethylpiperidinyl- <i>N</i> -oxyls)	500
12.5.1.9	Bicyclic bisnitroxides	509
12.5.1.10	Other miscellaneous bisnitroxides	510
12.5.2	Trisnitroxides	511
12.5.3	Other polynitroxides	514
12.6	References for 12	516
12.6.1	References for 12.1	516
12.6.1.1	References to some protein- and nucleic acid-derived nitroxides	516
12.6.1.2	References to reviews on nitroxides, spin trapping and spin labeling	516
12.6.2	References for 12.2	516
12.6.3	References for 12.3 and 12.4	525
12.6.4	References for 12.5	537

III General symbols and abbreviations

A	Symbols	540
B	Abbreviations	540
C	Substances or part of substances	541

<http://www.springer.com/978-3-540-43275-3>

Nitroxide Radicals and Nitroxide Based High-Spin
Systems

Alberti, A.

2005, XI, 546 p. With CD-ROM., Hardcover

ISBN: 978-3-540-43275-3