

## Index

### **a**

$\pi$ -acceptor property 105  
 achiral  $C_2$ -symmetric Salen ligand  
     synthesis 91  
 achiral nucleating ligand 91  
 achiral SB ligand synthesis 90–93  
 acid catalyst 55, 59, 62, 71, 74  
 aerobic oxidative synthesis, of SBs 61  
 agrochemical industry 125  
 Al-based Schiff base complexes 93  
 aldol condensation reactions 58  
 aldol reaction 158–159, 164  
 aldol-type reaction 58  
 aliphatic aldehydes 11, 58, 59  
 aliphatic ketones 55, 59  
 N-alkylsilyl imines preparation 68  
 Al-SB metal complexes 96  
 N-aluminium imines preparation 67  
 amines, dehydrogenation of 64  
 amino acid Schiff base metal complexes  
     45  
 4-amino antipyrine 30  
 2-(2-aminoethylthio)-N-(thiophene-  
     2-ylmethylene) aniline 109  
 anil camphor synthesis 64  
 annulation reaction 160–161, 164  
 aromatic ketones 59, 63, 157  
 aromatic nitriles, reduction of 65  
 asymmetric hetero-Diels–Alder  
     reaction 45

### **b**

Benesi–Hildebrand equation 170  
 N-benzylideneaniline derivatives 75  
 bidentate 9, 11, 14–16, 33, 83, 122, 140,  
     157  
 bidentate ligands 9, 33  
 biogas-SOFC systems 196, 197  
 biomolecular fluorescence chemosensors  
     184  
 biomolecular modelling 114  
 BODIPY-based sensors 186  
 Born–Oppenheimer MD 114  
 N-boryl imines preparation 67

### **c**

Car–Parrinello MD (CPMD) 114  
 catalyst, of Schiff bases 121–122  
 catalytic applications of SBs metal  
     complexes  
     aldol reaction 158–159  
     annulation reaction 160–161  
     click reaction 161–162  
     coupling reaction 149–151  
     cyclopropanation reaction 155–156  
     Diels–Alder reaction 161  
     Ene reaction 163–164  
     epoxidation reaction 153–154  
     hydrogenation reaction 157–158  
     hydrosilylation reaction 156–157  
     Mannich reaction 162–163

- catalytic applications of SBs metal complexes (*contd.*)
- Michael addition reaction 159–160
  - oxidation reaction 152–153
  - polymerization reactions 151–152
  - ring-opening epoxidation reaction 154–155
- cationic chiral tridentate Schiff base chromium complex 97
- cationic chromium complexes 98
- Cd SB complexes 86
- chelating agents 9, 11, 17, 38, 39, 121
- chelation effect 39
- chemosensing
- explosives sensing 179, 181
  - high pH sensing 180, 181
  - metal sensing 180–181
  - oxygen sensing 180, 181
  - porphyrinoid-based chemosensors and chemodosimeters 180, 181
- chemosensor technology
- for biological applications 183
  - CN<sup>-</sup> and Al<sup>3+</sup> chemosensor for bioimaging 191
  - fluorescence ON-OFF 184
  - fluorescent chemosensor for AcO<sup>-</sup> detection 189
  - OFF-ON chemosensors 185–186
  - ratiometric fluorescent chemosensors 186, 187
  - rhodamine-based sensors 187–189
- chiral coordination compounds 89
- chiral Cr(Salen)Cl synthesis 98
- chiral iminopyridine-oxazoline (IPO) ligand based iron complexes 156
- chiral Mn (III)-Salen Schiff base complex 90
- chiral SB ligand synthesis 90–93
- chiral SB metal complex synthesis 93–95
- chiral Schiff base ligands 45
- using chiral amines 90–91
  - from (1R)-(+)-camphor 90–91
- chiral Schiff bases 44
- of main group metals 96–102
  - of titanium, zirconium and vanadium 95–96
- chromite (FeO.Cr<sub>2</sub>O<sub>3</sub>) 3
- cisplatin 140, 170
- Click reaction 161–162, 164
- CN<sup>-</sup> and Al<sup>3+</sup> chemosensor for bioimaging 191
- cobalt(II) Salen complexes 98
- conventional/classical Schiff base formation 59
- coordination centre 4, 79
- coordination chemistry 3, 4, 11, 29, 30, 41, 43, 122, 171
- coordination complex chemistry 3
- coordination polymer 45
- copper-Schiff base complex 89
- coumarin-based sensors 186
- coumarinyl-based thioether Schiff base 107
- Cr-Salen complex 98, 154, 161
- crystal field theory 4–5
- current status, India 198–199
- cyanides, addition of organometallic reagents to 61–62
- α-cyanoimine synthesis 63
- cyclopropanation of styrene 45, 89
- cyclopropanation reaction 155–156
- d**
- DC-DC converter 196
- DC power supply 195
- Dean-Stark apparatus 23, 59
- density functional theory (DFT) 113
- based molecular dynamics (MD) techniques 114
  - in biomolecular modelling 114
  - high computing efficiency 115
  - metal complexes of thioether base Schiff base ligand 115–116
  - in Schiff base and their metal complexes 115–118
  - tetra-coordinated ONNO purine based Schiff base and metal complexes 117
- density-functional tight binding (DFTB) approach 115
- deoxyribonucleic acid (DNA) 169

affinity and binding selectivity 171  
 binding mechanism 170  
 cisplatin 170  
 modes of DNA interactions 169  
 Diels–Alder reaction 45, 161, 162, 164  
 Diesbach, Johann Jacob 3  
 4-dimethylamino benzaldehyde and  
   primary amine 31  
 dinuclear Schiff base metal complexes  
   83, 84  
 direct ligand synthesis 24  
 dispersion 113, 182  
 donor atoms in a ligand 9  
 dopants 44, 45  
 dual-emission fluorescent nanoparticles  
   186  
 dyes 30, 124, 183, 185

**e**

electronic excitation, in molecular organic  
   systems 114  
 electronic structure theory 113–115  
 The Electronic Theory of Valency 3  
 enantioselective Henry reaction 45  
 Ene reaction 163–164  
 epoxidation of unfunctionalized olefins  
   90  
 epoxidation reaction 153–155  
 explosives sensing 179, 181

**f**

Fe(Salen)Cl synthesis 98  
 fluorescence ON-OFF 184  
 fluorescent bioimaging of CK in HeLa  
   cells 187  
 fluorescent chemosensor for AcO<sup>-</sup>  
   detection 189–190  
 fluorescent nanomaterials based  
   chemosensors 185  
 fluorophore hybridization chemosensors  
   186  
 FMO theory 117  
 fuel cell electric vehicle (FCEV) 195  
 fuel cell industry 195

**g**

gram staining method 129  
 green method, for SB synthesis  
   73–75  
 Grignard reagent 61  
 grindstone technique 71, 72

**h**

hard-soft acid-base theory 41  
 heterocyclic Schiff bases 14, 15  
 hexadentate 17, 106  
 high pH sensing 180, 181  
 hydrazone-type ligands 12–13  
 hydrogenation reaction 157–158  
 1,3-hydrogen shift 57  
 hydrosilylation processes 30  
 hydrosilylation reaction 156–157

**i**

imines  
    $\alpha$ -amino acids, conversion of 66  
   bond 57  
   synthesis of  
     by active hydrogen compounds 64  
     from nitriles 65  
     from olefins and tertiary alcohols  
       with hydrazoic acid 66  
 integrated solid waste management  
   system (ISWM) 197  
 ionic charge 37  
 ionic size 37

**k**

ketamines  
   from alkali metals and aromatic  
     ketones 63  
 ketimines 62  
   from oximes 65  
   from reaction of phenol and nitriles  
     62–63  
 ketimines/enamines 55

**l**

lanthanide metal Schiff bases 99, 100  
 Lewis acid catalysts 59

- ligand 9  
 achiral nucleating ligand 91  
 field theory 6
- ligand parameters  
 basic character 38  
 chelation effect 39  
 concentration of 38  
 crystal field effect 39  
 size and charge of 38  
 solvation effect 39  
 substitution effect 38  
 thermodynamic and Kinetic effect 39–40
- Linear Stern–Volmer equation 170  
 lithium aluminum hydride 65, 161  
 N-lithium imines 67
- m**
- N-magnesium imines 67  
 Mannich reaction 162–164  
 mechanistic pathway of imine formation 23, 24  
 metal amines, oxidation of 64  
 metal complex 4  
 Mn-SB 97  
 mononuclear Schiff base 26, 82–83  
 N-metallo imines, preparation of 66  
 N-boryl and N-aluminium imines 67  
 metal-organic framework 43  
 metal Salen complexes 94, 97  
 metal sensing 180–181  
 Michael addition reaction 159–160, 164  
 microwave irradiation method, for SB synthesis 70–71  
 mixed ligand rhodium (III) complex 108  
 $ML_2Cl_2$  32  
 molecular orbital theory 5  
 Moller–Plesset perturbation theory 113  
 monodentate 9, 13–15, 39  
 mononuclear distorted square-antiprism Zr (IV) complexes, of SB ligand 85  
 mononuclear octahedral Ti(IV) complexes, of SB ligand 85
- MPPT tracking scheme 198  
 Multiport Converter 197
- n**
- nanocrystals 184  
 nature of central metal ions 37  
 neutral ONNO donor complexes 93  
 nickel Schiff base compounds 107  
 Ni-SB complexes 86  
 nitrones, synthesis of 64  
 $\alpha$ -nitrostyrenes, reduction of 65  
 $N_1, N_3$ -bis(furan-2-ylmethylene)propane-1,3-diamine 140  
 $N, N'$ -bis(salicylidene)-o-phenylenediamine (salphen) 91  
 $N_2O_4S$  donor Schiff base synthesis 107  
 $N_2S_2O_2$  donor Schiff base synthesis 107  
 nucleotides 169
- o**
- octahedral SB metal complexes 86  
 octahedral Zr (IV) complexes of SB ligand 84  
 OFF-ON chemosensors 185–186  
 ONO donor chiral Schiff bases ligand synthesis 99  
 organic fraction of municipal solid waste (OFMSW) 199  
 organolithium reagents 61  
 oxidation  
 of metal amines 64  
 reaction 152–153  
 oxidative addition, of amines 62  
 oxygen sensing 180, 181
- p**
- palladium complexes  
 HOMO and LUMO orbitals 115–116  
 optimized geometries 115  
 PEM fuel cell 198  
 pentadentate 17, 109  
 photocatalyst 125, 151  
 2-(piperazin-1-yl)-N-(thiophen-2-ylmethylene)-ethanamine 137  
 polydentate ligands 9, 105

- polymer chemistry 125
- polymerization reactions 151–152
- porphyrinoid-based chemosensors and chemodosimeters 180
- potentiostatic measurements 197
- power-sharing converter (PSC) 196
- primary aliphatic aldehydes 58
- Prussian blue 3
- pyrene based chemosensors 186
- q**
- QM/MM methods 114
- quantum dots (QDs) 184  
based chemosensors 184–185
- r**
- racemic mixture of Si-SB complex  
synthesis 102
- ratiometric fluorescent chemosensors 186
- (1R)-(+)-camphor 90, 91
- reduction of carbon-nitrogen compounds 65
- rhodamine-based sensors 185, 187
- ring-opening epoxidation reaction 154–155
- s**
- Salen complex formation 94–95
- Salen type ligands 12
- salophen-type ligands 12, 13
- Schiff bases (SB) 55  
analytical, biological, organic and inorganic chemistry 29  
aryl or aromatic aldehyde 55  
bonding modes of  
bidentate 15  
hexadentate 17  
monodentate 14–15  
pentadentate 17  
tetradentate 16–17  
tridentate 15–16  
chemical scheme 10  
definition 9  
fluxional octahedral complex 95  
formation of 23–26  
direct ligand synthesis 24  
rearrangement of heterocycles (oxazoles, thiazoles, etc.) 26  
template synthesis 25–26  
history of 10  
homogeneous and heterogeneous catalysis 30  
mechanism of 10–11, 56–59  
metal complexes 29–34  
organic, inorganic, biological, and analytical chemistry 11  
salophen-type ligands 12  
significance of 79  
types of  
heterocyclic Schiff bases 14  
hydrazone-type ligands 12–13  
Salen type ligands 12  
salophen-type ligands 12  
thiosemicarbazone/carbazone type ligands 13–14
- Schiff base copper (II) complexes 171
- Schiff base metal complexes 79  
agrochemical industry 125  
analytical chemistry 123–124  
antibacterial activity 122  
anticancer and anti-inflammatory agent 122–123  
antifungal activity 123  
catalyst 121–122  
coatings 123  
dinuclear 83, 84  
as a drug in a number of diseases 123  
dyes 124  
mononuclear 82–83  
photocatalyst 125  
polymer chemistry 125  
semi-conducting materials 124  
solar system 124–125  
synthesis of  
one step process or template synthesis 79–83, 84  
using metal acetate salts 82  
using metal alkoxides 81  
using metal alkyl complexes 82

- Schiff base metal complexes (*contd.*)  
 using metal amides 81  
 using metal halides 82–83
- Schiff bases in pharmacological applications  
 anthelmintic activity 142  
 anti-cancer activity of 139–141  
 anticonvulsant activity 142–143  
 antidepressant activity 142  
 antidyslipidemic and antioxidant activity 141  
 antifungal activity of 139  
 anti-inflammatory and analgesic activities 143  
 antimicrobial activity 136–138  
 antioxidant activity 143  
 anti-tubercular activity 142  
 antiviral activity 143
- Schiff bases, synthesis of 61, 68  
 addition of organometallic reagents 61–62  
 aerobic oxidative synthesis 61  
 by calcined egg shells 74–75  
 classical/conventional method 69–70  
 dehydrogenation of amines 64  
 green method using green catalyst 73–75  
 grindstone technique 71–72  
 using hydrazoic acid 66  
 from ketals 65–66  
 by kinnow peel powder 75  
 metal amines, oxidation of 64  
 microwave irradiation method 70–71  
 reaction of metal amides to ketone 63  
 reaction of nitroso compounds with active hydrogen compounds 63–64  
 reaction of phenol with nitriles 62–63  
 reduction of carbon-nitrogen compounds 65  
 using sodium hypochlorite 66  
 ultrasonic method 72–73  
 water as solvent method 71
- second-generation Salen complexes 94
- secondary aliphatic aldehydes 59  
 semi-conducting materials 124  
 semi-empirical techniques 115  
 semicarbazone 12, 57  
 N-silyl-aldimines 67–68  
 N-silylimines preparation 67  
 via reaction of lithium hexalkyldisilylamide 67  
 silylimines synthesis 68  
 Si metal Schiff bases 100  
 Sm(II) Schiff bases 99  
 S-methyl and S-benzyl dithiocarbazate Schiff bases 33  
 Sn metal Schiff bases 100  
 solar system 124–125  
 solid organic wastes (SOWs) 197  
 solid state anaerobic digestion (SS-AD) technologies 197  
 (1S,2R)-1-(((E)-3-bromo-5-chloro-2-hydroxybenzylidene)amino)-2,3-dihydro-1H-inden-2-ol 172  
 (1S,2R)-1-(((E)-2-hydroxy-4-methoxybenzylidene)amino)-2,3-dihydro-1H-inden-2-ol 172  
 (1S,2R)-1-(((E)-2-hydroxy-4-methylbenzylidene)amino)-2,3-dihydro-1H-inden-2-ol 172  
 substitution effect 38  
 sulphur containing proteins 41–42  
 supramolecular chemosensors 184
- t**
- template synthesis 80  
 Cu-complex using 80  
 tetradentate 11, 12, 16–17, 33, 83, 95, 121  
 theories of coordinate bond  
 crystal field theory 4–5  
 ligand field theory 6  
 molecular orbital theory 5  
 valence bond theory 4  
 thioether containing Schiff Base synthesis 107  
 2-(2-aminoethylthio)-N-(thiophene-2-ylmethylene) aniline 109

- (2-benzylthio) aniline 106  
 using 2-(benzylthio) aniline and  
 3-bromo-5-nitro salicylaldehyde  
 109  
 coumarinyl-based 107  
 hexadentate  $N_2O_2S_2$  donor ligand based  
 on thioether 106  
 2-hydroxy-5-methoxybenzaldehyde  
 106  
 2-(methylthio) aniline with  
 5-bromosalicylaldehyde and  
 3,5-dichlorosalicylaldehyde  
 110  
 $N_2S_2O_2$  donor Schiff base 107  
 square planar nickel (II) complexes  
 110  
 1,2,4-triazole Schiff base 106  
 tridentate thioether SB 109  
 thioether Schiff base 41–44, 105–110  
 thiosemicarbazone/carbazone type  
 ligands 13–14  
 N-tin imines synthesis 68  
 Ti(IV) SB complex synthesis 83  
 Ti(Salen) complexes 96  
 Ti(Salen) $X_2$  complexes 96  
 Ti-bis(phenoxyimine) complexes  
 95  
 $TiCl_4$  55, 69, 83, 84  
 time-dependent DFT (TDDFT) technique  
 114  
 tiny molecules chemosensors 184  
 transition metal complexes, chiral Schiff  
 bases 45  
 transketolase inhibitors 106  
 tridentate Schiff bases 15
- U**  
 ultrasonic method 69, 72–73  
 unsymmetrical chiral SB ligand synthesis  
 90  
 unsymmetrical Schiff bases 33, 44  
 ligand synthesis 32
- V**  
 valence bond theory 4  
 vanadium complexes, synthesis of 84  
 vitamin B12 29  
 VO(Salen) complex 96
- W**  
 Werner's coordination theory 3  
 Wolf-Shimer equation 170
- Z**  
 zero-ripple boost converter (ZRBC) 196  
 zero-ripple filter (ZRF) 196  
 zero-voltage switching (ZVS) 196  
 zinc (II) Salen complexes 99  
 zirconium Schiff bases 96  
 Zn SB complexes 86  
 Zn Schiff bases 99  
 Zr-bis(phenoxyimine) complexes 95







