

Index

a

acetaldehyde-ammonia (AAA) trimer
293

acetaldehyde (AA) ammoximation 293

acid sites regulation 300

ADOR

- assembly 126
- disassembly 127
- liquid-phase 128–129
- organization 127
- reassembly 127–128
- reverse 141–142
- vapour-phase 135–136

aldol reaction 55, 72, 78

alkaline-assisted metalation 54, 64

alkene epoxidation

- cases 329–335
- catalytic process of 327
- catalyzed by titanosilicate zeolites
326–329

alkyl lactates synthesis 55, 75–76

4-amino-2,2,6,6-tetramethylpiperidine
(TEMP) 37

ammoximation

- carbonyl compounds 290–295
- DMK 292
- of ketones and aldehydes 284–285
- of ketones or aldehydes 286
- MEK distribution 292
- regulation of Ti active sites 296–298
- titanosilicate-catalyzed 288–290
- titanosilicate/H₂O₂ system 295–296

amorphous pillars 124, 143

α -oxygen model 375

atom-planting method 54, 63–64, 392

Au particle properties

- oxidation states 408
- sites location 408, 409
- sizes 406–407

Au/TiO₂ catalyst 404, 405, 407, 408, 410,
414

Au-Ti synergy 404–406

Au/TS-1 catalyst 326, 407–409, 411, 413,
414

b

Baeyer–Villiger oxidation 34, 39, 44, 54,
68–69, 141, 231, 267

Beckmann rearrangement 1, 283, 305,
306, 308

benzene adsorption energy 376

benzene conversion 367, 369, 371, 373,
377–381

benzene hydroxylation 379

- to phenol 377–378

benzene oxidation 367–369, 371–373,
376, 377, 380

benzene to phenol conversion 369

beta structure 57–59, 64, 227

bicontinuous microemulsion droplets
(BMDs) 159

biomass conversion

- γ -valerolactone synthesis 76–77
- 5-(hydroxymethyl)furfural (HMF)
synthesis 74–75

- biomass conversion (*contd.*)
 lactic acid or alkyl lactates synthesis
 75–76
 sugar isomerization 73–74
- biomimetic catalysis 435
- bottom-up approaches 16
 dry-gel conversion methods 59–60
 hydrothermal synthesis 56–59
 interzeolite transformation 60–62
 structural reconstruction strategy
 62–63
- Bronsted acid 44, 112, 333, 374
- C**
- CAT 368, 380, 381, 383
- catalyst activation step 435
- catalytic ammoximation activity
 acid sites regulation 300
 enhancement of diffusion properties
 298–299
 hydrophobicity improvement 299–300
- catalytic ammoximation stability
 300–302
- catalytic recyclability
 of Fe- and Ti-containing zeolites 381
 of Fe-containing zeolites 383, 384
- cationic surfactant (CTA⁺) 153, 155,
 164, 384
- ¹²C/¹³C isotope tracer techniques 439
- CDO-type layered zeolites 40
- cetyltrimethyl-ammonium (CTA⁺) 153
- cetyltrimethyl-ammonium bromide
 (CTAB) 357
- chlorohydrin process 325, 347, 348, 363,
 403
- CIT-13 case 132–134
- CMHPPO process
 hierarchical titanasilicates for
 357–361
 industrial 362–363
 mesoporous Ti-doped catalysts for
 352–357
- CO-adsorption 425
- continuous slurry-bed reactors
 302
- CrO_x/Al₂O₃ catalysts 424–426
- Cr-Ti-based photocatalysts 455
- cumene method 368
- Cu-MOR catalyst 435
- cyclohexanone
 ammoximation 290–295
 ammoximation and oxidation of
 263–265
- cyclohexanone oxime 263, 283–285, 290,
 304, 305, 307, 308, 311
- d**
- delay addition and second crystallization
 strategy 165
- demetallation–metalation 54, 64–67
- dendritic mesoporous silica nanoparticles
 (DMSNs)
 nanopores for 169–172
 one-pot doping strategy for 165–167
 pore and particle sizes of 155, 157
 surface metal complexes, post-grafting
 for 167–169
 synthetic methods of 155, 160
 unified formation mechanism of 155,
 159–164
- dichloropropanol (DCP) 333
- dihydroxybenzenes (DHB) 367, 381–382
- dimethyl dichlorosilicane (DCDMS)
 183
- dimethyldipropylammonium hydroxide
 (DMDPAOH) 13
- dimethyl ketone (DMK) 290, 292
- direct metalation
 alkaline-assisted metalation 64
 atom-planting method 63–64
 interlayer-expanded method 63
- d*-orbitals 431
- dry-gel conversion methods 59–60, 66
- e**
- ε-caprolactam (CPL) 283, 304–306, 308,
 311
- electron-withdrawing effect 267
- epoxides compounds 323

- ethane dehydrogenation
 metallosilicates for non-oxidative 430–431
 metallosilicates for oxidative 431–432
- ethylbenzene hydroperoxide process 349
- ethylene epoxidation
 to EG 334–335
 to EO 334–335
- ETSs synthesis 17–18
- extended X-ray absorption fine structure (EXAFS) 220, 326, 408, 425
- extra-large-pore titanosilicates
 ETSs synthesis 17–18
 mesoporous titanosilicates synthesis 15–17
- f**
- Fe-containing molecular sieves 378–379
 active formation 373–374
 catalytic mechanism 374–377, 385, 387
 catalytic recyclability 383–384
 deposition of coke species 377
 hierarchically porous structure 383–384
 pore structure effect 371–373
 reaction conditions effect 382–383
- Fe state 383
- Fe-ZSM-5 226, 228, 367, 372, 378, 379, 383, 384
- furfural ammoximation 294, 295
- g**
- gas-phase reactions
 benzene hydroxylation to phenol 377–378
- Fe-containing molecular sieves 371–377
- heteroatomic molecular sieves 368–370
- Ge-doped SiO₂ 88
- Gemini-type OSDA 358
- Ge, price of 108
- Ge removal
 in post-synthesis 109
 in zeolite synthesis 108–109
- germanate
 and germanosilicate zeolite 93, 97
 and silicogermanates 90
- germanium silicate 88
- germanium silicon oxides 88
- germanosilicates
 catalytic research of 112
 derived catalysts 142–144
 derived zeolites 44–45
 Ge and catalytic research of 108–112
 glass 88–89
 inorganic structure-directing effects 93–94
 isomorphous substitution in 89, 92
 organic structure directing agents in 94–105
 silicogermanates 106–108
 UTL to IPC-1P 121–125
- germanosilicates/silicogermanates
 composition and structure 106
 pore opening 106–108
- germanosilicate zeolite
 germanate and 93, 97
- Ge/Si oxides
 property of 87–88
- glucose isomerization 268–272
- γ-valerolactone synthesis 76–77
- h**
- HAADF-STEM 425
- Halcon process 347–349
- heteroatom-containing zeolites
 built from fer-layers 36–41
 germanosilicate-derived zeolites 44–45
 MFI-type layered zeolites 41–44
 MWW-type layered 32–36
 and their derivative 32–37
- heteroatomic molecular sieves 368–370
- hexamethyldisilazane (HMDS) 16, 356, 413
- hexamethyldisiloxane (HMDSO) 184, 413
- hexamethyleneimine (HMI) 7, 57, 185, 300

HF/pyridine 9
 H_2O_2 378, 379
 hollow titanium silicate (HTS) zeolite
 333
 holy grail reaction 439
 HOMO 327, 404
 HQ (HQ) 381
 hydrogen peroxide 2, 258
 hydrogen peroxide propene oxide (HPPO)
 and CMHPPO routes 349–350
 reaction 328, 329
 hydrolytic stability and hydrolysis 122
 hydrophobicity effect 412–413
 hydrothermal method 370, 414
 hydrothermal synthesis
 beta structure 57–59
 MFI structure 56–57
 MWW structure 57
 others structure 59
 hydroxylamine route 288
 5-(hydroxymethyl)furfural (HMF)
 synthesis 74–75

i

imine route 288
 indocyanine green (ICG) 167
 industrial CMHPPO process
 CHP generation 362
 propylene epoxidation 362–363
 inelastic neutron scattering (INS) 405
 infrared spectroscopy 405
 inorganic structure-directing effects
 F⁻ 94
 Ge 93
 in-situ synthesis of hydrogen peroxide
 435–436
 interlayer-expanded method 63
 interlayer expanded zeolites (IEZ)
 124
 interzeolite conversion 60
 interzeolite transformation 60–62
 isomorphous substitution
 Ge in silicates 92–93
 Si in germanate 89–92
 IWW case 134–135

k

ketone ammoximation 302, 305

l

lactic acid synthesis 75–76
 large-pore titanosilicates 13–14
 Ti-beta synthesis 9–10
 Ti-MOR synthesis 10–11
 Ti-MSE synthesis 12–13
 LEIS 405
 Lewis acid catalysis
 aldol reaction 72
 propane dehydrogenation 73
 ring opening of epoxides 71–72
 ligand-to-metal charge-transfer (LMCT)
 448, 451
 liquid-phase ADOR 128–129
 CIT-13 case 132–134
 IWW case 134–135
 UOV case 134
 UTL case 129–132
 liquid-phase reactions
 Fe- and Ti-containing zeolites 381
 Fe-containing molecular sieves
 378–379
 microporous crystalline titanosilicates
 379–381
 local surface plasmon resonance (LSPR)
 effect 172
 LTS-1 zeolite catalyst 359
 LUMO 258, 327, 404–405

m

medium-pore titanosilicates
 Ti-MWW 6–8
 TS-1 5–6
 TS-2 8–9
 Meerwein–Pondorf–Verley redox
 70–71
 mesoporous channel system 353
 mesoporous silica (MS) 449
 mesoporous silica nanoparticles (MSNs)
 153
 mesoporous Ti-containing materials
 410–411

- mesoporous Ti-doped catalysts
 mesoporous channel system 353
 surface hydrophobicity and acidity 353–357
 tetrahedral Ti sites 353
- mesoporous titanosilicates synthesis 15–17
- methane
 direct partial oxidation of 436–439
 in-situ synthesizing hydrogen peroxide for 435–436
 to methanol 434–435
- methane monooxygenase 434
- MFI structure 56–57
- MFI-type layered zeolites 41–44
- microporous crystalline titanosilicates 379–381
- microporous Ti-containing materials 411–412
- molecular fence 436
- molecular gate effect 17
- MWW structure 57
- n**
- non-catalytic oximation 289
- NPs preparation
 of bimetallic metal 457–458
 of monometallic 456–457
- nuclear magnetic resonance (NMR) 230, 439
- o**
- octahedral coordination geometry 456
- one-pot doping strategy 165–167
- one-pot synthesis method 425
- organic linkers 125
- organic structure directing agent
 families of 95–105
 types and revolutions 94–95
- organic structure-directing agent (OSDA) 89, 358
- oxidation desulfurization (ODS) 265–267
- oxime/alkane solution 306
- p**
- p*-benzoquinone 381–382
- pH-assisted delay addition 165
- phenol
 benzene oxidation to 367
 conversion 368
 hydroxylation 368
- photo-assisted deposition (PAD) method 448
- photoelectric effect 219
- pillaring 123–124
- piperidine (PI) 57, 298
- platinum-based catalysts 426
- PO formation rate 414
- polydiallyldimethylammonium chloride (PDADMAC) 62
- PO production
 chlorohydrin process 347, 348
 ethylbenzene hydroperoxide process 349
 Halcon process 347–349
 HPPO and CMHPPO routes 349–350
 propylene epoxidation for 329–331
 technology and producers 346
- pore opening 106–108
- post-atom planting method 12
- promoters effect 413–415
- propane dehydrogenation 73
- propylene epoxidation
 Au particle properties 406–407
 Au-Ti synergy 404–406
 hydrophobicity effect 412–413
 mesoporous Ti-containing materials 410–411
 for PO production 329–331
 promoters effect 413–415
 propylene chloride 331–333
 techniques and processes 336–339
 Ti-SiO₂ materials 410
- protic molecule 201
- PtSn/Al₂O₃ catalysts 424
- pulse-quench method 237

q

- quantum mechanics/molecular mechanics (QM/MM) approach 255
- quantum size effect 447

r

- Raman light source 230
- Raman spectroscopy
 - active metal-oxygen species 228–230
 - synthesis mechanism and assembly of 228
- rapid detection test 302
- reactants diffusion 377
- redox catalysis
 - Baeyer–Villiger oxidation 68–69
 - Meerwein–Pondorf–Verley redox 70–71
- reductive degermanation 136–137
- reverse ADOR 141–142
- ring opening of epoxides 71–72

s

- second-harmonic generation (SNG) 88
- self-pillared MFI zeolite 43
- silicate mesophase 153
- silicogermanates 88
 - germanate and 90
- siloxane linkers 124
- silylation/organic group 356
- silylation reagents 183
- Sinclair–Catlow mechanism 405
- single-site photocatalysts 447
- single-site Ti-oxide 450
- slow disassembly approach 141
- Sn-doped zeolites
 - glucose isomerization 268–272
 - other catalytic reactions 272–273
 - substitution T sites and acidity 267–268
- solid grinding method 407
- solid-state NMR spectroscopy
 - of active site proximity 233–235
 - of host-guest interactions 233–235
 - of metal elements 231–233

- of reaction mechanisms 235–238
- solid-state transformations 137–138
- solvent effect
 - on adsorption/desorption 199–200
 - on diffusion 197–199
 - on surface reactions 197, 200
 - on Ti–O–O–H formation 200–202
 - on Ti–O–O–H stability 202–203
 - on Ti–O–O–H transfer 203–204
- structural-activity relationship 255
- structural reconstruction strategy 62–63
- structure-directing agents (SDAs) 31, 119
- structure stabilisation
 - degermanation 139–140
 - functionalization with catalytic sites 140–141
 - slow disassembly 141
- styrene monomers (SM) 349
- sugar isomerization 73–74
- surface acidity 353–357
- surface hydrophobicity 353–357
- surface metal complexes, post-grafting 167–169
- synchrotron radiation (SR) source 219

t

- tandem ammoximation reactions 306–310
- temperature programmed desorption (TPD) 405
- tert*-butyl hydroperoxide (TBHP) 167, 184
- tetraalkoxysilane-assisted self-emulsification templating (TASET) 162–163
- tetrabutyl ammonium hydroxide (TBAOH) 59, 298
- tetrabutyl titanate (TBOT) 357
- tetraethoxysilane (TEOS) 163
- tetraethyl orthosilicate (TEOS) 302, 357
- tetrahedral Ti sites 353
- tetrapropylammonium bromide (TPABr)

- tetrapropylammonium hydroxide
(TPAOH) 5, 298, 378, 425
- tetrapropyl orthotitanate (TPOT) 451
- thermodynamic equilibrium 426
- thin films
with metal oxide species 452–454
with Ti-oxide species 450–452
- Ti active sites
adjacent silanol groups of 193–196
ammoximation regulation of 296–298
content 184–186
coordinate state of 191–193
distribution 186–187
electrophilicity of 187–191
- Ti-based single-site photocatalysts 454,
455
- Ti-Beta synthesis 4, 9–10
- Ti/defect mechanism 405
- Ti-doped zeolites 254–255
active site with H_2O_2 258–261
ammoximation and oxidation of olefins
263–265
epoxidation of olefins 261–263
Lewis acid 257–258
oxidation desulfurization (ODS)
265–267
tetrahedral (T) sites for substitution
255–257
- Ti-MCM-68 12, 13, 254, 388
- Ti-MOR synthesis 10–11
- Ti-MSE synthesis 12–13
- Ti-MWW synthesis 6–8
- Ti-SiO₂ materials 410
- titanium oxide photocatalysts 448
- titanosilicate-based bifunctional catalysts
306–310
- titanosilicate catalysts 288–290
- titanosilicate/ H_2O_2 catalytic system 265
- titanosilicate/ H_2O_2 system 295–296
- titanosilicate molecular sieves
pore structure effect 387–389
reaction conditions effect 391–392
solvent effect 389–391
Ti species, stability of 392–393
- titanosilicates
hierarchical 182–183
structures 286
surface hydrophilicity and
hydrophobicity 183–184
- titanosilicates/ H_2O_2 system (TS/ H_2O_2
system) 181
- titanosilicate zeolite
catalytic performance 332
reaction routes of 332
- top-down approaches
demetallation–metalation 64–66
direct metalation 63–64
- tracer chromatographic method 199
- transition metal complexes 393
- 1,3,5-trimethylbenzene (TMB) 371
- TS-1 synthesis 5–6, 8
- TS-2 synthesis 8–9
- turnover frequency (TOF) 69, 167, 360,
370
- U**
- UOV case 134
- UTL case 132
continuously tuneable porosity
129–131
kinetics 131
unfeasible zeolites 131–132
- UTL to IPC-1P 121–125
amorphous pillars 124
hydrolytic stability and hydrolysis 122
intercalation 122–123
linkers 124–125
pillaring 123–124
- UV-light irradiation 449, 450, 453–457
- UV-VIS-NIR
of framework and non-framework
metal species 224–226
ion exchange sites of zeolites 226–227
- V**
- vapour-phase ADOR 135–137
- visible light irradiation 378, 449,
453–455

W

wrinkled silica nanoparticles (WSNs)
155, 161

X

X-ray absorption near edge structure
(XANES) 326
X-ray absorption spectroscopy (XAS)
217, 219–222, 226, 238, 451
X-ray photoelectron spectroscopy (XPS)
217, 222–224, 309, 326, 405

X-ray technique 217–224

XRD technique 217–219

Z

zeolite-based catalysts

ethane dehydrogenation 439

methane oxidation 439

for non-oxidative PDH 425–426

for oxidative PDH 426–429

zeolite Y as catalysts 393

ZSM-5 zeolites 63, 231, 368, 369, 374

