

Index

a

- absorption, for VOCs removal 135
- acetylene production 374–377
- acid–base reactions 244–251
 - conductivity changes 246–251
 - pH changes 246–251
- activated carbon (AC) 290–291
- active oxides, in catalysts preparation 55–56
- adsorption 175–177
 - for VOCs removal 135
- aerosols, plasma chemistry induced by discharge plasmas in 215–217
- aliphatic compounds 275–279
 - dimethylsulfoxide 277–279
 - methanol 275–277
 - tetranitromethane 279
- alumina (Al₂O₃), in catalysts preparation 49–50
 - flame hydrolysis 49
 - neutralization 49
 - spray pyrolysis 49
 - transition alumina synthesis by thermal treatment 49
- aluminum phosphate (APO) 53
- anode directed streamers 13
- aqueous-phase chemistry of electrical discharge plasma 243–293, *See also* organic dyes; plasmachemical decontamination of water
 - aliphatic compounds 275–279
 - in water and in gas–liquid environments 243–293
- aqueous-phase plasma-catalytic processes 279–292
 - activated carbon (AC) 290–291
 - iron 280–284
 - platinum 284–286
 - silica gel 291
 - titanium dioxide 288–290
 - tungsten 286–288
 - zeolites 291–292
- aqueous-phase plasmachemical reactions 243–259
 - acid–base reactions 244–251
 - oxidation reactions 244, 251–256
 - photochemical reactions 245, 257–259
 - reduction reactions 244, 256–257
- aromatic hydrocarbons 260–267
 - phenol 260–263
- aryl carbonium ion dyes 271–275
 - diarylmethanes 271
 - malachite green (MG) 271–272
 - methylene blue (MB) 273
 - triphenylmethanes 271
- atmospheric pressure glow discharges (APGDs) 21
- attrition milling 59
- autothermal reforming 356
 - of liquid fuels 378–381
 - of methane 378
 - reforming with carbon dioxide and oxygen 381
- azo dyes 268–270

b

- background ionization 16
- bacterial inactivation, post-discharge phenomena in 327–330
 - temporal post-discharge reaction phenomenon 327
- ball-formed catalysts 68
- ball-milling-assisted hydrothermal synthesis 59
- barrier discharges 2–3
 - discharges at atmospheric pressure 2

- bioelectrics 335–336
 - biofiltration, for VOCs removal 135
 - biological effects of electrical discharge plasma 309–337
 - microbial inactivation by nonthermal plasma 310–317
 - in water and in gas–liquid environments 309–337
 - Birkeland–Eyde process 207
 - branching, streamers 18–20
 - breakdown field 5
 - bubbles, plasma chemistry induced by discharge plasmas in 214–215
 - bulk ionization mechanisms 4–5
- c**
- capillary impregnation 60
 - carbon dioxide dry reforming 369–373
 - coupling to higher hydrocarbons 372
 - of higher hydrocarbons 372–373
 - of methane to syngas 369–372
 - carbon dioxide reforming (CDR) 357, 381
 - carbon nanotubes 74
 - carbonyl dyes 270–271
 - catalysis and plasma catalysis, comparison 160–161
 - catalysts forming 67–73
 - ball-formed catalysts 68
 - extrusion 70–72
 - foams 72
 - metal textile catalysts 73
 - pelletization 69–70
 - spherulizing 69
 - tableting 67–68
 - catalytic NO_x remediation from lean model exhausts gases, NTP-assisted 112–123
 - composite catalyst concept 117
 - consumption of oxygenates and RNO_x 112–114
 - – conversion of NO_x and total HC versus temperature 112–113
 - – GC/MS analysis 113–114
 - NTP advantages 114–117
 - NTP reactor coupling with catalyst reactor for catalytic-assisted deNO_x 116–117
 - catalytic processes 45–77. *See also*
 - plasma-assisted catalytic processes
 - oxidation, for VOCs removal 134
 - cathode directed streamers 13
 - chemical energy efficiency 360
 - chemical mechanisms of electrical discharge plasma 317–330
 - interactions with bacteria in water 317–330
 - – bacterial structure 319–320
 - – peroxyinitrite 325–327
 - – reactive nitrogen species 324–327
 - – reactive oxygen species 320–324
 - chemical processes induced by discharge plasma directly in water 217–224
 - issues in 221–222
 - plasma characteristics effect 222–224
 - solution properties effect 222–224
 - water dissociation by discharge plasma in water 217–221
 - chemical vapor infiltration (CVI) 64
 - Chick–Waston approach 316
 - cold atmospheric pressure (CAP) plasma 27
 - cold nonthermal discharge 4
 - colony forming unit (CFU) 311
 - combined heat powers (CHPs) 90
 - DBD effect on methane oxidation in 106–107
 - complex package 61
 - composite catalyst concept 117–119
 - propene- deNO_x on ‘ Al_2O_3 /// Rh–Pd/ $\text{Ce}_{0.68}\text{Zr}_{0.32}\text{O}_2$ /// Ag/ $\text{Ce}_{0.68}\text{Zr}_{0.32}\text{O}_2$ ’ composite catalyst 118–119
 - – GC/MS analysis of gas compounds at the outlet of catalyst reactor 119
 - – NO_x and C_3H_6 global conversion versus temperature 118–119
 - condensation, for VOCs removal 136
 - conventional solid state reaction 59
 - conversion 139
 - coprecipitation-impregnation 59, 61
 - coprecipitation method 57, 59
 - coupled with reactive grinding 58
 - coprecipitation-sedimentation 61
 - corona discharges 137
 - corona streamer discharges 2–3
 - coronas 9–20
 - applications 9–11
 - continuous corona discharges 10
 - DC corona discharges 10
 - occurrence 9–11
 - positive-polarity-pulsed corona 11
 - pulsed corona 11
- d**
- deNO_x reaction, plasma-assisted 90–96
 - NTP-assisted deNO_x reaction 95
 - release of N_2 90
 - – function F1 91
 - – function F2 90
 - – function F3 90, 93
 - three-function catalyst model 90
 - – $T_{\text{HC}} = T_{\text{NO}}$ 92

- – $T_{\text{HC}} \ll T_{\text{NO}}$ 91
 - – $T_{\text{HC}} \gg T_{\text{NO}}$ 94
 - density functional theory (DFT) 277
 - deposition by electroless plating 61
 - deposition–precipitation method 66
 - diarylmethanes 271
 - dichloroacetyl chloride (DCAC) 162
 - dielectric barrier discharges (DBDs) 4, 26–32, 89, 173, 353
 - applications of 31–32
 - basic geometries 26–28
 - effect on methane oxidation 106–107
 - main properties 29–30
 - diffusional impregnation 60
 - dimethylsulfoxide 277–279
 - discharge with water spray 314
 - discharges at atmospheric pressure 2
 - barrier discharges 2–3
 - corona streamer discharges 2–3
 - dry carbon dioxide reforming 357
 - dry gas plasma 311–313
 - dry mixing 61
- e**
- electric field effects 335–336
 - electrical discharge plasma in gas–liquid environments and in liquids 185–224, *See also* aqueous-phase chemistry of electrical discharge plasma
 - in bubbles and foams 214–215
 - chemical processes induced by discharge plasma directly in water 217–224, *See also individual entry*
 - electrode configurations 186
 - elementary chemical phenomena in 185–224
 - elementary physical phenomena in 185–224
 - gas-phase chemistry with water molecules 201–210
 - – emission spectra 205
 - – hydroxyl radicals in 204–205
 - – optical emissions spectroscopy 205
 - in gas phase with water vapor 188–189
 - – discharge in bubbles 191–192
 - – discharge with droplets and particles 192–193
 - in gas–liquid systems 189–193
 - – point-to-plane discharge 191
 - plasma-chemical reactions at gas–liquid interface 210–214
 - plasma generation
 - – discharge over water 189–191
 - – in gas–liquid environments and liquids 188–199
 - – physical mechanisms 188–199
 - plasma generation directly in liquids 193–199
 - – physical observations 198
 - – point-to-plane discharge 195–196
 - – thermal energy balance 197–199
 - primary chemical species formation by discharge plasma in contact with water 199–217
 - – chemical species in gas phase with water vapor 199–210
 - in water spray and aerosols 215–217
 - electrical discharge plasma in water and in gas–liquid environments 309–337
 - biological effects of 309–337, *See also under* biological effects
 - electrical discharge plasma interactions with living matter 330–336
 - electron energy distributions 1–2
 - electroplating 62–64
 - electroporation 335
 - electrostatic precipitator (ESP) 10
 - electrosurgical plasmas 334–335
 - Eley–Rideal mechanism 284
 - embedded nanoparticles 62
 - extracorporeal shockwave lithotripsy (ESWL) 333
 - extrusion 70–72
 - cylinders 71
 - honeycombs 71
 - miniliths 71

f

 - Fenton's process 280–281, 285–286
 - flame hydrolysis 49–51
 - foams 72
 - plasma chemistry induced by discharge plasmas in 214–215
 - fuel production efficiency 359
 - full width at half maximum (FWHM) pulses 98
 - fullerenes 74

g

 - gas discharge in bubbles 314
 - gas hourly space velocity (GHSV) 108, 356, 360–361
 - gas–liquid interface, plasma-chemical reactions at 210–214
 - emissions spectroscopy of 212
 - glow discharge electrolysis 211
 - hydrogen peroxide formation 213

- gas–liquid interface, plasma-chemical reactions at (*contd.*)
 - laser-induced fluorescence (LIF) spectroscopy of 212
 - reactions of ozone 213
 - gas to liquid hydrocarbon fuels (GTL) 355
 - gliding arc plasma reactor 376
 - gliding arcs 32–34
 - global warming 132
 - glow discharge plasma electrolysis 364
 - glow discharges at higher pressures 4, 20–26
 - glow-to-spark transition 20
 - high-pressure glow discharges 21
 - instabilities 25–26
 - low-pressure glow discharge 20
 - properties 21–22
 - spark/arc formation 20
 - studies 22–25
 - – DC glow 23
 - – microglow discharges 23
 - – microplasmas 24
 - – nanosecond-pulsed discharges 25
 - – Townsend mode 3
 - glycerol 377
- h**
- Haber-Weiss process 282
 - heterocyclic aromatic hydrocarbons 265–267
 - homogeneous breakdown 14
 - Hüls process 358, 374–375
 - humid gas plasma 313
 - hybrid models 14
 - hydrocarbons, hydrogen and syngas
 - production from 353–384
 - autothermal reforming 356
 - description and evaluation of the process 358–360
 - dry carbon dioxide reforming 357
 - energy balance 359–360
 - – efficiency 359–360
 - – energy requirement 359–360
 - materials balance 358–359
 - – conversion 358–359
 - – selectivity 358–359
 - – yield 358–359
 - partial oxidation (POX) 356–357
 - plasma-assisted reforming 360–382
 - – autothermal reforming of liquid fuels 378–381
 - – autothermal reforming of methane 378
 - – carbon dioxide dry reforming 369–373
 - – combined processes 377–382
 - – partial oxidation 365–369
 - – plasma pyrolysis 373–377
 - – steam reforming 360–365
 - pyrolysis 357–358
 - steam reforming (SR) 355–356
 - hydrogen peroxide 254, 321–324
 - OH radical attack on proteins 322
 - hydrogen production from hydrocarbons 353–384
 - current state of 354–358
 - hydrogen radical 256–257
 - hydrothermal reactions 48, 51–53, 56, 59
 - hydroxyl radical 252–253, 320–321
- i**
- ignition method 59
 - impact ionization 4–5
 - impregnation 59, 61, 66
 - capillary 60
 - diffusional 60
 - incipient wetness impregnation 60
 - wet impregnation 60
 - inception voltage 14
 - incipient wetness impregnation 60
 - initiation cloud 16–18
 - in-plasma catalysis (IPC) 97, 141, 171
 - interaction, streamers 18–20
 - intimate mixed oxides 56
 - iron 280–284
 - catalytic cycle, in plasmachemical degradation of phenol 282–284
- l**
- Langmuir–Hinshelwood (LH) model 179
 - late streamers 16–18
 - living matter, electrical discharge plasma interactions with 330–336
 - electric field effects and bioelectrics 335–336
 - physical mechanisms of 330–336
 - – shockwaves 332–334
 - – UV radiation 331–332
 - – x-ray emission 332
 - thermal effects and electrosurgical plasmas 334–335
 - local field approximation 5
 - lumped resistor approach 22
- m**
- malachite green (MG) 271–272
 - mechanical mixing 59, 61

membrane separation, for VOCs removal 136

metal catalysts 62–67

- preparation
- – via chemical vapor infiltration 64
- – via electroplating 62–64
- embedded nanoparticles 62
- metal wires 64–65
- nanowires 65
- supported metals 65–66
- supported noble metals 66–67

metal-containing molecular sieves 53–55

metal oxides on metal foams and metal textiles 61–62

metal textile catalysts 73

metal wires 64–65

methane catalytic oxidation, NTPs in 105–112, *See also under* nonthermal plasmas (NTPs)

- effect of catalyst composition 107–110
- – effect of support 107–108
- – effect of noble metals 108–109
- – palladium-based catalysts 108–109
- – platinum-based catalysts 109
- influence of water in CHP conditions 109–110
- – coupled plasma–Pt(X)/Al₂O₃ or plasma–Pd(X)/Al₂O₃ 110
- – influence of wet mixture on support 110
- – on palladium-based catalysts 110
- – on platinum based catalysts 110

methanol 275–277

- methanol pyrolysis 377

methylene blue (MB) 273–274

microbial inactivation by nonthermal plasma 310–317

- bacterial inactivation
- – by DBD plasma 312
- – by glow discharge plasma 312
- – by microwave plasma 311
- dry gas plasma 311–313
- gas plasma in contact with liquids 313–314
- – discharge over water and hydrated surfaces 313–314
- – discharge with water spray 314
- – gas discharge in bubbles 314
- humid gas plasma 313
- kinetics of 315–317
- – sterilization 316–317
- – viability tests 316–317
- plasma directly in water 314–315

microdischarges 29, 96

microscopic discharge mechanisms 4–6

- bulk ionization mechanisms 4–5
- surface ionization mechanisms 6

microwave discharge 3

minimal streamers 17

mixed oxides, in catalysts preparation 56–59

- intimate mixed oxides 56
- perovskites 56–59

Monte Carlo model 14

moving boundary models 14

multi-walled nanotubes (MWCNTs) 75

n

N-acetylglycosamine (NAG) 319

N-acetylmuramic acid (NAM) 319

nanosecond pulsed DBD reactor coupled with a catalytic deNO_x reactor 97–99

nanowires 65

neutralization 49

noble metal catalysts, in VOCs removal 140

nonequilibrium plasmas at atmospheric pressure 1–34, *See also* microscopic discharge mechanisms

- barrier discharges 2, *See also* dielectric barrier discharges (DBDs); surface discharge
- corona streamer discharges 2, *See also* coronas; streamers
- electron energy distributions 1–2
- gliding arcs 32–34
- glow discharges at higher pressures 20–26, *See also individual entry*
- nonthermal plasmas 1–2, *See also* nonthermal discharges

nonthermal discharges 1–2

- barrier discharges 2
- chemical activity 6–8
- – ozone production 6–7
- cold nonthermal discharge 4
- corona streamer discharges 2
- diagnostics 8–9
- – nitrogen-containing discharges 9
- – optical emission spectroscopy 9
- glow discharges 4
- microwave discharge 3
- Townsend discharge 4
- transient discharges 3
- transition to sparks, arcs, or leaders 4

nonthermal plasmas (NTPs) 89, 137–139

- catalytic NO_x remediation from lean model exhausts gases 112–123, *See also individual entry*
- chemistry 100–102
- for environmental applications 89

- nonthermal plasmas (NTPs) (*contd.*)
 - kinetics 100–102
 - methane catalytic oxidation on
 - alumina-supported noble metal catalysts 105–112
 - – DBD effect in CHP conditions 106–107
 - – effect of catalyst composition 107–110
 - – effect of dielectric material 106
 - – effect of water 106
 - microbial inactivation by 310–317
 - NO_x remediation 89–90, 96–105
 - – nanosecond pulsed DBD reactor coupled with a catalytic deNO_x reactor 97–99
 - – UHCs presence, importance 96–97
 - NTP assisted catalytic deNO_x reaction in presence of multireductant feed 119–123
 - – conversion of NO_x and global HC versus temperature 119–120
 - – GC/MS analysis 120–123
 - NTP-assisted deNO_x reaction 95
 - plasma energy deposition and energy cost 102–105
 - NO_x abatement by plasma catalysis 89–125
 - general deNO_x model over supported metal cations 90–96, *See also* deNO_x reaction, plasma-assisted
 - nonthermal plasma-assisted catalytic NO_x remediation 89–90, *See also* nonthermal plasmas (NTPs)
- o**
- organic dyes 267–275
 - aryl carbonium ion dyes 271–275
 - azo dyes 268–270
 - carbonyl dyes 270–271
 - oxidation reactions 251–256
 - hydrogen peroxide 254
 - hydroxyl radical 252–253
 - organic radicals 253
 - ozone 253–254
 - peroxyxynitrite 255–256
 - oxides and oxide supports, in catalysts
 - preparation 49–52, *See also* alumina (Al₂O₃); silica (SiO₂); titanium dioxide (TiO₂); zirconium oxide (ZrO₂)
 - oxygen, reforming with 381
 - ozone 253–254
- p**
- packed-bed discharges 30–31, 138
 - palladium-based catalysts 108–109
 - partial oxidation (POX) 356–357, 365–369
 - conversion of higher hydrocarbons 367–369
 - conversion of methane 365–367
 - pelletization 69–70
 - perhydroxyl radical (HO[•]₂) 257
 - perovskites 56–59
 - attrition milling 59
 - conventional solid state reaction 59
 - coprecipitation 57, 59
 - – coupled with reactive grinding 58
 - hydrothermal synthesis 59
 - – ball-milling-assisted 59
 - ignition method 59
 - reactive grinding of single oxides 58
 - sol–gel route 57
 - solid state reaction of mixed oxides 57
 - sol-precipitation method 59
 - spray pyrolysis 57
 - peroxone process 254
 - peroxyxynitrite 255–256, 325–327
 - reactivity with lipids 326
 - phenol 260–263
 - nitration of 263
 - nitrosation of 263
 - OH[•] radical attack on phenol ring 261
 - ozone radical attack on phenol ring 261
 - photocatalysis, for VOCs removal 134
 - photochemical reactions 245, 257–259
 - photolysis of ozone 258
 - use of UV radiation 258
 - photochemical smog 132
 - photo-Fenton reaction 282
 - photoionization 15–16
 - placed postplasma (PPC) 97
 - plasma-activated water (PAW) 327
 - plasma-assisted catalytic processes 45–77, *See also* catalysts forming; metal catalysts
 - activation 45–77
 - catalysts preparation methodologies 49–67
 - – active oxides 55–56
 - – mixed oxides 56–59
 - – oxides and oxide supports 49–52
 - – supported oxides 59–62
 - – zeolites 52–55
 - chemical composition and texture 47–48
 - – hydrothermal syntheses 48
 - – precipitation 48
 - – template-assisted syntheses 48
 - elements used 48
 - features generated by 46–47
 - plasma discharge, catalysts changes generated by 46–47
 - preparation 45–77
 - regeneration 45–77

- of catalysts 73
 - single-stage plasma catalysis reactor 47
 - sputtering processing 47
 - VOC removal from air by 131–165, *See also* volatile organic compounds (VOCs)
 - plasma bullets 28
 - plasma display panel (PDP) 27
 - plasma-driven catalysis (PDC) 141
 - plasma produced catalysts and supports 74–76
 - sputtering 76
 - plasma pyrolysis 373–377
 - acetylene production 374–377
 - methane pyrolysis to hydrogen and carbon 373–374
 - pyrolysis of oxygenates 377
 - plasmachemical decontamination of water 259–279
 - aromatic hydrocarbons 260–267
 - – heterocyclic 265–267
 - – phenol 260–263
 - – polycyclic 265–267
 - – substituted 263–265
 - plasmajet 3
 - platinum 284–286
 - as catalyst in Fenton’s reaction 285–286
 - platinum-based catalysts 109
 - polychlorinated biphenyl (PCB) compound 266
 - polycyclic aromatic hydrocarbons 265–267
 - positive-polarity-pulsed corona 11
 - positive streamer propagation 15–16
 - background ionization 16
 - electron sources for 15–16
 - photoionization 15–16
 - post-discharge phenomena in bacterial inactivation 327–330
 - postplasma catalysis configuration (PPC) 97, 171
 - precipitation 48, 50
 - primary streamers 16–18
 - pulsed corona 11
 - pyrogenic titania 52
 - pyrolysis 357–358, *See also* plasma pyrolysis
 - of oxygenates 377
- r**
- Raether–Meek criterion 14
 - reactive grinding 58
 - reactive nitrogen species (RNS) 310, 324–327
 - reactive oxygen species (ROS) 310, 320–324
 - hydrogen peroxide 321–324
 - hydroxyl radical 320–321
 - reduction reactions 244, 256–257
 - hydrogen radical 256–257
 - perhydroxyl/superoxide radical 257
- s**
- secondary streamers 16–18
 - physical mechanism of 18
 - selective catalytic reduction (SCR) 89
 - separate package 61
 - shockwaves 332–334
 - silica (SiO₂), in catalysts preparation 50–51
 - flame hydrolysis 50–51
 - hydrothermal reactions 51
 - precipitation 50
 - sol–gel methodology 50
 - sol–gel processes 50
 - silica gel 291
 - silicalite 51
 - silicon-aluminum phosphate (SAPO) 53
 - single-stage plasma catalysis reactor 47
 - single-stage plasma-catalytic systems 141–150
 - acetone 143
 - benzene 144–145
 - dichloromethane 144
 - formaldehyde 143
 - isopropanol 143
 - noble metal catalysts 147–148
 - phenol 145
 - propane 143
 - TiO₂ 147
 - toluene 145–146
 - transition metal oxides 148
 - trichloroethylene 144
 - and two-stage plasma catalysis, comparison, 161–162
 - single-walled nanotubes (SWCNTs), 75
 - sol–gel processes 50, 57, 59
 - sol-precipitation method 59
 - specific input energy (SIE) 139
 - spherulizing 69
 - spray pyrolysis 49, 57
 - sputtering 76
 - steam reforming (SR) 355–356, 360–365
 - conversion of higher hydrocarbons 362–363
 - conversion of methane 360–362
 - conversion of oxygenates 363–365
 - microwave plasma 363
 - toluene 363
 - sterilization 316–317
 - streamers 9–20
 - applications 9–11

- streamers (*contd.*)
 - – gas and water cleaning 10
 - – ozone generation 10
 - – particle charging 10
 - branching 18–20
 - homogeneous breakdown 14
 - initiation 14
 - initiation cloud 16–18
 - interaction 18–20
 - late streamers 16–18
 - negative streamers 12–13
 - occurrence 9–11
 - positive streamers 12
 - primary streamers 16–18
 - propagation 15–16, *See also* positive streamer propagation
 - properties 11–14
 - – hybrid models 14
 - – Monte Carlo model 14
 - – moving boundary models 14
 - secondary streamers 16–18
 - substituted aromatic hydrocarbons 263–265
 - superoxide radical 257
 - supported metals 65–66
 - supported noble metals 66–67
 - deposition–precipitation method 66
 - impregnation 66
 - supported oxides, in catalysts preparation 59–62
 - complex package 61
 - coprecipitation 59–60
 - coprecipitation-impregnation 59, 61
 - coprecipitation-sedimentation 61
 - dry mixing 61
 - impregnation 59
 - mechanical mixing 59, 61
 - metal oxides on metal foams and metal textiles 61–62
 - separate package 61
 - sol–gel 59
 - wet mixing 61
 - surface discharge 26–32
 - basic geometries 26–28
 - main properties 29–30
 - and packed beds 30–31
 - surface ionization mechanisms 6
 - syngas production from hydrocarbons 353–384
- t**
- tableting 67–68
 - technical scale plasma reactor 370
 - temperature-programmed desorption (TPD) 90
 - template-assisted syntheses 48
 - temporal post-discharge reaction phenomenon 327
 - tetranitromethane (TNM) 256, 279
 - thermal activation 177–178
 - thermal oxidation, for VOCs removal 133–134
 - thermal treatment, transition alumina synthesis by 49
 - three-function catalyst model 89–91
 - titanium dioxide (TiO₂) 51–52, 288–290
 - Townsend discharge 4
 - Townsend impact ionization coefficient 5
 - transient discharges 3
 - transition metal oxides, in VOCs removal 140
 - trichloroacetaldehyde (TCAA) 162
 - triphenylmethanes 271
 - tungsten 286–288
 - two-stage plasma-catalytic systems 141–142, 150–153
 - adsorbent materials 153
 - benzene 151
 - butyl acetate 151
 - cyclohexane 151
 - dichloromethane 151
 - ozone role 150
 - propane 151
 - toluene 151–152
 - transition metal oxides 150
 - trichloroethylene 151
- u**
- unburned hydrocarbons (UHCs) 89, 96–97
 - UV radiation 331–332
- v**
- viability tests 316–317
 - volatile organic compounds (VOCs) 131–165
 - decomposition in plasma-catalytic systems 142–164
 - – catalyst loading effect 157–159
 - – chemical structure, effect of 154
 - – experimental conditions, effect of 155–159
 - – humidity effect 155–156
 - – inorganic by-products 163–164
 - – organic by-products 162–163
 - – oxygen partial pressure effect 156–157
 - – plasma catalysis and adsorption combination 159–160
 - – reaction by-products 162–164
 - – single-stage plasma-catalytic systems 142–150, *See also individual entry*

- - VOC initial concentration, effect of 155
 - emission in atmosphere, sources 131
 - - anthropogenic 131
 - - biogenic 131
 - environmental problems related to 132–133
 - - global warming 132
 - - photochemical smog 132
 - health problems related to 132–133
 - - chronic effects 132
 - - eye and respiratory tract irritation 132
 - plasma-catalytic hybrid systems for VOC decomposition 137–142
 - - catalysts types 140–141
 - - corona discharges 137
 - - noble metal catalysts 140
 - - nonthermal plasma reactors 137–139
 - - packed-bed discharges 138
 - - process selectivity considerations 139
 - - single-stage plasma-catalytic systems 141
 - - transition metal oxides 140
 - - two-stage plasma-catalytic systems 141–142, 150–153, *See also individual entry*
 - removal from air by plasma-assisted catalysis 131–165, 171–180
 - - adsorption 175–177
 - - catalyst influence in plasma processes 172–174
 - - catalyst properties 174–175
 - - interactions between plasma and catalysts 171–180
 - - mechanisms 171–180
 - - physical properties of discharge 172–174
 - - plasma influence on catalytic processes 174–177
 - - plasma–catalyst combinations 172
 - - plasma-catalytic mechanisms 179–180
 - - plasma-mediated activation of photocatalysts 178–179
 - - reactive species production 174
 - - thermal activation 177–178
 - removal techniques 133–137
 - - absorption 135
 - - adsorption 135
 - - biofiltration 135
 - - catalytic oxidation 134
 - - condensation 136
 - - membrane separation 136
 - - photocatalysis 134
 - - thermal oxidation 133–134
- w**
- water gas shift (WGS) reaction 355
 - water spray, plasma chemistry induced by discharge plasmas in 215–217
 - wet impregnation 60
 - wet mixing 61
 - wetness impregnation 62
- x**
- x-ray emission 332
- z**
- Zeldovich mechanism 207
 - zeolites 291–292
 - in catalysts preparation 52–55
 - - hydrothermal method 53
 - - hydrothermal synthesis 52
 - - metal-containing molecular sieves 53–55
 - - structure of 54–55
 - zirconium oxide (ZrO₂), in catalysts preparation 52
 - flame hydrolysis 52
 - precipitating agents 52

