

Subject Index

a

- accompanying gas 220
- acetylene 240
 - application in autogeneous engineering 247
 - critical point 244
 - decomposition 243
 - dew point 244
 - hydrate 244
 - ignitable mixtures with air 243
 - liquefaction 243
 - petrochemical 246
 - recovery from calcium carbide 246
 - storage 246
 - supply system 247
- acetylene generator 245
- acetylene hydrate 244
- acetylidyde 244
- air, medical 282
- air booster 21
- air separation by cryogenic rectification 20
- air separation unit
 - process analysis 64
 - safety 59
 - safety, ignition source 60
- air separator
 - cold section 24
 - cryogenic 23
 - safety, ignition in reboilers 63
 - two-column 113
 - warm section 23
- alkaline electrolyser, electrolysis of water 143
- aluminium plate-fin type, air separation 49
- ambient air, helium content 125
- aMDEA 150
- ammonia synthesis gas, processing, nitrogen wash process 156

- ammonium nitrate for processing of nitrous oxide 280
- Andrews 3
- AOD 4
- argon
 - applications 104
 - history 12
 - occurrence 13
 - properties 13
- argon bulge, air separation 29
- Asia Industrial Gases Association (AIGA) 7
- ATR 148, *see also* autothermal reforming
- autogeneous engineering 247
- autogenous technology 241
- autothermal reactor 149
- autothermal reformer 148
- autothermal reforming 148
 - production of synthesis gas 144

b

- Barrer 16
- Bartlett, N. 112
- Base-Load-Plants, natural gas 231
- Benfield-process 150
- Berthelot 240
- Birkeland 9
- Black 185
- Bosch 4, 9
- Boudouard-equilibrium 188
- box reformers 146
- Bunsen, Robert 218

c

- C₂H₂ 243
- C₂H₄ 249
- C2plus 230
- C3MR 232
- C3MR-process 232
- C3plus 226

Cailletet 9, 141
 calibration gas mixtures 261
 – fittings and pipes 272
 – production 264
 – production, dynamic-volumetric method 264
 – production, gravimetric method 265
 – production, manometric-static method 264
 – supply systems 273
 can-type reformers 146
 carbon dioxide
 – as greenhouse gas 186
 – high purity 195
 – liquefaction 193
 – liquid, properties 187
 – occurrence 185
 – pre-purification 191
 – properties 186
 – recovery 189
 – recovery from flue gas 198
 – sources 190
 carbonic acid 185, 188
 – medical 281
 carbonic acid anhydride 185
 carbon molecular sieves, O₂ production 18
 carbon monoxide
 – applications 182
 – occurrence 141
 – properties 141
 carbonyl complexes 141
 Caro 9
 Cavendish 3, 9, 12, 136
 CGA 6
 Charles, C. 136
 Charles, J. 3
 chemical scrubbing 150
 China Industrial Gases Industry Association (CIGIA) 7
 CIGIA 7
 Claude, G. 2, 3
 Clement 141
 CMS 18, *see also* carbon molecular sieves
 CO 141
 CO₂ 185
 CO₂ reforming, synthesis gas production 144
 CO₂ scrubbing 191, 192
 CO₂ source 189
 cold box 21, 23
 columns, air separation 54
 Commission Permanente Internationale (CPI) 6

compressed air for breathing apparatuses 282
 compressed gas 287
 – liquefied, storage 286
 – liquefied, storage in cryogenic jugs 287
 – liquefied, storage in vertical tanks 287
 – pipeline 286
 – pipeline systems 286
 Compressed Gas Association 6
 compressed gas cans 285
 compressed gas cylinder 283, 284
 – colour labelling 284
 compressed gas cylinder bundles 285
 compressed gas trailers 286
 compressor, air separation 45
 concentration units 262
 convective reformer 149
 crude argon column
 – air separation 26
 – McCabe-Thiele diagram 29

d

D 137
 Davy, E. 1, 240
 Desormes 141
 deuterium 137
 Dewar 3, 136
 Dirty Shift 150
 dot notation, pure gases 256
 dry ice 187
 – production 200
 DVS 241

e

EIGA 6
 electronic gases 269
 ethane, recovery from natural gas 229
 ethene 249, *see also* ethylene
 – application in autogeneous engineering 249
 – recovery 249
 ethylene, properties 249
 ethyne 243, *see also* acetylene
 European Dry Ice Association (EDIA) 6
 European Industrial Gases Association 6
 exergy
 – definition 35
 – loss 35
 expansion turbines, air separation 48
 external compression, oxygen recovery 33
 Eyde 9

f

- Fenske, formula by 30
 Fick's Law 16
 Fischer 4, 136
 Fischer-Tropsch synthesis 4, 136
 flooding in the downcomer 57
 Fontana, Felice 136
 Frank 9
 FT-synthesis 136
 fuel gases 239

g

- GAN 2
 gas-to-liquid 238
 gas companies, shares in the world market 5
 Gases and Welding Distributors Association (GAWDA) 7
 gases in medicine 277
 gasification reactor 147
 gas mixtures 261
 – production 263
 Gas Subcooled Process 227
 GAWDA 7
 generator gas 135
 glycol scrubbing, natural gas 225
 GOX 2
 GOX med 278
 GSP 226, 227
 GTL 2, 238

h

- Haber 4, 9
 heat exchanger
 – air separation 49
 – coil-wound 234, 235
 He I 127
 He II 127
 helium
 – high purity, recovery 128
 – liquefaction 130
 – occurrence 125
 – properties 127
 – recovery 127
 helium-method, age determination of minerals 125
 helium content, ambient air 125
 Henry's Law 16
 high-temperature shift 150
 Hoppe 112
 HTS 150
 HyCO-unit 158
 hydrogen
 – applications 164

– bridge bonds 140

- frequency 137**
- heavy 137**
- normal 138**
- occurrence 136**
- ortho 137**
- para 137**
- production by electrolysis of water 143**
- properties 137**

i

- industrial gas companies 5
 industrial gases, supply, logistics 283
 Industriegasverband e.V. (IGV) 7
 instrumentation gases for analytical measuring methods 258
 internal compression, oxygen recovery 33
 International Oxygen Manufacturers Association (IOMA) 7

j

- Japanese Industrial Gas Association (JIGA) 7
 jet flooding 57
 Joule, J. P. 3
 Joule-Thomson effect 1, 3

k

- Kamerlingh-Onnes, H. 3, 125
 Kr/Xe
 – fine purification 115
 – fine purification, combustion of hydrocarbons at the catalyst 115
 – fine scrubbing 117
 – pre-enrichment in the air separator 113
 krypton 111
 – occurrence 111
 – recovery 112

l

- Lasonne 141
 laughing gas, *see* nitrous oxide
 laughing gas for anaesthesia 280
 Lavoisier 11, 185
 Linde, C. v. 1, 3, 9
 Linde air liquefier 1
 Linde air separation 2
 Linz-Donawitz (LD) process 4
 liquefied natural gas 220
 liquefied petroleum gas 225
 – recovery from natural gas 225
 liquefiers 37
 liquid turbines, air separation 48
 LNG 220

- applications 238
- low-pressure column, air separation 28
- low-temperature shift 150
- LOX 59
- LOX med 278
- LPG 225
- ITS 150

- m**
- MAG 4
- McCabe-Thiele diagram
- binary O₂/Ar-mixture 29
- crude argon column 29
- MDEA 192
- MEA 150, 191
- Medical Device Directive, medical gases 278
- medical gases 277
- medium-temperature shift 150
- membrane, nitrogen recovery 16
- membrane module, parameters 17
- metal hydrides 140
- methanation 151
- methane hydrate 218
- methane scrubbing, cryogenic 155
- methyldiethanolamine 192
- as chemical solvent for synthesis gas 150
- MFC process 234
- Mikropor A 246
- Mixed Fluid Cascade process 234
- Moissan, H. 1, 3, 240
- molecular sieves
- for pressure swing adsorption 18
- zeolitic, O₂ recovery 18, 20
- mole fraction 262
- monoethanolamine 191
- as chemical solvent for synthesis gas 150
- mtpa 231
- MTS 150

- n**
- N₂ 10
- nasal cannula 279
- natural gas 217
- basic feed for synthesis gas 136
- calorific value 220
- composition 223
- dew-point adjustment 224
- dry 220
- ethane separation 229
- glycol scrubbing 224
- liquefaction 231
- nitrogen separation 236
- occurrence 218
- occurrence, detected 218
- separation from liquefied petroleum gas 225
- treatment 224
- wet 220
- natural gas bubble 218
- natural gas deposits 219
- natural gas development 217
- natural gas reserves 219
- neon 111
- occurrence 111
- properties 112
- recovery 118
- recovery, fine purification 119
- recovery, pre-enrichment 118
- nitrogen
- applications 67
- chemical properties 10
- fixation 10
- history 9
- inversion temperature 10
- occurrence 9
- properties 10
- nitrogenase 10
- nitrogen generators 36
- nitrogen recovery
- by means of PSA 19
- membranes 16
- nitrogen scrubbing 156
- nitrous oxide, medical, processing 280
- noble gas hydrates 112
- normal-hydrogen 138

- o**
- OHR 228
- OHR-process 228
- OMA 7
- ortho-hydrogen 137
- oxygen
- applications 83
- concentrators 279
- for medical application 278
- history 11
- inversion temperature 11
- occurrence 11
- properties 11
- refining 12

- p**
- para-hydrogen 137
- partial oxidation, production of synthesis gas 144, 146

- Patart 4, 136
 peak-shaving plants, natural gas 231
 permeabilities of membranes 16
 photosynthesis 186
 PO 146
 PO-plant 160
 – gasification of heavy oil 159
 PO-reactor 147
 – Texaco 148
 polymeric membranes, gas separation 16
 potash as a chemical solvent for synthesis
 gas 150
 pre-reformer 158
 pressure column, air separation 25
 Pressure Swing Adsorber Unit
 – helium recovery 128
 pressure swing adsorption 18
 – nitrogen recovery 18
 – oxygen recovery 18
 – production of high-purity hydrogen
 from synthesis gas 151
 Priestley 9, 11, 141
 primary reformer 148
 process analytics, synthesis gas plants 161
 production of hydrogen, reformer plant
 157
 production of pure argon 29
 promoted combustion-test 61
 PSA 18, 151
 Puls Discharge Detector 120
 pure argon column, air separation 26
 pure gases 256
 – dot notation 256
 – fittings and pipes 272
 – supply systems 273
- q**
 Q-T-Diagram 33
 quantum fluid 127
 quantum solid 127
- r**
 radon, occurrence 111
 Ramsay 111
 Rayleigh, J. W. 12
 rectisol process 151
 rectisol scrubbing 151
 Recycle Split Vapor 229
 RSV 229, 230
- s**
 Scheele 9
 secondary reformer 148
 separation factor 40, 114
 SFR 227
 Shell-method, partial oxidation 147
 sieve tray columns, air separation 55
 Sirius-Linde, development system for
 acetylene 246
 specialty gases, disposal 271
 Split Flow Reflux 227
 steam reformer 145, 157, 159
 steam reforming, *see* steam reformer
 superfluid 127
 synthesis gas
 – applications 182
 – definition 135
 – generation by autothermal reforming
 148
 – generation by partial oxidation 146
 – generation by steam reforming 145
 – processing 150
 – processing, condensation process 154
 – processing, cryogenic processes 153
 – processing, membrane process 152
 – processing, methanation 151
 – processing, methane scrubbing 154
 – processing, removal of carbon dioxide
 150
 – production 143
 – production from hydrocarbons 144
 – removal of acid gases 150
 synthol-process 136
- t**
 T 137
 tandem reformer 149
 Technical Rules for Compressed Gases 285
 Texaco-method, partial oxidation 147
 Texaco-process, partial oxidation 159
 thermosiphon and downflow evaporator 53
 Thilorier 185
 Thomson, W. 3
 TIG 4
 TRG 285
 tritium 137
 Tropsch 4, 136
 turbines, air separation 47
 turbo compressor, radial, air separation 45
 two-column nitrogen generator 36
- v**
 vacuum pressure swing adsorption 20
 Verband der Chemischen Industrie e.V.
 (VCI) 7
 VPSA 20

w

- water-gas shift equilibrium 146, 148
- water-gas shift reaction 145, 147
- water-gas shift reactor 150
- water gas equilibrium 188
- weeping 57
- welding engineering, history 240
- Wilson, T. L. 1, 3, 240
- Wöhler, F. 1, 240

x

- xenon 111
 - in anaesthesia 281
 - occurrence 111
 - properties 112
 - recovery 112
- XePtF₆ 112