Cumulative Subject Index¹

Volumes 56-60

A

Acetate

surface intermediate, acetic acid decomposition on Ni/Cu (110), 60, 441

Acetic acid

decomposition on Ni/Cu(110), 60, 441

Acetone

adsorption, effect on electron spin resonance of Cu²⁺ in CuO-silica-alumina, **56**, 290

hydrogenation over Raney nickel plate, activity: relationship to hydrogen content, 58, 74

from isobutane oxidation over TiO₂, 60, 369

Acetylene

deuteration in presence of [14C] ethylene, over Pd black, 60, 83

hydrogenation over Rh-Y zeolite, 58, 82 selective hydrogenation, over Pd black, 60, 83

Acid

solid, and catalyst acidity measurement, 60, 417 Acid-base

properties

alumina-zinc oxide, 57, 35 iron based mixed oxides, 60, 306

Acidity

distributions, solid catalysts, 60, 417

of offretite zeolites, 57, 136

surface, boron phosphate: role in activity and selectivity of alcohol dehydration, 57, 167

zeolite type H-ZSM-5, 59, 248

Acrylonitrile

from propylene ammoxidation, mechanism, 59, 314, 317

Activation

initial, platinum-rhodium gauzes for ammonia oxidation, 60, 430

palladium catalysts, in ethylene oxidation, **60**, 295 Active site

in cumene dealkylation over HY and LaY zeolites, 60, 77

spacings, controlled in amorphous silica-alumina, 60, 156

water gas conversion on alumina, 57, 64

Activity

specific, toluene hydrodealkylation over Group VIIB and Group VIII metals on alumina, 56, 32

Adam's platinum-palladium oxides

for alkyne hydrogenation, 57, 494

Adsorbed layers

exoelectron emission during catalytic reactions, 60.8

Adsorbed species

on silica-supported Ru, ir spectra, 58, 170

Adsorption

acetone, effect on electron spin resonance of Cu²⁺ in CuO-silica-alumina, **56**, 290

ammonia on metal oxides, 60, 1

atomic hydrogen on alumina by hydrogen spillover, 58, 287

benzene, pyridine, aniline, and nitrobenzene on evaporated Ni and Fe, 60, 228

carbon monoxide on supported Pd-Au, ligand and ensemble effects, 59, 201

cyanogen on Pt(111), 60, 316

entropies, use to validate rate equations, 56, 358

ethylene on transition metals, 59, 239

gas mixtures, kinetics, 57, 187

heterolytic dissociative, hydrogen on chromium oxide/silica, 59, 168

hydrocarbons on zeolites, 56, 377

hydrogen

on platinum and platinum-gold, 57, 458

on reduced molybdena-alumina, 60, 404

iron pentacarbonyl-HY zeolite interaction, 58, 230

olefin, on NiO, 59, 465

pyridine, and catalyst acidity measurement, 60,

by silicalite, 58, 114

thiophene on copper chromite, 60, 21

by ZSM-5-type zeolite, 58, 114

Alcohol

dehydration

on y-Al₂O₃ and ThO₂, geometric factor, 57, 208

¹ Boldface numbers indicate appropriate volume; lightface numbers indicate pagination.

Alumina, see also Aluminum oxide over boron phosphate, 57, 167 over oxides, selectivity and stereospecificity, Co-Mo-Al₂O₃ desulfurization catalysts, 59, 452 59, 405 on TiO₂, mechanism, 57, 191 thiophene hydrodesulfurization over, 56, 363 dimethylebutene isomerization and deuterium secondary, dehydration on alumina: inductive effects and product distributions, 58, 493, 496 exchange, 57, 264 microporous, formation, 57, 222 Aliphatic alcohols Pt-Ir/Al₂O₃, alloy formation, 59, 446 interaction on TiO₂, 56, 299; 57, 191 Pt-Re/Al₂O₃, alloy formation and oxide segrega-Alkali tion, 59, 434 catalysts, in magnetite reduction, 59, 1, 15 secondary alcohol dehydration on: inductive ef-Alkali metal-graphite fects and product distributions, 58, 493, 496 intercalates, CO hydrogenation over, 56, 258 support for Alkaline earth catalysts: Pt-Re/ γ -Al₂O₃, **56**, 468 catalysts, in magnetite reduction, 59, 1, 15 Group VIIB and Group VIII metals, activities Alkane and selectivities, 56, 32 hydrogenolysis, mechanism, 58, 144 nickel, hydrogenation of chemisorbed CO and reactions on platinum-palladium alloy films, 56, surface carbon, 57, 406 platinum crystallites, role of wetting in redis-Alkene persion, 59, 109 hydrogenation over nickel boride, effect of catalyst ruthenium, carbon monoxide desorption and poisons, 60, 148 reaction with H₂, 57, 397 isomerization over alumina, mechanism, 57, 264 ruthenium, nitric oxide reduction with H2 over, water addition, over clay minerals, 58, 238 60, 204 Allovs silver, effects of heat treatment, 57, 372 binary, surface segregation, 57, 450 surface polarity relative to Co-Mo-Al₂O₃ and copper-nickel MoS₂ catalysts, 58, 436 formladehyde decomposition, 56, 349 transfer hydrogenation of muconic acid, 58, 320 thermal desorption from, 56, 349 water gas conversion on, 57, 64 formation X-ray photoelectron spectrum, peak assignments, Pt-Ir/Al₂O₃, 59, 446 57, 522, 525 Pt-Re/Al₂O₃, 59, 434 iron-ruthenium, freshly reduced: Fischer-Tropsch support for chromia, carbon monoxide oxidation, synthesis over, 60, 394 59, 100 nickel-copper γ-Alumina acetic acid decomposition on, 60, 441 methylcyclohexenes and methylenecyclohexane, with silica support, surface composition, 60, 325 kinetics of double bond shift isomerization palladium-gold, supported: ligand and ensemble over, 59, 45 effects in CO adsorption, 59, 201 racemization activity, 58, 276 palladium-silver, surface composition, 60, 100 support for platinum-palladium cobalt molybdate, Raman spectra, 60, 276 crystallites on silica, morphology and composirhodium: hydrogenolysis of neopentane and tion, 56, 198 n-pentane, mechanisms, 56, 12 films, alkane reactions on, 56, 430 rhodium: n-pentane hydrogenolysis, n-butane films, deuterium exchange of methane and oxidation, and nitrie oxide reduction, 56, 21 ethane, 56, 438 surface, electron donor and acceptor properties, platinum-rhodium crystallites on amorphous 58, 470 SiO₂, morphology 60, 356 Alumina-zinc oxide powders, platinum-iridium: reforming catalysts, acid-base properties, 57, 35 59, 211 Aluminum surfaces, prediction of segregation to, 59, 430 distribution in faujasite, 58, 489 Allyl Aluminum chloride charge, on zinc oxide, 58, 1 mixture with CuCl₂, pentane conversion over, 56, radicals, interaction with bismuth molybdates, 59, 79 Aluminum oxide, see also Alumina Allylic oxidation γ-Al₂O₃, geometric factor in alcohol dehydration

on, 57, 208

propylene, 58, 8

Autoxidation

cumene, over Cu(II)-acetylacetonate, effect of

polarity of medium 56, 141

gibbsite, thermal decomposition, 57, 222 Azopropene -supported platinum particles, electron microsallyl radicals from 59, 79 copy, **56**, 390 Amberlite IRC-50, see Carboxy cation-exchange resin Benzaldehyde Amino acids main oxidation product from benzyl alcohol over asymmetric, modifiers of Raney nickel, 60, 184 Cu(II)NaY zeolite, 56, 52 Ammonia Benzene adsorption on metal oxides, 60, 1 adsorption on evaporated Ni and Fe, 60, 228 formation, over noble metals in auto exhaust: formation from effects of SO₂, 57, 380 cyclohexane over MoO₃-Al₂O₃, mechanism, 60, nitric oxide reduction by, over Cu(II) NaY, 59, 193 319 toluene hydrodealkylation over Group VIIB oxidation and Group VIII metals on alumina, 56, 32 hydrogenation activation of Pt-Rh gauzes, 60, 430 over Pt-Rh gauze: catalyst deactivation, 56, on palladium/silica, 58, 206 472 over platinum and platinum-nylon, selectivity, reaction with NO on V₂O₅, 57, 526, 528 57, 193 synthesis, over K-N₂-Ru complex, 58, 313 isotope Ammoxidation effects in hydrogenation and H/D-exchange on 3-picoline on vanadium oxides, 58, 383 Pt and Ni. 58, 43 exchange with cyclohexane over supported propylene Au-Pt, 57, 272 over bismuth molybdates, mechanisms, 59, 79 mechanism, 59, 314, 317 production, from toluene over nickel-zeolite, 58, 198 over Te oxide/silica-alumina, 59, 148 Benzyl alcohol Anatase, see Titanium dioxide oxidation, over Cu(II)NaY zeolite, 56, 52 Aniline Binding energies adsorption on evaporated Ni and Fe, 60, 228 Mo 3d, in molybdenum (II) carboxylates on silica: Antimony redox reactions with CO, NO, and H₂, 60, 171 interaction with reduced supported nickel, 56, 130 Bismuth Sb-Sn-O: surface composition, X-ray photoelec-Bi-Mo-O type catalyst, for ammoxidation, 59, tron spectroscopy, 58, 52 314, 317 Sn-Sb oxides, surface composition Bismuth molybdate activity, relationship to bulk composition, 58, 68 ¹⁸O labeled X-ray photoelectron spectroscopy, 58, 61 propylene oxidation over, 56, 84 Aromatic hydrocarbons reduction by propylene, 56, 84 from synthesis gas, over ZSM-5 zeolite, 56, 268 propylene oxidation over Aromatics infrared and Raman spectroscopy 57, 331 polycyclic, hydrodesulfurization over sulfided mechanism, 56, 73 $CoO-MoO_3/\gamma-Al_2O_3$, 57, 509 selective propylene oxidation and ammoxidation Aromatization over, mechanisms, 59, 79 n-hexane, over Pt, 58, 108 Bismuth-molybdenum oxide Auger electron spectroscopy system, phase diagram, 58, 409 methanol synthesis over Cu/ZnO/M2O3 (M Bismuth trioxide-molybdenum trioxide Al, Cr), low pressure, 56, 407 3:2, low and high temperature forms, 58, 409 palladium-silver alloys, 60, 100 7:1, phase diagram, 58, 409 platinum-iridium alloy powders, surface composi-Bonding parameters tion, 59, 211 Cu(II)NaY-amine systems, 56, 52 Autocatalysis Book review in methanol to hydrocarbon reactions over zeo-Chemistry of Catalytic Processes. B. C. Gates, lites, 59, 123 J. R. Katzer, and G. C. A. Schuit, 60, 343 Automobile exhaust Boron phosphate effects of SO₂ on noble metals, 57, 380 surface acidity, role in activity and selectivity of

alcohol dehydration, 57, 167

in magnetite reduction, 59, 1, 15

Boudouard reaction

on nickel, sulfur poisioning, 59, 395 **Bromination** halobenzenes over zeolites, 60, 110 Brønsted centers ammonia adsorption on metal oxides, 60, 1 Butadiene from 1-butene oxidative dehydrogenation over Sn-Sb mixed oxides, 58, 68 catalytic oxidation over MoO₃-TiO₂, 57, 253 oxidation over vanadium pentoxide-titanium dioxide system, 57, 476 1,3-Butadiene hydrogenation by cyclohexadiene over CoS, 59, 423 over ThO₂, 56, 303 liquid phase diacetoxylation over Pd-Te-C, 58, 155 n-Butane hydrogenolysis over Pt-Fe, 60, 121 oxidation by O_2 over Rh/ γ -Al₂ O_3 , 56, 21 2-Butanol dehydration on alumina, inductive effects and product distributions, 58, 493 Butene catalytic oxidation, heterogeneous-homogeneous effects during, 60, 476 1-Butene catalytic oxidation over MoO₃-TiO₂, 57, 253 isomerization over Al₂O₃-ZnO, 57, 35 and dehydrogenation on mica, molecular beam study, 57, 96 on ZrO₂, 57, 1 oxidative dehydrogenation to butadiene over Sn-Sb mixed oxides, 58, 68 2-Butene isomerization, sulfur dioxide induced: over cationexchanged X zeolites, 56, 88 cis-2-Butene isomerization and dehydrogenation on mica, molecular beam study, 57, 96 trans-2-Butene-1,4- d_2 formation over ThO2, 56, 303 But-1-thiol hydrodesulfurization over Co-Mo/Al₂O₃, 56, 363 tert-Butyl hydroperoxide propylene epoxidation with, over carboxy cationexchange resin, 56, 150

C

Calcination

iron sulfates, in preparation of iron oxide catalysts, 57, 231

Calcium oxide

formose reaction over, effects of solvent, 58, 296 Carbided tungsten

reaction with formic acid, 58, 149

Carbidic intermediates

incorporation into hydrocarbons, 58, 95; 60, 95 Carbiding

surface, suppression by iridium in Pt-Ir reforming catalysts, 59, 211

Carbon

active, formation: in methanation of CO and CO₂ over Ru/molecular seive, 60, 57

Boudouard, incorporation into hydrocarbons, 58, 95; 60, 344

formation

shape selectivity and, in zeolites, 56, 139 on zeolites, 56, 377

in ZSM-5 zeolite, **56**, 195

role in methanation by cobalt and ruthenium, 56, 284

-supported platinum particles, electron microscopy, 56, 390

surface

hydrogenation on supported Ni, 57, 406 incorporation into hydrocarbons, mechanism, 58, 95; 60, 344

Carbon dioxide

formation, from propylene oxidation over bismuth molybdate, 56, 73

 $\begin{array}{c} methanation \ over \ Ru/molecular \ sieve, \ mechanism, \\ \textbf{60, 57} \end{array}$

Carbon monoxide

adsorption

-desorption on Ru, 57, 397

on Pd-Ag alloys, 60, 100

over Pt/Ce·Al₂O₃ and Pd/Ce·Al₂O₃, 58, 131

on supported Pd-Au alloys, ligand and ensemble effects, 59, 201

automotive exhause emissions, poison-resistant catalysts for control of, 56, 321

chemisorption, on palladium/silica, 58, 206 coadsorption with evanogen on Pt (111), 60

coadsorption with eyanogen on Pt (111), 60, 316 disproportionation over Ru, 57, 397

dissociation over supported Ru-Pt, 59, 130

in hydrocarbon synthesis over silica-supported Ru, ${\bf 58},\,170$

and hydrogen: hydrocarbon synthesis over graphite lamellar compound intercalated by ferric chloride, 57, 27

hydrogenation

over alkali metal-graphite intercalates, 56, 258 over iron, role of readsorption in product distribution, 56, 249

over nickel, metal-support effects, 56, 236

interaction with hydrogen on cobalt (0001), 58, 28 methanation

by cobalt and ruthenium, role of carbon, 56, 284 over Ru/molecular sieve, mechanism, 60, 57 nitric oxide

and hydrogen: reactions with molybdenum(II) carboxylates on silica, 60, 171

reduction over Pt, kinetics and ir spectra, 59, reforming platinum-iridium, characterization and performance, 59, 211 oxidation platinum-tin, surface, 56, 65 on α -alumina-supported chromia, 59, 100 selective oxidation for, 59, 448 over CoO-MgO solid solutions: mechanism, 58, shell, molybdena-alumina: sintering, 57, 87 over iridium, kinetics and mechanism, 58, 303 Catalytic activity attenuation by H2, 59, 138 low temperature, over MnO2 and MnO2-CuO, Catalytic reactions over Pt-alumina, effects of particle size, 59, 272 exoelectron emission during, 60, 8 hydrocarbons over Pt-Pd alloy films, 56, 430, 438 and three-way conversion over Pt/Ce·Al₂O₃ Cerium oxide and $Rh/Ce \cdot Al_2O_3$, 58, 131 poisoning by, in deuterium-water exchange on interaction with Pt, Pd, and Rh, 58, 131 platinum-alumina, 56, 229 growth in Fischer-Tropsch synthesis, 57, 183; 58, reactions, effect of catalyst loading, 57, 513 95; 60, 344, 484 species on rhodium, 57, 72 surface reactions with NO and O2 on Pt-alumina, localization on oxygen ions, in allylic oxidation 57, 361 of propylene, 58, 8 Carbon oxides formation from cyclohexane over MoO₃-Al₂O₃, Charge transfer iron carbonyl, in photochemical and thermal demechanism, 60, 193 composition, comparison, 58, 230 Carbonylation butadiene over palladium, 60, 27 Chemical state methanol over Rh-Y zeolite, kinetics and mechsupported palladium, 60, 295 Chemisorption anism, 59, 53, 61 rhodium zeolite, X-ray photoelectron spectroscarbon monoxide copy and infrared spectra, 59, 340 and H₂ on palladium/silica, 58, 206 Carboxy cation-exchange resin on Pd-Au alloys, 59, 201 hydrogen propylene epoxidation with tert-butyl hydroperand carbon monoxide on rhodium rafts, 57, 41 oxide over, 56, 150 on cobalt (0001), 58, 28 Catalysis on Pt-Al₂O₃ catalysts, 59, 138 asymmetric, enantioselective hydrogenation on on silica-supported nickel-copper, 60, 325 modified Ni, 58, 276 nitric oxide on Ni and Pd films, 57, 80 automobile exhaust, 56, 321 heterogeneous compensation parameters, 60, 335 assay of molybdena-alumina, 59, 311 on supported gold, 57, 177 and homogeneous, olefin hydrogenation over Pd, 57, 516 Chromatography rate equations, criteria and validity, 56, 358 three-way, effects of SO₂ on noble metals in auto polarity of hydrodesulfurization catalysts, 58, exhaust, 57, 380 436 Chromia Catalyst a-alumina support, carbon monoxide oxidation, acidity measurement, titration, 60, 417 automobile exhaust, 56, 321 catalytic cracking, poisoning, 56, 130 Chromium coprecipitated: nickel on silica, characterization ions by X-ray photoelectron spectroscopy, 56, 336 clustering, effect of water, 59, 153 hydrotreating electron paramagnetic resonance, 59, 153 deactivation, 56, 315 magnetic susceptibility, 59, 153 effects on indole hydrodenitrogenation, 57, 390 reduction with carbon monoxide, 59, 153 loading, effect on simultaneous reactions of NO, reduction with hydrogen, 59, 153, 168 CO, and O₂, 57, 513 reoxidation by silanol groups, 59, 153, 168 metal, supported: splitting kinetics, 57, 504 Chromium oxide/silica poisoning, in automobile exhaust, 56, 321 interaction with hydrogen, 59, 168 practical, desorption from, 56, 134 olefin hydrogenation and ethene polymerization preparation, effect of dehydration on particle size over, 59, 153, 168

preparation and structure, 59, 153

and alloy formation, 58, 337

Conversion Chromocene supported, role of silanol groups in formation of, isopropanol, by processed coal minerals and pv-60, 68 rite, **60**, 216 Clay minerals methanol over zeolites, 56, 169 water addition to alkenes over, 58, 238 pentane over AlCl₃-CuCl₂ mixtures, 56, 47 synthesis gas to aromatic hydrocarbons over Clusters bimetallic, platinum-iridium on silica or alumina, ZSM-5 class zeolite, 56, 268 toluene, over nickel-zeolite, 58, 198 56. 1 effects: copper-nickel, formaldehyde decomposi-Copper tion, 56, 349 Cu(II) complex platinum-ruthenium, supported: surface composibasic: halogen displacement polymerization of tion, 58, 188 2,4,6-trihalogenophenols over, kinetics, 58, 444 Coadsorption cyanogen with CO on Pt(111), 60, 316 with sodium methoxide, active species, 58, 444 Cu(II)NaY zeolite hydrotreating, 58, 485 benzyl alcohol oxidation over, 56, 52 minerals, processed: isopropanol conversions over, nitric oxide reduction by ammonia over, 59, 319 **60**, 216 CuO-silica-alumina, electron spin resonance of Cu2+ in: effect of acetone adsorption, 56, 290 Cobalt carbonyl clusters, supported: olefin hydroformylsurface CuMn₂O₄, formtion on MnO₂-CuO catalysts, 58, 419 ation over, 59, 67 Copper acetylacetonate Co (0001), carbon monoxide-hydrogen interaction cumene autoxidation over, 56, 141 on, 58, 28 cumyl hydroperoxide decomposition over, 56, 141 Co-Mo-Al₂O₃ Copper chromite desulfurization catalysts, 59, 452 thiophene adsorption, 60, 21 thiophene hydrodesulfurization over, 56, 363 Co-Mo/γ-Al₂O₃, vanadium deposition during Copper-nickel hydrodesulfurization process, 56, 315 single-crystal surfaces, formaldehyde decomposition, 56, 349 CoO-MoO₃/ γ -Al₂O₃, sulfided: polycyclic aromatic hydrodesulfurization over, 57, 509 Coprecipitated catalysts ion dispersion, effect on H2-D2 equilibration over nickel on silica, characterization by X-ray photoelectron spectroscopy, 56, 336 CoO-MgO solid solutions, 58, 396 methanation by, role of carbon, 56, 284 Cracking promotion of hydrodesulfurization catalysts, 56, activity, zeolite ZSM-5, 60, 140 cumene on HY and LaY zeolites, 60, 77 single crystals, methanation enhancement by surheptane over tetrapropylammonium-silica-aluface cobalt oxide, 58, 328 mina, 60, 156 supported n-hexane over Pt/Al₂O₃ kinetics, **60**, 133 2,2-dimethylbutane and n-hexane hydrogenolyproperties of offretite zeolites, 57, 136 sis, 58, 268 Crystal 2,3-dimethylbutane hydrogenolysis, 58, 260 lanthanum phosphate catalysts, morphology, 56, propane hydrogenolysis, 58, 253 185 Cobalt-molybdenum Crystallite binary oxide catalysts, X-ray photoelectron specplatinum-palladium, morphology and compositroscopy, 57, 153 tion, 56, 198 Cobalt-molybdenum sulfide platinum-rhodium alloy, on amorphous SiO₂: unsupported, X-ray photoelectron spectroscopy, morphology, 60, 356 56, 99 size distribution, sintered nickel on silica, 57, 417 Crystallization Cobaltous sulfide 1,3-butadiene hydrogenation by cyclohexadiene zeolite over, 59, 423 ZSM-4, via faujasite metamorphosis, 59, 263 Cobalt oxide ZSM-5, kinetics, 60, 241 solid solutions with MgO, isopropanol decomposi-Crystallographic shear planes tion over, 56, 160 in supported tungsten oxide, 58, 34 Coke, see Carbon Cumene autoxidation over Cu(II)-acetylacetonate, effect Compensation parameters

in heterogeneous catalysis, 60, 335

of polarity of medium, 56, 141

dealkylation over HY and LaY zeolites, kinetics, oxidative 1-butene to butadiene over Sn-Sb mixed 60, 77 oxides, 58, 68 Cumyl hydroperoxide decomposition over Cu(II)-acetylacetonate, effect copper(II)-exchanged zirconium phosphate as of polarity of medium, 56, 141 catalyst, 56, 296 ethylbenzene on zirconium phosphate, 56, 294 Cyanogen surface chemistry, on Pt (111), 60, 316 Desorption Cycloalkanones carbon monoxide on Ru, 57, 397 hydrogenation on Pt/SiO₂ and Ru/SiO₂, 57, 147 from practical catalysts, 56, 134 Cyclohexadiene temperature programmed 1,3-butadiene hydrogenation by, over CoS, 59, 423 carbon monoxide and H₂, 56, 453 Cyclohexane experimental errors, 56, 134 dehydrogenation over molybdenum-alumina, hydrogen from Pt-Al₂O₃, 59, 138 hydrogen, platinum and platinum-gold, 57, 458 mechanism, 60, 193 isotopic exchange with benzene over supported improved techniques, 56, 134 Au-Pt, 57, 272 nitric oxide, hydrogen, and nitrogen over ruthe-Cyclohexene nium on alumina, 60, 204 intermediate, in tert-butylbenzene hydrogenation thermal on rhodium, 58, 370 acetic acid on Ni/Cu(110), 60, 441 curve, analysis: for heterogeneous surfaces, 56, D cyanogen on Pt(111), 60, 316 Deactivation Desulfurization alkali metal-graphite intercalates, carbon moncatalyst, MoS₂: supported, 59, 452 oxide hydrogenation over, 56, 258 Deuteration methanol synthesis catalysts: Cu/ZnO/M₂O₃, 1,3-butadiene derivatives over ThO₂, 56, 303 low pressure, 56, 407 Deuterium nickel and nickel bimetallics, by hydrogen sulexchange, of methane and ethane over Pt-Pd fide, 60, 257 alloy films, 56, 438 Dealkylation exchanged Raney nickel, in asymmetric hydrotoluene by steam over rhodium, 60, 472 genation of methyl acetoacetate, 60, 184 Decomposition gas, exchange with water on platinum-alumina, acetic acid on Ni/Cu(110), 60, 441 56, 229 cumyl hydroperoxide over Cu(II)-acetylaceton-1,4-Diacetoxy-2-butene ate, effect of polarity of medium, 56, 141 synthesis, reaction mechanism, 58, 155 formic acid on tungsten, 58, 149 Diacetoxylation hydrogen peroxide, on MnO2 and MnO2-CuO, liquid phase, heterogeneous: 1,3-butadiene over 58, 419 isopropanol over MgO and CoO-MgO, 56, 160 Pd-Te-C, 58, 155 Dibismuth trioxide, see Bismuth trioxide photochemical and thermal, comparison: iron pentacarbonyl on HY zeolite, 58, 230 Dienes thermal: gibbsite, under low pressures, 57, 222 conjugated, carbonylation over palladium, 60, 27 Defect point, concentrations in magnetite, 59, 15 -reaction interactions, intrapellet, 59, 272 Dehydration surface, atomic hydrogen on alumina, 58, 287 alcohols Dimerization over γ-Al₂O₃ and ThO₂, 57, 208; 59, 405 ethylene over boron phosphate, 57, 167 over NiO-SiO₂, 59, 303 on TiO₂, mechanism, 57, 191 over Rh-Y zeolite, 58, 82 2-propanol over y-alumina, kinetics, 60, 460 2,2-Dimethylbutane secondary alcohols, on alumina: product distribuhydrogenolysis, on supported ruthenium, nickel, tion, 58, 493, 496 cobalt, and iron, 58, 268 Dehydrogenation 2,3-Dimethylbutane cyclohexane over molybdenum-alumina, mechhydrogenolysis, on supported ruthenium, nickel, anism, 60, 193 cobalt, and iron, 58, 260 cyclohexene and cyclohexane on Pt, effect of

Dimethylbutene

isomerization over alumina, mechanism, 57, 264

strongly bound oxygen, 57, 426

isopropanol over CoO-MgO, 56, 160

Dispersion Enantioselectivity platinum-iridium on silica or alumina, 56, 1 hydrogenations ketones and C-C double bonds over modified Disproportionation toluene over HY zeolite/β-AlF₃/Cu, 59, 26, 37 Raney nickel, 60, 184 xylene on partially cation-exchanged H-mordenon modified Ni, 58, 276 ite, 56, 445 Energy dispersive analysis Dissociation methanol catalysts, Cu/ZnO and Cu/ZnO/Cr2O3, carbon monoxide over supported Ru-Pt, 59, 130 57, 339 Double bond Entropies shift isomerization of methylcyclohexenes and adsorption, use to validate rate equations, 56, 358 methylenecyclohexane over γ-alumina, kinet-Epitaxial growth ics, 59, 45 methanol catalysts, Cu/ZnO and Cu/ZnO/Cr2O3, Double labeling 57, 339 method, acetylene deuteration in presence of Epoxidation [14C]ethylene, **60**, 83 propylene with tert-butylhydroperoxide over carboxy cation-exchange resin, 56, 150 E Ethane Electrochemistry deuterium exchange over Pt-Pd alloy films, 56, methanol photocatalytic oxidation on rutile, 58, 22 Electrolyte hydrogenolysis over solid, for potentiometric oxygen measurement on Ni/SiO₂, kinetics, 60, 345, 452 Pt, Ag, Au, 57, 296 Pt-Fe, 60, 121 Electron Ethene, see Ethylene -accepting centers, ammonia adsorption on metal Ether oxides, 60, 1 from water addition to alkenes over clay minerdonor and acceptor properties, y-alumina surface, als, 58, 238 Ethylbenzene transfer, in nonstoichiometric manganese dioxide, oxidative dehydrogenation on zirconium phos-**58**. 419 phate, 56, 294 Electronic properties oxydehydrogenation, over nickel-tungsten oxides $Cu/ZnO/M_2O_3$ (M = Al, Cr), methanol cataon alumina, 58, 34 lysts, 56, 407 Ethylene Electron microscopy π -adsorbed, on alumina-supported Pt, Pd, and Rh, high resolution, lanthanum phosphate catalysts, 59, 239 56, 185 [14C] labeled, hydrogenation over Pd black, 60, 83 methanol catalysts, 57, 339 dimerization platium-palladium on silica, 56, 198 on NiO-SiO₂, 59, 303 rhodium rafts, ultradispersed on alumina, 57, 41 over Rh-Y zeolite, 58, 82 supported hydrogenation over metal particles: Pt/TiO2, 59, 293 intermetallic compounds, 56, 119 platinum particles, 56, 390 Rh-Y zeolite, 58, 82 Electron paramagnetic resonance TiC, WC, and TaC, 59, 472 chromium ions, 59, 153 oxidation over Cu2+ in CuO-silica-alumina, effect of acetone Pd, support effect and catalyst activation, 60, adsorption, 56, 290 295paramagnetic platinum and oxygen species, on supported silver, 57, 372 supported Pt. 59, 278 polymerization over vanadium on spent catalyst materials, 56, 315 chromium oxide/silica, 59, 153, 168 H-ZSM-5 zeolite, 59, 248 Electron spectroscopy for chemical analysis, see supported chromocene, 60, 68 X-Ray photoelectron spectroscopy Exchange deuterium, of methane and ethane over Pt-Pd Electron spin responance, see Electron paramagnetic alloy films, 56, 438 resonance hydrogen/deuterium in benzene on Pt and Ni, 58, γ-Elimination 43 dehydration of alcohols over oxides, 59, 405

Exoelectron emission

from reacting adsorbates, 60, 8

Elovich equation

adsorption rates of gas mixtures, 57, 187

Gibbsite

thermal decomposition, 57, 222

F Gold effect on carbon monoxide adsorption on palla-Fauiasite dium, 59, 201 lattice, aluminum distribution in, 58, 489 polycrystalline, sulfur dioxide oxidation on, 57, metamorphosis, ZSM-4 zeolite crystallization via, 59. 263 supported, oxygen chemisorption, 57, 177 Ferric chloride Gold-platinum graphite lamellar compound intercalated by, supported, activity and characterization, 57, 272 hydrocarbon synthesis over, 57, 27 **Films** Graphite nickel and palladium gasification by hydrogen, Pt catalyzed, 60, 41 lamellar compound, intercalated by ferric chloride: nitric oxide chemisorption, 57, 80 hydrocarbon synthesis from CO and H2, 57, olefin reactions on, 60, 15 platinum, silica support: sintering, particle size by X-ray photoelectron spectroscopy, 58, 454 Growth chain, 57, 183; 58, 95; 60, 344, 484 platinum-palladium alloy epitaxial: methanol catalysts, Cu/ZnO and Cu/ alkane reactions on, 56, 430 deuterium exchange of methane and ethane, 56, ZnO/Cr₂O₃, 57, 339 438 Fischer-Tropsch Н catalyst, combined with ZSM-5 class zeolites; improved gasoline selectivity and quality Halobenzenes from, 56, 274 bromination over zeolites, 60, 110 synthesis Halogen carbides formed by, over supported Fe and displacement polymerization: 2,4,6-trihalogeno-FeNi, 58, 348 phenols over basic copper(II) complex, kineteffect of iron carbides, 58, 361 ics, 58, 444 hydrocarbon chain growth, 57, 183 Hammett indicators over iron-ruthenium alloys, 60, 394 and catalyst acidity measurement, 60, 417 mechanism, 60, 484, 485 Hevall effect over nickel, metal-support effects, 56, 236 nickel particle size, 56, 297 reaction mechanism, 60, 481 n-Heptane over ruthenium, 58, 170 cracking, over tetrapropylammonium-silica-alusurface carbon incorporation into hydrocarbons, mina, 60, 156 mechanism, 58, 95; 60, 344 reforming, model reaction on Pt-Ir, 59, 211 Formaldehyde 1,5-Hexadiene aldol condensation, 58, 296 formation decomposition on copper-nickel alloys, 56, 349 over metal oxides from propylene, 57, 287 Formic acid on ZnO, mechanism, 59, 375 decomposition on tungsten, 58, 149 n-Hexane Formose adsorption on type Y zeolites, 56, 377 reaction: over CaO, solvent effects, 58, 296 hydrogenolysis, on supported ruthenium, nickel, cobalt, and iron, 58, 268 G isomerization and cyclization, over platinum, 58, Gadolinium oxide hydrogen-oxygen reaction on, kinetics and mechreactions, over various platinum catalysts, 56, 219 anism. 59, 176 reforming, model reaction on Pt-Ir, 59, 211 Gas selective isomerization, over nickel on silicacoexisting, effect on NO reduction by ammonia alumina: mechanism, 58, 220 over Cu(II) NaY, 59, 319 simultaneous isomerization and cracking over mixtures, adsorption rates, 57, 187 Pt/Al_2O_3 , kinetics, 60, 133 Gasification 1-Hexene graphite by hydrogen, Pt catalyzed, 60, 41 adsorption on type Y zeolites, 56, 377 Geometric factor High-resolution electron microscopy in alcohol dehydration on γ -Al₂O₃ and ThO₂, 57, lanthanum phosphate catalysts, 56, 185

Holmium oxide

anism, 59, 188

hydrogen-oxygen reaction on, kinetics and mech-

```
and carbon monoxide
Hume-Rothery
                                                            hydrocarbon synthesis over graphite lamellar
   size correlation, prediction of segregation to alloy
                                                              compound intercalated by ferric chloride, 57,
       surfaces, 59, 430
Hydrides
                                                            and nitric oxide, reactions with molybdenum-
  ethylene hydrogenation over, 56, 119
                                                               (II) carboxylates on silica, 60, 171
Hydrocarbon
                                                          chemisorption
  automotive exhaust emissions, poison-resistant
                                                            and interaction with carbon monoxide on co-
       catalysts for control of, 56, 321
                                                              balt (0001), 58, 28
  chain
                                                            on palladium/silica, 58, 206
    formation, 60, 485
                                                            on platinum-iridium, 56, 1
     growth in Fischer-Tropsch synthesis, 57, 183
                                                            on silica-supported nickel-copper, 60, 325
  hydrogenolysis on nickel, 60, 339
                                                          desorption from hydrides, 56, 119
  from methanol, over zeolites, 56, 169; 59, 123
                                                          exchange reaction, between deuterium gas and
                                                              water on platinum-alumina, 56, 229
  reactions
     over Pt-Pd alloy films, 56, 430, 438
                                                          gasification of graphite, Pt catalyzed, 60, 41
    on supported iridium, 59, 325
                                                          heterolytic dissociative adsorption, 59, 168
  synthesis
                                                          in hydrocarbon synthesis over silica-supported
                                                              Ru, 58, 170
    from CO and H<sub>2</sub> over silica-supported Ru, 58,
                                                          nitric oxide reduction by, over ruthenium on
                                                              alumina, 60, 204
    over graphite lamellar compound intercalated
                                                          in Raney nickel plate, electrolytic removal and
       by ferric chloride, 57, 27
                                                              determination, 58, 74
    mechanism, 58, 95; 60, 344
                                                          reaction with CO on Ru, 57, 397
  unsaturated, liquid phase: hydrogenation over
                                                         spillover
       palladium-polyamide, 57, 195
                                                            effect on gel of silica, 59, 467
Hydrodealkylation
                                                            on Pt/Al<sub>2</sub>O<sub>3</sub>, 58, 287
  toluene,
                                                          transfer activity between benzene and cyclo-
    kinetic analysis, 56, 40
                                                              hexane over supported Au-Pt, 57, 272
    specific activities and selectivities of Group
                                                       Hydrogenation
       VIIB and Group VIII metals on alumina, 56,
                                                         acetone over Raney nickel plate, activity: rela-
                                                              tionship to hydrogen content, 58, 74
Hydrodenitrogenation
                                                         acetylenes
  indole, effects of hydrotreating catalysts, 57, 390
                                                            (15), over polymer-bound palladium (II) com-
  reaction mechanism, 58, 485
                                                              plexes: mechanism and kinetics, 57, 315
Hydrodesulfurization
                                                            over Rh-Y zeolite, 58, 82
  catalysts
                                                         π-adsorbed ethylene, by hydrogen on alumina-
    cobalt-molybdenum sulfide, X-ray photoelec-
                                                              supported Pt, Pd, and Rh, 59, 239
      tron spectroscopy, 56, 99
                                                         alkenes, over metal borides, 60, 148
    sorption on, 58, 436
                                                         asymmetric, ketones and C-C double bonds over
  polycyclic aromatics over sulfided CoO-MoO<sub>3</sub>/
                                                              modified Raney nickel, 60, 184
      \gamma-Al<sub>2</sub>O<sub>3</sub>, 57, 509
                                                         benzene
  over supported cobalt molybdate, 60, 276
                                                            on palladium/silica, 58, 206
  surface polarity of Mo catalysts, 58, 436
                                                           over platinum and platinum-nylon, selectivity,
  thiophene over sulfided Co-Mo/Al<sub>2</sub>O<sub>3</sub>, mecha-
                                                              57, 193
      nism, 56, 363
                                                         1,3-butadiene by cyclohexadiene over CoS, 59, 423
Hydroformylation
                                                         tert-butylbenzenes, on rhodium: kinetics, stereo-
  olefins, over
                                                              chemistry, and mechanism, 58, 370
    supported Rh-Co clusters, 56, 127
                                                         carbon monoxide
    supported Rh, Rh-Co, and Co carbonyl clus-
                                                           over alkali metal-graphite intercalates, 56, 258
      ters, 59, 67
                                                           on graphite lamellar compound intercalated by
Hydrogen
                                                             ferric chloride, 57, 27
  activation, on Fe/MgO, 59, 382
                                                           over iron, role of readsorption in product dis-
  adsorption
                                                             tribution, 56, 249
    and desorption, platinum and platinum-gold,
                                                         competitive, olefins on NiO, 59, 465
                                                         cycloalkanones on Pt/SiO2 and Ru/SiO2, effects
    reduced molybdena-alumina, 60, 404
                                                             of ring size, 57, 147
```

cyclohexene on Pt, effect of strongly bound oxy-Hydrotreating gen, 57, 426 catalysts enantioselective, methyl acetoacetate over modicobalt molybdate on alumina, deactivation. fied Ni, 58, 276 ethylene over effects on indole hydrodenitrogenation, 57, 390 coal and heavy oil, hydrodenitrogenation, 58, 485 intermetallic compounds, 56, 119 Hydroxy acids Rh-Y zeolite, 58, 82 modifiers of Raney nickel, 60, 184 TiC, WC, and TaC, 59, 472 Hydroxyl groups and H/D-exchange, of benzene and perdeuteriosurface benzene on Pt and Ni, 58, 43 ammonia adsorption on metal oxides, 60, 1 heterogeneous and homogeneous, olefins over reduced molybdena-alumina, 60, 404 dispersed Pd, 57, 516 1-octyne over platinum-palladium oxides, 57, 494 ١ olefins over alkali metal-graphite intercalates, 56, 258 Imperfections chromium oxide/silica, 59, 153, 168 structural, lanthanum phosphate catalysts, 56, 185 reactions over nickel in type Y zeolites, 57, 126 Indicators Hammett, and catalyst acidity measurement, 60, transfer, muconic acid on alumina, 58, 320 unsaturated hydrocarbons over palladium-poly-Indole amide, 57, 195 hydrodenitrogenation, effects of hydrotreating Hydrogen-deuterium catalysts, 57, 390 equilibration over CoO-MgO solid solutions, 58, Inductive effects secondary alcohol dehydration on alumina, 58, kinetic isotope effect, absence on Ni, Ru, and Pt, 493, 496 60, 167, 169 Infrared spectra Hydrogenolysis adsorbed species alkane, mechanism, 58, 144 2-propanol dehydration over y-alumina, 60, 460 2,2-dimethylbutane and n-hexane on supported on silica-supported Ru, 58, 170 ruthenium, nickel, cobalt, and iron: kinetammonia adsorption on metal oxides, 60, 1 ics, 58, 268 carbon monoxide 2,3-dimethylbutane, on supported ruthenium, adsorbed on rhodium, 57, 41 nickel, cobalt, and iron: kinetics, 58, 260 adsorption on Pd-Au alloys, 59, 201 dissociation over supported Ru-Pt, 59, 130 and n-butane over Pt-Fe, 60, 121 coke formation on zeolites, 56, 377 over Ni/SiO₂, kinetics, 60, 345, 452 ethylene adsorption on transition metals, 59, 239 gel of silica, effect of hydrogen spillover, 59, 467 isopentane on nickel, 60, 339 in situ analysis of heterogeneous catalysts at neopentane elevated pressure and temperature, flow reand n-pentane over Rh/γ - Al_2O_3 , mechanisms, actor for, 56, 287 molybdena-alumina, reduced: surfaces, 60, 404 on platinum, mechanism, 58, 334 nickel oxide-silica, ethylene dimerization over, n-pentane over 59, 303 Pt-Al₂O₂, 59, 138 nitric oxide reduction by CO over Pt, 59, 223 Rh/γ-Al₂O₃, 56, 21 platinum-ruthenium clusters, supported, 58, 188 propane, on supported nickel, cobalt, iron, and reflection: nitric oxide chemisorption on Ni and ruthenium: kinetics, 58, 253 Pd films, 57, 80 reaction networks, 58, 260, 268 rhodium zeolite carbonylation catalyst, 59, 340 Hydrogen-oxygen supported rhodium carbonyls, 59, 357 reaction on lanthanide oxides, kinetics and mechtype of active oxygen for propylene oxidation of anism, 59, 176, 188 bismuth molybdate, 57, 331 Hydrogen peroxide water gas conversion on alunima, 57, 64 decomposition, over MnO2 and MnO2-CuO, 58, H-ZSM-5 zeolite, 59, 248 419 Intermediates Hydrogen sulfide carbidic, incorporation into hydrocarbons, 58, poisoning, nickel methanation catalysts, 60, 257 95; 60, 344

Intermetallic compounds

LaNi₅, PrCo₅, LaCo₅, CeCo₅, SmCo₅: ethylene hydrogenation over, **56**, 119

 $_{
m Ions}$

radical, perylene: generated on γ -alumina surface, 58, 470

Iridium

better decomposition catalyst than reduction catalyst, 60, 93

nitric oxide adsorption and decomposition, **60**, 93 oxidation of surface, **60**, 93

platinum-iridium

alumina support, alloy formation, 59, 446 reforming catalysts, characterization and performance, 59, 211

polycrystalline, carbon monoxide oxidation, 58, 303

supported, hydrocarbon reactions on, 59, 325 Iron

based mixed oxides, relationship between oxidation activity and acid-base properties, 60, 306-containing potassium-graphite, CO hydrogenation, 56, 258

direct reduction by carbon, 59, 1, 15

evaporated films, adsorption of benzene, pyridine, aniline, and nitrobenzene, **60**, 228

Fe/MgO, magnetic method and Mössbauer spectra, 59, 382

Fe₂O₃, interaction of ammonia with surface, 60, 1
Fe₃O₄, surface area titration using nitric oxide,
57, 105

 $Fe_2O_3-P_2O_5$, $Fe_2O_3-K_2O$, and $Fe_2O_3-Bi_2O_3-P_2O_5$ systems. **60**. 306

graphite lamellar compound intercalated by ferric chloride, hydrocarbon synthesis over, 57, 27 magnesium oxide support, Fischer-Tropsch synthesis on, 58, 361

particles, dispersed on HY zeolite, 58, 230 silica support, Fischer-Tropsch synthesis on, 58,

single crystals, carbon monoxide hydrogenation over, 56, 249

supported

2,2-dimethylbutane and n-hexane hydrogenolysis, 58, 268

2,3-dimethylbutane hydrogenolysis, **58**, 260 propane hydrogenolysis, **58**, 253

Iron carbide

in Fischer-Tropsch synthesis, kinetics, 58, 361 formation during Fischer-Tropsch synthesis, effect of particle size, 58, 348

Iron carbonyl

decomposition on HY zeolite, ¹³C-nmr spectroscopy, **58**, 230

Iron nickel

silica support, effect of pretreatment on particle size, 58, 337

Iron oxide

preparation from iron sulfate calcination, X-ray photoelectron spectroscopy, 57, 231

Iron pentacarbonyl

decomposition on HY zeolite, ¹³C-nmr spectroscopy, **58**, 230

Iron-ruthenium

alloys

catalysts, X-ray photoelectron spectroscopy/ secondary ion mass spectrometry, **56**, 174 freshly reduced: Fischer-Tropsch synthesis over, **60**, 394

Iron sulfates

calcination, in preparation of iron oxide catalysts, 57, 231

Isobutane

photocatalytic oxidation over TiO2, 60, 369

Isomerization

1-butene

over Al_2O_3 –ZnO, 57, 35

on ZrO₂, 57, 1

catalytic, xylenes: mechanism, 57, 444

dimethylbutene, over alumina: mechanism, 57, 264

n-hexane, over Pt, 58, 108

methylcyclohexenes and methylenecyclohexane over γ -alumina, kinetics of double bond shift, 59, 45

neopentane over Pt-Pd alloy films, 56, 430 selective, n-hexane over nickel on silica-alumina, 58, 220

and simultaneous cracking of n-hexane over Pt/ Al₂O₃, kinetics, **60**, 133

sulfur dioxide induced, of butene over cationexchanged X zeolites, 56, 88

Isopentane

hydrogenolysis on nickel, 60, 339

Isopropanol

conversion by processed coal minerals and pyrite, 60, 216

decomposition over MgO and CoO-MgO, 56, 160 Isotope

effect, kinetic

H₂-D₂: absence on Ni, Ru, and Pt, **60**, 167, 169 on Pt and Ni, in hydrogenation and H/D-exchange of benzene. **58**, 43

exchange

between benzene and cyclohexane over supported Au-Pt, 57, 272

in cyanogen adsorbed layers, **60**, 316 reactions, oxygen on platinum, **60**, 378 shifts, ¹³CO and C¹⁸O on rhodium, **57**, 72

L

Langmuir-Hinshelwood kinetics, criteria and validity, 56, 358

Lanthanide oxides

hydrogen-oxygen reaction on, kinetics and mechanism, 59, 176, 188

Lanthanum phosphate

catalysts, high-resolution electron microscopy, 56, 185

Ligand

and ensemble effects in CO adsorption on supported Pd-Au alloys, 59, 201

M

Magnesium

CoO-MgO solid solutions: H₂-D₂ equilibration over, effect of cobalt ion dispersion, 58, 396 Fe/MgO, magnetic method and Mössbauer spectra, 59, 382

Magnesium oxide

isopropanol decomposition on, 56, 160

Magnetic method

activation of H₂ on Fe/MgO, 59, 382 silica-supported nickel-copper, 60, 325

Magnetic susceptibility

chromium ions, 59, 153

Magnetite

Fe₃O₄, surface area titration, 57, 105 reduction

by charcoal, 59, 15 by graphite, 59, 1

Maleic anhydride

formation from butenes, 57, 253

manufacture: butene oxidation over vanadyl phosphate, 57, 236

Manganese

MnO₂-CuO, physicochemical properties, **58**, 419 surface CuMn₂O₄, formation on MnO₂-CuO catalysts, **58**, 419

Manganese dioxide

crystalline modifications, 58, 419

physicochemical properties, correlation with catalytic activity, **58**, **419**

Medium

polarity, effect on cumyl hydroperoxide decomposition and cumene autoxidation over Cu(II)-acetylacetonate, 56, 141

Metal

alloys

acetic acid decomposition on, 60, 441 surface composition, models and results, 57, 113 catalysts, supported: splitting kinetics, 57, 504 Group VIIB and Group VIII on alumina, activities and selectivities, 56, 32

noble, see Noble metals

particles

size, effect on iron carbides formed during Fischer-Tropsch synthesis, 58, 348

supported: electron microscopy, 56, 390; 59, 293

supported, propane hydrogenolysis, 58, 253 transition, see Transition metals

Metal boride

alkene hydrogenation over, effect of catalyst poisons, 60, 148

Metal molybdates

reactivity of oxygen in, 59, 448

Metal oxides

ammonia adsorption, ir spectra, 60, 1 olefin oxidation, 59, 375 reduction with propylene, 57, 287 support for Rh, Rh–Co, and Co carbonyl clusters:

olefin hydroformylation over, 59, 67

Metal-support

effects on CO-H₂ reactions over Ni, 56, 236 interaction, coprecipitated nickel on silica, 56, 336

Metal-zeolites

synthesis gas conversion over, 56, 268

Metamorphosis

faujasite, ZSM-4 zeolite crystallization via, 59, 263

Metastable phase

transformations, zeolite ZSM-5 in (TPA)₂O-Na₂O-K₂O-Al₂O₃-SiO₂-H₂O system, **60**, 241

Metathesis

catalyst: rhenium oxide on alumina, laser-Raman spectra, 56, 279

Methanation

carbon monoxide and carbon dioxide over Ru/molecular sieve, mechanism, 60, 57

by cobalt and ruthenium, role of carbon, 56, 284 over cobalt, enhancement by surface cobalt oxide, 58, 328

ensemble effect, 59, 395

heterogeneous: H_2 - D_2 kinetic isotope effect, absence on Ni, Ru, and Pt, 60, 167, 169

mechanism, 58, 95; 60, 344

over nickel

metal-support effects, 56, 236 and nickel bimetallics, deactivation by H₂S, 60, 257

reaction

on nickel, sulfur poisoning, 59, 395

over Ru, Ru-Ni, Ru-Cu, and Ni clusters in zeolite Y: kinetics, 57, 11

on supported nickel, using temperature programmed heating, 56, 453

Methane

deuterium exchange over Pt-Pd alloy films, 56, 438

from hydrogenation of chemisorbed CO and surface carbon on Ni/Al₂O₃, 57, 406

synthesis, over cobalt: enhancement by cobalt oxide, **58**, 328

Methanol

carbonylation over Rh-Y zeolite, kinetics and mechanism, 59, 53, 61

hydrocarbons from, over zeolites, 56, 169; 59, 123 photocatalytic oxidation on rutile, Wagner-Traud mechanism, 58, 22

synthesis over

Cu/ZnO and Cu/ZnO/Cr₂O₃, 57, 339 Cu/ZnO/M₂O₃ (M = Al, Cr), low pressure: mechanism, 56, 407

Methyl acetate

formation from methanol carbonylation, kinetics and mechanism, **59**, 53, 61

Methyl acetoacetate

hydrogenation over modified Ni, 58, 276

2-Methyl-1,3-butadiene

hydrogenation over ThO₂, 56, 303

(E)-2-Methyl-2-butene-1,4- d_2 formation over ThO₂, 56, 303

Methylcyclohexenes

double bond shift isomerization over γ -alumina, kinetics, 59, 45

Methylcyclopentane

reactions, over various platinum catalysts, 56, 219

Methylenecyclohexane

double bond shift isomerization over γ -alumina, kinetics, 59, 45

Mica

surface: butene isomerization and dehydrogenation, molecular beam study, 57, 96

Microanalysis

platinum-palladium on silica, 56, 198

Microcalorimetry

H-ZSM-5 zeolite, acidity, 59, 248

Microdiffraction

methanol catalysts, Cu/ZnO and Cu/ZnO/Cr $_2$ O $_3$, 57, 339

Microporous alumina

formation, **57**, 222

Model

kinetic, differential and integral: infrared cellrecycle reactor, 60, 460

Molecular beam

study of butene isomerization and dehydrogenation on mica, 57, 96

Molecular orbital

studies: xylene isomerization, mechanism, 57, 444 Molybdates

metal, reactivity of oxygen in, 59, 448 supported, characterization, laser Raman spectra, 60, 276

Molybdena-alumina

assay, by oxygen chemisorption, 59, 311 reduced, surface chemistry, 60, 404 shell catalysts, sintering, 57, 87

Molybdenum

Bi-Mo-O type catalyst, for ammoxidation, 59, 314, 317

Bi₂O₃-MoO₃ system, phase diagram, **58**, 409 catalysts, sulfided: surface polarity, **58**, 436 Co-Mo-Al₂O₃

desulfurization catalysts, 59, 452

thiophene hydrodesulfurization over, 56, 363

Molybdenum-alumina

MoO₃-Al₂O₃, cyclohexane dehydrogenation over, **60**, 193

Molybdenum (II) carboxylates

on silica, redox reactions with CO, NO, and H_2 , 60, 171

Molybdenum disulfide

identification in used Co-Mo-Al₂O₃ desulfurization catalysts, **59**, **452**

Molybdenum trioxide

interaction of ammonia with surface, 60, 1

Molybdenum trioxide-titanium dioxide

1-butene and butadiene oxidation over, **57**, 253 Montmorillonite

water addition to alkenes over, 58, 238

Mössbauer spectra

activation of H₂ on Fe/MgO, 59, 382

iron and iron nickel, silica support, 58, 337

iron carbides

formed during Fischer-Tropsch synthesis, kinetics, 58, 361

on iron and iron nickel, 58, 348

Muconic acid

transfer hydrogenation, on alumina, 58, 320

Ν

Neopentane

hydrogenolysis

on platinum, mechanism, 58, 334

over Rh/γ -Al₂O₃, mechanisms, 56, 12

isomerization over Pt-Pd alloy films, **56**, 430 Nickel

action in type Y zeolites, in hydrogenation reactions, 57, 126

alumina support, hydrogenation of chemisorbed

CO and surface carbon, 57, 406
Boudouard and methanation reactions, sulfur

poisoning, 59, 395 catalysts, metal-support effects on activity and selectivity in CO-H₂ reactions, 56, 236

clusters, in zeolite Y: methanation reaction over, 57, 11

coprecipitated on silica methanation catalysts, 56, 336

corrosive chemisorption, 58, 276

evaporated films, adsorption of benzene, pyridine, aniline, and nitrobenzene, 60, 228

films

nitric oxide chemisorption, 57, 80 olefin reactions on, 60, 15

Nickel tartrate

58, 276

catalyst modifier, enantioselective hydrogenation,

interaction of nitric oxide with, 60, 385 Nickel-tungsten oxides isopentane hydrogenolysis, 60, 339 alumina support, ethylbenzene oxydehydrogenaisotope effects in benzene reactions on, 58, 43 tion over, 58, 34 methanation catalysts, sulfur poisoning, 60, 257 Nickel-zeolite modified with tartaric acid or nickel tartrate, bifunctional action, in toluene conversion, 58, 198 enantioselective hydrogenation, 58, 276 Nitric oxide oxidized, interaction of nitric oxide with, 60, 385 adsorption particle size, Hedvall effect, 56, 297 and decomposition on iridium, 60, 93 Raney on magnetite, 57, 105 modified with amino acids and hydroxy acids, carbon monoxide, and hydrogen: reactions with and exchanged with deuterium: asymmetric molybdenum(II) carboxylates on silica. 60. hydrogenations of ketones and C-C double bonds, 60, 184 chemisorption on Ni and Pd films, 57, 80 interaction with nickel and oxidized nickel, 60, plate, activity and hydrogen content, 58, 74 silica support, sintered, crystallite size distribution, 57, 417 olefin adsorption, nature of, 59, 465 silica-alumina support reactions n-hexane selective isomerization, 58, 220 with ammonia over Cu(II)NaY, mechanism: interactions, 58, 220 effect of coexisting oxygen, 59, 319 supported with ammonia on V₂O₅, 57, 526, 528 2.2-dimethylbutane and *n*-hexane hvdroeffect of catalyst loading, 57, 513 genolysis, 58, 268 reduction 2,3-dimethylbutane hydrogenolysis, 58, 260 by ammonia on zeolites, 59, 319 methanation, absence of H₂-D₂ kinetic isotope by CO over Pt, kinetics and ir spectra, 59, 223 effect, 60, 167, 169 by H_2 over Rh/γ - Al_2O_3 , 56, 21 methanation, using temperature programmed by H₂ over ruthenium on alumina, 60, 204 heating, 56, 453 surface reactions with CO and O2 on Pt-alumina, propane hydrogenolysis, 58, 253 57, 361 Nickel-antimony Nitrobenzene interaction, 56, 130 adsorption on evaporated Ni and Fe, 60, 228 Nickel boride Nitrogen alkene hydrogenation over, effect of catalyst fixation over K-N₂-Ru complex, 58, 313 poisons, 60, 148 K-N₂-Ru complex for nitrogen fixation, 58, 313 temperature-programmed desorption over ru-Nickel carbide temperature programmed hydrogenation, 57, 406 thenium on alumina, 60, 204 Nitrogen oxide Nickel-copper alloy surfaces, acetic acid decomposition on, 60, automotive exhaust emissions, poison-resistant catalysts for control of, 56, 321 silica support, surface composition, 60, 325 decomposition, over CoO-MgO solid solutions: single-crystal surfaces, formaldehyde decomposimechanism, 58, 396 tion, 56, 349 Noble metals Nickel hydroxide aluminum support, interaction with cerium silica support, methanation catalysts, 56, 336 oxide, 58, 131 Nickel oxide effects of SO₂, in auto exhaust, 57, 380 silica support, methanation catalysts, 56, 336 Nuclear magnetic resonance supported: Tetralin oxidation, kinetics, 59, 460 ¹³C, spectra Nickel oxide-silica acetylenes, 57, 315 structure, ir spectra: for ethylene dimerization, iron pentacarbonyl, decomposition on Hy **59**, 303 zeolite, 58, 230 Nickel/silica vanadium on spent catalyst materials, 56, 315 ethane hydrogenolysis, kinetics, 60, 345, 452 Nickel silicate 0 amorphous, spectra: in coprecipitated nickel-onsilica methanation catalysts, 56, 336 1-Octvne

hydrogenation over platinum-palladium oxides,

57, 494

Offretite, see Zeolite, offretite

| Oil | vapor phase, benzyl alcohol: over Cu(II)NaY |
|---|---|
| heavy, hydrotreating, 58, 485 Olefins | zeolite, 56, 52 |
| | o-xylene, on potassium vanadates, 58, 15 |
| adsorption in NiO, 59, 465 | Oxidative dehydrogenation, see Dehydrogenation, oxidative |
| hydroformylation, over supported Rh-Co clusters, 56 , 127 | Oxides |
| | |
| Rh, Rh–Co, and Co carbonyl clusters, 59, 67 | alcohol dehydration over, 59, 405 |
| hydrogenation over | bismuth and molybdenum, 18O enriched: solid |
| chromium oxide/silica, 59, 153, 168 | state reaction, 56, 84 |
| dispersed Pd, 57, 516 | segregation, Pt-Re/Al ₂ O ₃ , 59, 434 |
| oxidation | solid state, activity, in allylic oxidation of pro- |
| by metal oxides, 57 , 287; 59 , 375 | pylene, 58 , 8 |
| over MoO_3 – TiO_2 , 57, 253 | supporting, effects on styrene oxidation, 60, 341 |
| reactions on Ni and Pd films, 60, 15 | surfaces, redox properties, 58, 478 |
| Orientation | Oxydehydrogenation |
| chemisorbed NO and (NO) ₂ on Ni and Pd films, | ethylbenzene, over nickel-tungsten oxides on |
| 57 , 80 | alumina, 58 , 34 |
| Oxidation | Oxygen |
| activity, intrinsic: relationship with acid-base | active, type: propylene oxidation over bismuth |
| properties of iron based mixed oxides, 60, 306 | molybdate, 57 , 331 |
| allylic, propylene, 58, 8 | activity, on Pt, Au, Ag, 57, 296 |
| ammonia | chemisorption |
| initial activation of Pt-Rh gauzes, 60, 430 | assay of molybdena-alumina, 59, 311 |
| over Pt-Rh gauze: catalyst deactivation, 56, | on supported gold, 57, 177 |
| 472 | with hydrogen on lanthanide oxides, kinetics and |
| butadiene, over vanadium pentoxide-titanium | mechanism, 59, 176, 188 |
| dioxide system, 57, 476 | ions, charge localization, 58, 8 |
| <i>n</i> -butane, by O_2 over Rh/ γ -Al ₂ O ₃ , 56, 21 | isotope equilibration over Pt, 60, 378 |
| butene | molecular, isotopic exchange, 59, 448 |
| butadiene, methanol, and formic acid over iron | O-compounds, conversion to hydrocarbons over |
| based mixed oxides, 60, 306 | zeolites, 56 , 169 |
| catalytic and gas phase interactions, 60, 476 | O ₂ - species, on supported Pt, 59, 278 |
| carbon monoxide | oxidic |
| on α -alumina-supported chromia, 59, 100 | reactivity, 57, 287 |
| over iridium, kinetics and mechanism, 58, 303 | of ZnO: reactivity, 59, 375 |
| over MnO ₂ and MnO ₂ -CuO, 58, 419 | paramagnetic, species on supported Pt, 59, 278 |
| over Pt-alumina: effects of particle size, 59, 272 | reactions, effect of catalyst loading, 57, 513 |
| catalytic, 1-butene and butadiene over MoO ₃ - | species, role in photocatalytic oxidation of iso- |
| TiO ₂ , 57, 253 | butane over TiO ₂ , 60 , 369 |
| ethylene, over | strongly bound, effect on dehydrogenation and |
| Pd, support effect and catalyst activation, | hydrogenation activity and selectivity of |
| 60, 295 | Pt, 57, 426 |
| supported silver, 57, 372 | surface reactions of NO, CO, and O ₂ on Pt- |
| olefin, by metal oxides, 57, 287; 59, 375 | alumina, 57, 361 |
| | thermal desorption curves, on ZnO and silver, 56, |
| photocatalytic | 110 |
| isobutane over TiO ₂ , mechanisms, 60 , 369 | 110 |
| methanol on rutile, 58, 22 | n. |
| process, segregation in vanadium pentoxide— | P |
| molybdenum trioxide catalysts, 57, 326 | Palladium |
| propylene over bismuth molybdate, 57, 331; | alumina support |
| mechanisms, 56, 73; 59, 79 | ethylene adsorption, 59, 239 |
| selective | interaction with cerium oxide, 58, 131 |
| hydrocarbons on Sn-Sb oxides, 58, 61 | atomically dispersed, olefin hydrogenation, 57, 516 |
| propylene on Sb-Sn-O, 58, 52 | butadiene carbonylation over, 60, 27 |
| styrene, effects of supporting oxides, 60, 341 | films |
| sulfur dioxide over Pt, Au, Ag, 57, 296 | nitric oxide chemisorption, 57, 80 |
| Tetralin over supported NiO, kinetics, 59, 460 | olefin reactions on, 60, 15 |

platinum and, dispersion on silica: effect of tem-Physicochemical properties manganese dioxide, correlation with catalytic perature on crystallite size, 60, 270 polymer-bound Pd(II) complexes: acetylene hyactivity, 58, 419 drogenation, kinetics, 57, 315 3-Picoline silica support ammoxidation on vanadium oxides, 58, 383 benzene hydrogenation, 58, 206 Platinum structure and activity, effect of reduction temalumina support perature, 58, 206 carbon monoxide oxidation: effect of partical supported, dual state behavior in ethylene oxidasize on multiple steady states, 59, 272 tion, 60, 295 ethylene adsorption, 59, 239 Palladium black interaction with cerium oxide, 58, 131 acetylene deuteration in presence of [14C]ethylene γ -alumina support, surface interactions, 59, 365 over. 60, 83 benzene hydrogenation over, selectivity, 57, 193 Palladium-gold -catalyzed gasification of graphite by hydrogen, alloys, supported: ligand and ensemble effects in 60, 41 CO adsorption, 59, 201 crystallites, alumina support: role of wetting in Palladium-polyamide redispersion, 59, 109 unsaturated hydrocarbon hydrogenation, 57, 195 cycloalkanone hydrogenation on Pt/SiO₂, 57, 147 Palladium-silver dispersed, hydrogen adsorption, 57, 458 alloys, surface composition, 60, 100 film, silica support: sintering, particle size by Palladium tellurides X-ray photoelectron spectroscopy, 58, 454 charcoal support, diacetoxylation of 1,3-butan-hexane aromatization and isomerization, 58, 108 diene, 58, 155 hydrogen and carbon monoxide chemisorption, Paramagnetic oxygen 59, 365 species on supported Pt, 59, 278 isotope effect in benzene reactions on, 58, 43 Paramagnetic platinum neopentane hydrogenolysis, mechanism, 58, 334 species on supported Pt. 59, 278 oxygen isotope reactions on, catalytic activity, 60, **Particles** metal, supported: electron microscopy, 56, 390; and palladium dispersion on silica, effect of tem-59, 293 perature on crystallite size, 60, 270 size paramagnetic, species on supported Pt, 59, 278 determination by X-ray photoelectron spectrosparticles, supported: electron microscopy, 56, 390 copy: model development, 58, 454 effect on iron carbides formed during Fischer-269 Tropsch synthesis, 58, 348 supported Fe: effect of dehydration, 58, 337 Pt-Re/Al₂O₃ conversion over AlCl₃-CuCl₂ mixtures, 56, 47 hydrogenolysis effects of surface structure of Rh/γ-Al₂O₃, 56, 21 over Rh/\gamma-Al2O3, mechanisms, 56, 12 surface reactions, on γ -alumina, 58, 470 diagram, Bi₂O₃-MoO₃ system, 58, 409

polycrystalline, sulfur dioxide oxidation on, 57, Pt (111), surface chemistry of cyanogen on, 60, 316 Pt-Ir/Al₂O₃, alloy formation, 59, 446 alloy formation and oxide segregation, 59, 434 n-Pentane state of Re in, 56, 468 Pt/TiO₂, electron microscopy, 59, 293 Ru-Pt bimetallic clusters, silica support: CO dissociation over, 59, 130 silica support: NO reduction by CO over, kinetics Perylene and ir spectra, 59, 223 single crystal surfaces, effect of strongly bound Phase oxygen on dehydrogenation and hydrogenation activity and selectivity, 57, 426 metastable, transformation: zeolite ZSM-5 in supported $(TPA)_2O-Na_2O-K_2O-Al_2O_3-SiO_2-H_2O$ sysmethanation, absence of H2-D2 kinetic isotope tem, 60, 241 effect, 60, 167, 169 Photocatalysis paramagnetic platinum and oxygen species on, isobutane oxidation over TiO₂, 60, 369 59, 278 rutile, methanol oxidation on, 58, 22 unsupported and supported: comparison, in Photoconductivity hexane reactions, 56, 219 in situ measurements, isobutane oxidation over TiO₂, 60, 369 Platinum-alumina carbon monoxide poisoning in deuterium-water Photooxidation exchange on, 56, 229 methanol on rutile, 58, 22

n-hexane simultaneous isomerization and cracking Polarity over, kinetics, 60, 133 of medium, effect on cumyl hydroperoxide decommodification by hydrogen at high temperatures, position and cumene autoxidation over Cu-59, 138 (II)-acetylacetonate, 56, 141 surface reactions of NO, CO, and O2, 57, 361 Polycyclic aromatics hydrodesulfurization over sulfided CoO-MoO₃/ Platinum black γ -Al₂O₃, **57**, **509** attenuation of activity, 59, 138 Polymer Platinum-gold -bound palladium (II) complexes, acetylene hyhydrogen adsorption, 57, 458 drogenation, 57, 315 supported, surface composition, 57, 272 Polymerization Platinum-iridium ethylene, over alloy powders, reforming catalysts, 59, 211 chromium oxide/silica, 59, 153, 168 reforming catalysts, characterization and persupported chromocene, 60, 68 formance, 59, 211 halogen displacement, over basic Cu(II) complex: silica or alumina support, dispersion and structure, kinetics, 58, 444 56. 1 Pore Platinum-iron sizes, amorphous silica-alumina, 60, 156 silica support, characterization and catalytic Potassium-dinitrogen-ruthenium activity, 60, 121 complex, for nitrogen fixation, 58, 313 Platinum-nylon Potassium vanadates benzene hydrogenation over, selectivity, 57, 193 reduction, 58, 15 Platinum oxide o-xylene oxidation on, 58, 15 on y-alumina Pressure temperature programmed reduction, 59, 365 effect on two phases, 59, 365 tert-butylbenzene hydrogenation on rhodium, Platinum-palladium alloys, films methanol conversion over zeolites, 56, 169 alkane reactions on, 56, 430 Pretreatment deuterium exchange of methane and ethane, 56, supported Fe and FeNi, effect on particle size, 58, 337 silica support, crystallites: morphology and com-Probability position, 56, 198 sticking, oxygen on platinum, 60, 378 Platinum-palladium oxides Product 1-octyne hydrogenation, 57, 494 distribution: carbon monoxide hydrogenation Platinum-rhenium over Fe single crystals, role of readsorption, alumina support, state of Re in, 56, 468 Propane Platinum-rhodium hydrogenolysis, on supported nickel, cobalt, iron, alloy crystallites on amorphous SiO₂, morphology. and ruthenium, 58, 253 2-Propanol gauze dehydration over γ -alumina, kinetics, **60**, 460 activation for ammonia oxidation, 60, 430 Propene, see Propylene rhodium oxide formation on surface, 56, 472 Platinum-ruthenium Propylene adsorption on ZnO, sites for, 59, 375 clusters, supported: surface composition, 58, 188 allylic oxidation, 58, 8 Platinum-tin ammoxidation reforming catalysts, surface, 56, 65 mechanism, 59, 314, 317 Poison over Te oxide/silica-alumina, 59, 148 -resistant catalysts for control of automotive exepoxidation with tert-butyl hydroperoxide over haust emissions, 56, 321 carboxy cation-exchange resin, 56, 150 by carbon monoxide, in deuterium-water exchange over bismuth molybdate, 56, 84; 57, 331; stable on platinum-alumina, 56, 229 intermediate in, 56, 73 selective, dimethylbutene isomerization over by metal oxides (14), 57, 287 alumina, 57, 264 by ZnO, 59, 375 sulfur, nickel methanation catalysts, 60, 257 reaction routes on zinc oxide, 58, 1

reduction of ¹⁸O-labeled bismuth molybdate, **56**, infrared cell-recycle, differential and integral kinetic modeling in, 60, 460 selective oxidation recycling molecular beam: 1-butene on mica, reand ammoxidation over bismuth molybdate, action probabilities. 57, 96 mechanisms, 59, 79 Readsorption on Sb-Sn-O, 58, 52 during iron catalysis, 56, 249 Reconstruction Pyridine surface, on Pd catalysts in ethylene oxidation, 60, adsorption and catalyst acidity measurement, 60, 417 on evaporated Ni, and Fe, 60, 228 Redispersion platinum crystallites supported on alumina, role from propylene ammoxidation over tellurium of wetting, 59, 109 oxide/silica-alumina, 59, 148 Redox properties, of four oxide surfaces, 58, 478 isopropanol conversions over, 60, 216 Reduction chromium ions Q with carbon monoxide, 59, 153 Quinhydrone with hydrogen, 59, 153, 168 surface reactions, on four oxide surfaces, 58, 478 magnetite by charcoal, 59, 15 R by graphite, 59, 1 metal oxides (14), with propylene, 57, 287 Radiotracers nitric oxide carbon formation in zeolites, 56, 195 by ammonia over Cu(II) NaY, 59, 319 Raman spectra by carbon monoxide over Pt, kinetics and ir laser spectra, 59, 223 rhenium oxide metathesis catalyst, alumina by H_2 over Rh/γ - Al_2O_3 , 56, 21 support, 56, 279 by H₂ over ruthenium on alumina, 60, 204 supported molybdates, characterization, 60, 276 process, segregation in vanadium pentoxidetype of active oxygen for propylene oxidation over molybdenum trioxide catalysts, 57, 326 bismuth molybdate, 57, 331 temperature programmed Pt-Ir/Al₂O₃, alloy formation, 59, 446 carbon monoxide with H2 on Ru, 57, 397 Pt-Re/Al₂O₃, alloy formation and oxide segremechanisms gation, 59, 434 correlation with surface structure, 60, 15 zinc oxide, with propylene, 59, 375 Fischer-Tropsch synthesis, 60, 481 Reforming catalysts networks platinum-iridium, characterization and performacetylene deuteration in presence of [14C]ance, 59, 211 ethylene, 60, 83 platinum-tin, surface, 56, 65 in catalytic hydrodenitrogenation, 57, 390 Regeneration probability, effect of translational and vibrational supported metal catalysts, 57, 504 energy, 57, 96 Reoxidation rate. measurement: hydrocarbon synthesis over by silanol groups, chromium ions, 59, 153, 168 silica-supported Ru, 58, 170 Rhenium hydrotreating catalysts, indole hydrodenitroskeletal alkanes over Pt-Pd alloy films, 56, 430 genation over, 57, 390 C6-hydrocarbons: over various platinum cata-Pt-Re/Al₂O₃, alloy formation and oxide segrelysts, 56, 219 gation, 59, 434 state in Pt-Re/ γ -Al₂O₃, 56, 468 surface, see Surface, reactions temperature programmed Rhenium oxide carbon monoxide and H₂, 56, 453 alumina support, Raman spectra, 56, 279 nitric oxide with hydrogen over ruthenium on Rhodium active state in rhodium exchanged Y zeolite, alumina, 60, 204 X-ray photoelectron spectroscopy, 58, 82 Reactor alumina support flow, spectroscopic: in situ analysis of heterogeneethylene adsorption, 59, 239 ous catalysts at elevated pressure and tem-

perature by ir spectroscopy, 56, 287

interaction with cerium oxide, 58, 131

γ-alumina support Ruthenium-copper in zeolite Y, methanation reaction over, 57, 11 dispersion, 56, 21 hydrogenolysis of neopentane and n-pentane, Ruthenium-nickel mechanisms, 56, 12 in zeolite Y, methanation reaction over, 57, 11 surface structure, effects on n-pentane hydro-Ruthenium-platinum genolysis, n-butane oxidation, and nitric bimetallic clusters, silica support: CO dissociation oxide reduction, 56, 21 over, 59, 130 tert-butylbenzene hydrogenation, 58, 370 carbonyl clusters, supported: olefin hydroformyl-S ation over, 59, 67 clusters in zeolites, 59, 357 Scanning electron microscopy particles, alumina support: carbon monoxide ZSM-4 crystallization, morphology, 59, 263 bonding to, 57, 72 Scanning transmission electron microscopy rafts, ultradispersed on alumina: existence and methanol catalysts, Cu/ZnO and Cu/ZnO/Cr₂O₃, topology, 57, 41 **57**, 339 toluene steam dealkylation over, 60, 472 Secondary ion mass spectrometry Rhodium-cobalt iron-ruthenium alloy carbonyl clusters, supported: olefin hydroformylcatalysts, 56, 174 ation over, 59, 67 surface analysis, 60, 394 cluster, supported: olefin hydroformylation over, 56, 127 Segregation binary alloys: free energy of, and theoretical Rhodium oxide correlation, 57, 450 formation on surface of Pt-Rh gauze, 56, 472 oxide, in Pt-Re/Al₂O₃, 59, 434 Rhodium-Y zeolite prediction of, alloys surface, 59, 430 methanol carbonylation, kinetics and mechasurface nism, 59, 53, 61 in cobalt-molybdenum binary oxide catalysts, Rhodium zeolite 57, 153 carbonylation catalyst, X-ray photoelectron specmetal alloy, comparison of models and results, troscopy and infrared spectra, 59, 340 **57**, 113 Ruthenium quantitative prediction, 57, 450 alumina support in vanadium pentoxide-molybdenum trioxide, carbon monoxide desorption and reaction with in oxidation and reduction processes, 57, 326 H₂, 57, 397 Selectivity nitric oxide reduction with H2 over, 60, 204 alcohol dehydration over cycloalkanone hydrogenation on Ru/SiO₂, 57, 147 boron phosphate, 57, 167 FeRu oxides, **59**, 405 alloy catalysts, X-ray photoelectron spectrosbenzene hydrogenation over platinum and platicopy/secondary ion mass spectrometry, 56, num-nylon, geometric effects, 57, 193 174 bromination of halobenzenes over zeolites, 60, 110 synthesis catalysts, 60, 394 carbon monoxide hydrogenation over alkali K-N₂-Ru complex for nitrogen fixation, 58, 313 metal-graphite intercalates, 56, 258 criteria: V-P-O phases in butene oxidation to methanation maleic anhydride, 57, 236 of CO and CO2 over Ru/molecular sieve, mechcyclohexene dehydrogenation on Pt, effect of anism, 60, 57 strongly bound oxygen, 57, 426 by, role of carbon, 56, 284 metal-support effects on CO-H₂ reactions over silica support Ni, 56, 236 adsorpted species, ir spectra, 58, 170 product hydrocarbon synthesis, 58, 170 amorphous silica-alumina with controlled pore supported 2,2-dimethylbutane and n-hexane hydrogenolysize, 60, 156 zeolite ZSM-5, 60, 140 sis, 58, 268 2,3-dimethylbutane hydrogenolysis, 58, 260 shape, and carbon formation in zeolites, 56, 139 methanation, absence of H2-D2 kinetic isotope toluene hydrodealkylation over Group VIIB effect, 60, 167, 169 and Group VIII metals on alumina, 56, 32 propane hydrogenolysis, 58, 253 Silanol groups

role in formation of supported chromocene, 60, 68

in zeolite Y, methanation reaction over, 57, 11

| Silica | Splitting |
|--|--|
| amorphous, morphology of Pt-Rh alloy crystal- | supported metal catalysts, kinetics, 57, 504 |
| lites on, 60, 356 | Stability |
| gel, effect of hydrogen spillover, 59, 467 | steam, zeolite ZSM-5, 60, 140 |
| molybdenum(II) carboxylates on, 60, 171 | Steady states |
| platinum and palladium dispersion on, 60, 270 support for | multiple, isothermal: effects of catalyst particle size, 59, 272 |
| cobalt molybdate, Raman spectra, 60, 276 | Steam |
| nickel, methanation catalysts, 56, 336 | dealkylation, toluene over rhodium, 60, 472 |
| nickel-copper, surface composition, 60, 325 | Stereochemistry |
| Pt, NO reduction by CO over, 59, 223 | alcohol dehydration over alumina and thoria, 59, |
| Pt-Fe, characterization and catalytic activity, | 405 |
| 60, 121 | tert-butylbenzenes, hydrogenation on rhodium, |
| Ru, hydrocarbon synthesis, 58, 170 Silica-alumina | 58, 370 |
| amorphous, with controlled pore sizes, 60, 156 | Sticking |
| catalyst: CuO, electron spin resonance of Cu ²⁺ in, | probability, oxygen on platinum, 60 , 378 |
| 56, 290 | Stoichiometry surface reactions of NO, CO, and O ₂ on Pt- |
| Silicalite | alumina, 57, 361 |
| adsorption by, 58, 114 | Styrene |
| reactions on, poisoning, 58, 114 | oxidation, effects of supporting oxides, 60, 341 |
| Silicate sheet, intercalates: water addition to alkenes over, | production, 58, 34 |
| 58, 238 | Sulfur |
| Silicon oxide | poisoning |
| -supported platinum particles, electron mi- | metal boride catalysts, 60, 148 |
| croscopy, 56 , 390 | nickel methanation catalysts, 60 , 257 Sulfur dioxide |
| Silver | effects on noble metals in auto exhaust, 57, 380 |
| ethylene oxidation, effects of alumina support, | -induced isomerization of 2-butene over X |
| 57, 372 | zeolites, 56 , 88 |
| oxygen on, thermal desorption curves, 56, 110 polycrystalline, sulfur dioxide-oxygen interaction | oxidation over Pt, Au, Ag, 57, 296 |
| on, 57, 296 | Surface |
| Sintering | acidity: boron phosphate, role in activity and |
| platinum-palladium on silica, 56, 198 | selectivity of alcohol dehydration, 57, 167 |
| shell molybdena–alumina, 57, 87 | area, titration: magnetite, using nitric oxide, 57, 105 |
| Site | chemistry |
| active, see Active site | cyanogen on Pt(111), 60, 316 |
| basic, on ZrO ₂ , 57, 1 | reduced molybdena-alumina, 60, 404 |
| density, surface: redox, 58 , 478 reducing, on ZrO_2 , 57 , 1 | composition |
| surface, redox, 58 , 470 | cobalt-molybdenum binary oxide catalysts, |
| Size | 57, 153 iron-ruthenium, effect on hydrocarbon selec- |
| correlation, Hume-Rothery: surface segregation | tivity, 60, 394 |
| from alloys, 59 , 430 | palladium-silver alloys, 60, 100 |
| Sodium | platinum-palladium alloy system, 56, 438 |
| Na-Ni-tartrate, hydrogenation activity, 58, 276 | platinum-ruthenium clusters, supported: ir |
| Solid solution | spectra, 58 , 188 |
| CoO-MgO H_2 -D ₂ equilibration over, effect of cobalt ion | relationship to methanation enhancement over |
| dispersion, 58, 396 | cobalt, 58 , 328 Sb-Sn-O, by X-ray photoelectron spectroscopy, |
| isopropanol decomposition over, 56, 160 | 58, 52 |
| Cu(I) in ZnO, 56, 407; 57, 339 | silica-supported nickel-copper, 60, 325 |
| Solvent | tin and antimony mixed oxides, 58, 61, 68 |
| effects in formose reaction, 58, 296 | enrichment in Pt-Rh gauzes, 60, 430 |
| Sorption | heterogeneous: thermal desorption curve, computer simulation, 56, 110 |
| hydrodesulfurization catalysts, 58, 436 | puoti simulavion, 00, 110 |

interactions, in Pt/ γ -Al₂O₃ system, 59, 365 Tetraalkylammonium cations effect on pore sizes and active site spacings in mobility, aromatic ions, 58, 470 platinum-tin reforming catalysts, 56, 65 amorphous silica-alumina, 60, 156 Tetrahydrothiophene polarity by gas chromatography, 58, 436 hydrodesulfurization over Co-Mo/Al₂O₃, 56, 363 reactions NO, CO, and O₂ on Pt-alumina, 57, 361 Tetrakis(triphenylphosphine) perylene on γ -alumina, 58, 470 complexes, Pt and Pd on silica from, 60, 270 Tetralin quinhydrone on silica-alumina, γ-alumina, oxidation over supported NiO, kinetics, 59, 460 magnesium oxide, and zinc oxide, 58, 478 validity of rate equations for, 56, 358 Tetrapropylammonium reconstruction, on Pd catalysts in ethylene oxidain (TPA)₂O-Na₂O-K₂O-Al₂O₃-SiO₂-H₂O system. tion, 60, 295 zeolite ZSM-5 crystallization in, 60, 241 structure Tetrapropylammonium-silica-alumina correlation with reaction mechanisms, 60, 15 heptane cracking over, 60, 156 influence on ethane hydrogenolysis over Thermal desorption, see Desorption, thermal Ni/SiO₂, kinetics, 60, 452 Thermodesorption rhodium/ γ -alumina, effects on *n*-pentane hyhydrogen from Pt/Al₂O₃, 58, 287 drogenolysis, n-butane oxidation, and nitric Thermodynamics oxide reduction, 56, 21 n-hexane reactions on Pt, 58, 108 Thermolysis, see Decomposition, thermal titrations, of Pt by H₂ and O₂, 59, 138 Syngas Thiophene reactions, butadiene carbonylation over paladsorption on copper chromite, 60, 21 ladium, 60, 27 hydrodesulfurization over sulfided Co-Mo/Al₂O₃, Synthesis gas conversion to Thoria, see Thorium oxide aromatic hydrocarbons over ZSM-5 class Thorium oxide zeolite, 56, 268 alcohol dehydration, 59, 405 methanol over $Cu/ZnO/M_2O_3$ (M = Al, Cr), 1,3-butadiene hydrogenation over, 56, 303 low pressure, 56, 407 geometric factor in alcohol dehydration on, 57, methanol synthesis from, 57, 339 208 reactions over alkali metal-graphite intercalates, Tin hydrocarbon selectivities, 56, 258 Sb-Sn-O: surface composition, X-ray photoelectron spectroscopy, 58, 52 T Sn-Sb oxides, surface composition activity, relationship to bulk composition, 58, Tantalum carbide 68 ethylene hydrogenation, 59, 472 X-ray photoelectron spectroscopy, 58, 61 Tartaric acid Titanium carbide catalyst modification of Ni, enantioselective ethylene hydrogenation, 59, 472 hydrogenation, 58, 276 Titanium dioxide Tellurium alcohol dehydration, mechanism, 57, 191 Pd-Te, charcoal support: diacetoxylation of aliphatic alcohols, interaction on, 56, 299; 57, 191 1,3-butadiene, **58**, 155 isobutane oxidation over, 60, 369 Tellurium dioxide MoO₃-TiO₂, 1-butene and butadiene oxidation and silica-alumina, propylene ammoxidation to over, 57, 253 pyridines over, 59, 148 photoconductivity, 60, 369 Tellurium oxide, see Tellurium dioxide Pt/TiO₂, electron microscopy, 59, 293 Temperature -supported nickel, metal-support effects in CO/H effect on crystallite size, Pt and Pd dispersion on synthesis reactions, 56, 236 silica, 60, 270 ultraviolet irradiated, 60, 369 Temperature programmed desorption, see Desorp-Titanium oxide tion, temperature programmed Temperature programmed reaction, see Reaction, -supported platinum particles, electron microscopy, 56, 390 temperature programmed Temperature programmed reaction spectroscopy Toluene conversion, over nickel-zeolite, 58, 198 formic acid decomposition on tungsten, 58, 149

dealkylation and disproportionation, over nickel-

zeolite, **58**, 198

Temperature programmed reduction, see Reduction,

temperature programmed

oxidation, 57 476

disproportionation over HY zeolite/β-AlF₃/Cu, Vanadium sulfides nuclear magnetic resonance, 56, 315 **59**, 26, 37 hydrodealkylation Vanadyl complexes kinetic analysis, 56, 40 electron paramagnetic resonance, 56, 315 specific activities and selectivities of Group Vanadyl phosphate VIIB and Group VIII metals on alumina, butene oxidation to maleic anhydride, selectivity 56, 32 criteria, 57, 236 steam dealkylation over rhodium, 60, 472 TPA, see Tetrapropylammonium Transient response method, propylene oxidation over bismuth Water molybdate, 56, 73 addition to alkenes over clay minerals, 58, 238 Transition metals deuterium exchange on platinum-alumina, 56, ethylene adsorption, 59, 239 Transmission electron microscopy Water gas methanol catalysts, Cu/ZnO and Cu/ZnO/Cr₂O₃, conversion on alumina, ir spectra, 57, 64 **57**, 339 Wetting 2,4,6-Trihalogenophenols role in redispersion of supported platinum crystalhalogen displacement polymerization over basic lites, 59, 109 copper(II), 58, 444 Work function Trimethylbenzene measurement, cyanogen on Pt(111), 60, 325 shape-selective formation of 1,2,4-isomer, 56, 445 Wustite Tungsten from magnetite reduction, 59, 1, 15 carbided, reaction with formic acid, 58, 149 W(100), formic acid decomposition on, 58, 149 X Tungsten carbide X-Ray Auger electron spectroscopy ethylene hydrogenation, 59, 472 charge localization on oxygen for oxide catalysts, Tungsten oxide **58**, 8 alumina support, ethylbenzene oxydehydrogena-X-Ray diffraction tion, 58, 34 methanol synthesis catalysts: Cu/ZnO/M2O3 Tunneling spectroscopy (M = Al, Cr), low pressure, 56, 407 catalytic properties of alumina, transfer hydromolybdenum disulfide, identification in used genation of muconic acid, 58, 320 Co-Mo-Al₂O₃ desulfurization catalysts, 59, model catalyst surface, 57, 72 452 U platinum-iridium on silica, 56, 1 X-Ray photoelectron spectroscopy Ultraviolet adsorption of benzene, pyridine, aniline, and irradiated TiO₂, 60, 369 nitrobenzene on evaporated Ni and Fe, 60, 228 alumina, peak assignments, 57, 522, 525 Vanadium charge localization on oxygen for oxide catalysts, V₆O₁₂, stabilization by potassium vanadates, 58, cobalt-molybdenum binary oxide catalysts, 57, V-P-O phases in butene oxidation to maleic anhydride, 57, 236 cobalt-molybdenum sulfide, unsupported, 56, 99 Vanadium oxides coprecipitated nickel on silica methanation V₂O₅, V₆O₁₃, V₂O₄, activity, 3-picoline ammoxidacatalysts, 56, 336 tion, 58, 383 intensity ratio: supported particle size distribu-Vanadium pentoxide tion, effect of shape, 58, 454 interaction of ammonia with surface, 60, 1 iron oxide catalysts from iron sulfate calcination, reaction between NO and NH₃ on, 57, 526, 528 57, 231 Vanadium pentoxide-molybdenum trioxide iron-ruthenium alloy segregation in, oxidation and reduction processes, catalysts, 56, 174 **57**, 326 surface analysis, 60, 394 Vanadium pentoxide-titanium dioxide methanol synthesis over Cu/ZnO/M2O3 system, structure and activity for butadiene

= Al, Cr), low pressure, 56, 407

molybdenum(II) carboxylates on silica, redox

reactions with CO, NO, and H₂, 60, 171 siliceous, 60, 241 nitric oxide X, cation-exchanged: SO₂-induced isomerization adsorption on iridium, 60, 93 of 2-butene over, 56, 88 on nickel, 60, 385 Y particle size determination, silica-supported Pt action of nickel, in hydrogenation reactions, 57 film, **58**, 454 Rh(I) activity in Rh-Y zeolite, 58, 82 coke formation on, 56, 377 rhodium zeolite carbonylation catalyst, 59, 340 methanation reaction over Ru, Ru-Ni, Ru-Cu, Sb-Sn-O, surface composition, 58, 52 and Ni clusters in, 57, 11 ZSM-4, crystallization via faujasite surface composition, tin and antimony mixed oxides, 58, 61 morphosis, 59, 263 zinc-molybdenum binary oxide catalysts, 57, 153 ZSM-5 o-Xvlene adsorption by, 58, 114 oxidation on potassium vanadates, 58, 15 coking and aging rates, 56, 195 cracking activity, product selectivity, and Xvlenes isomerization over silica-alumina, mechanism, steam stability, 60, 140 57, 444 methanol conversion over, 56, 169; 59, 123 molecular orbital studies, 57, 444 reactions on, poisoning, 58, 114 production, from toluene over nickel-zeolite, 58, synergism with Fischer-Tropsch iron catalyst, 56, 274 shape-selective disproportionation over partially synthesis, 60, 241 cation-exchanged H-mordenite, 56, 445 synthesis gas conversion to aromatic hydrocarbons, 56, 268 Z H-ZMS-5, acidity, 59, 248 Zinc-molybdenum Zeolites binary oxide catalysts, X-ray photoelectron aluminum distribution in, 58, 489 spectroscopy, 57, 153 bromination of halobenzenes over, 60, 110 Zinc oxide coke formation, shape selectivity, 56, 139 crystal morphology, 57, 339 containing rhodium for carbonylation, X-ray interaction of ammonia with surface, 60, 1 photoelectron spectroscopy and infrared oxygen on, thermal desorption curves, 56, 110 spectra, 59, 340 propylene reaction routes on, 58, 1 Cu(II)NaY, benzyl alcohol oxidation over, 56, 52 reduction with propylene, 59, 375 H-mordenite: shape-selectivity, partial cationrhodium-cobalt clusters on, olefin hydroformylaexchange, 56, 445 tion over, **56**, 127 HY and LaY, cracking activity in cumene Zirconium oxide dealkylation, 60, 77 1-butene isomerization, 57, 1 HY/β-AlF₃/Cu, toluene disproportionation over, Zirconium phosphate 59, 26, 37 catalytic sites in ethylbenzene oxidative demolecular sieve, 60, 241 hydrogenation, 56, 294 offretite, acidic and cracking properties, 57, 136 copper(II)-exchanged: oxidative dehydrogenaorganic cation, 60, 241 tion catalyst, 56, 296 rhodium clusters in, 59, 357 Rh-Y ZSM-5-type zeolite, see Zeolite methanol carbonylation over, 59, 53, 61 Z value X-ray photoelectron spectroscopy, 58, 82 in formose reaction, effect of solvent, 58, 296