

Ullmann's Encyclopedia of Industrial Chemistry

Sixth, Completely Revised Edition

Volume 40

Index Volume

Numerical data, descriptions of methods or equipment, and other information presented in this book have been carefully checked of accuracy. Nevertheless, authors and publisher do not assume any liability for misprints, faulty statements, or other kinds of errors. Persons intending to handle chemicals or to work according to information derived from this book are advised to consult the original sources as well as relevant regulations in order to avoid possible hazards.

Library of Congress Card No.: Applied for.

British Library Cataloguing-in-Publication Data:
A catalogue record for this book is available from the British Library.

Bibliographic information published by Die Deutsche Bibliothek.

Die Deutsche Bibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic data is available in the Internet at <<http://dnb.ddb.de>>.

ISBN 3-527-30385-5

© 2003 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim.

Printed on acid-free paper.

The paper used corresponds to both the U. S. standard ANSI Z.39.48 – 1984 and the European standard ISO TC 46.

All rights reserved (including those of translation into other languages). No part of this book may be reproduced in any form – by photoprinting, microfilm, or any other means – nor transmitted or translated into a machine language without written permission from the publishers. Registered names, trademarks, etc. used in this book, even when not specifically marked as such are not to be considered unprotected by law.

Cover Design: Gunther Schulz, Fussgönheim
Composition: Steingraeber Satztechnik GmbH, Dossenheim

Printing: Strauss Offsetdruck GmbH, Mörlenbach
Bookbinding: Litges & Dopf Buchbinderei GmbH, Heppenheim

Printed in the Federal Republic of Germany

Ullmann's Encyclopedia of Industrial Chemistry

Volume 40

Ullmann's Encyclopedia of Industrial Chemistry

Volumes 1 - 39: Alphabetically Arranged Articles
Volume 40: Index

Editorial Advisory Board

Matthias Bohnet
Technical University Braun-
schweig, Braunschweig,
Germany

C. Jeffrey Brinker
Advanced Materials Laboratory,
Albuquerque, NM, USA

Boy Cornils
Hoechst Aktiengesellschaft,
Frankfurt am Main, Germany

Trevor J. Evans
Institution of Chemical
Engineers, Rugby, Great Britain

Helmut Greim
Technical University of Munich,
Freising-Weihenstephan,
Germany

L. Louis Hegedus
ATOFINA Chemicals, Inc., King
of Prussia, PA, USA

Joachim Heitbaum
Chemetall GmbH, Frankfurt am
Main, Germany

Wolfgang A. Herrmann
Technical University of Munich,
Garching, Germany

Wilhelm Keim
RWTH Aachen, Aachen,
Germany

Axel Kleemann
ASTA Medica AG, Hanau,
Germany

Gerhard Kreysa
DECHEMA e.V., Frankfurt am
Main, Germany

Trevor Laird
Scientific Update, East Sussex,
Great Britain

Jürg Löliger
Nestlé Research Center, Kempt-
thal, Switzerland

Roger O. McClellan
Chemical Industry Institute of
Toxicology, Albuquerque, NM,
USA

John L. McGuire
Johnson and Johnson, New
Brunswick, NJ, USA

James W. Mitchell
Bell Laboratories, Murray Hill,
NJ, USA

Akio Mitsutani
Nippon Chemtech Consulting,
Takarazuka, Japan

Takeru Onoda
Mitsubishi Chemical
Corporation, Tokyo, Japan

Ludolf Plass
Lurgi AG, Frankfurt am Main,
Germany

Gregory
Stephanopoulos
Massachusetts Institute of Tech-
nology, Cambridge, MA, USA

Dietmar Werner
BASF Aktiengesellschaft,
Ludwigshafen, Germany

Peter Woditsch
Bayer Aktiengesellschaft, Kre-
feld, Germany

Naoya Yoda
Graduate School of Business,
Rissho University, Yokohama,
Japan

Contents of Volumes 1 to 39

Vol. 1

Abrasion and Erosion	1	Acrolein and Methacrolein	271
Abrasives	27	Acrylic Acid and Derivatives	289
Absorption	47	Acrylonitrile	307
Acaricides	89	Activation Analysis	317
Acetaldehyde	131	Acylation and Alkylation	337
Acetic Acid	149	Adhesives	383
Acetic Anhydride and Mixed		Adipic Acid	453
Fatty Acid Anhydrides	179	Adsorption	465
Acetone	195	Aerogels	521
Acetylene	215	Air	549
Acridine	269		

Vol. 2

Air Classifying	1	Aluminum Compounds, Inorganic	299
Alcohols, Aliphatic	19	Aluminum Compounds, Organic	317
Alcohols, Polyhydric	47	Aluminum Oxide	339
Aldehydes, Aliphatic and Aromatic	65	Amines, Aliphatic	379
Alkaloids	105	Amines, Aromatic	433
Alkyd Resins	173	Amino Acids	455
Allyl Compounds	191	Aminophenols	517
Aluminothermic Processes	215	Amino Resins	537
Aluminum	227	Ammonia	567
Aluminum Alloys	251		

Vol. 3

Ammonium Compounds	1	Antiasthmatic Agents	319
Analeptics	27	Antibiotics	341
Analgesics and Antipyretics	29	Antidiabetic Drugs	441
Analytical Chemistry:		Antiemetics	453
Purpose and Procedures	83	Antiepileptics	457
Analytical Voltammetry		Antifreezes	471
and Polarography	105	Antihypertensives	481
Anesthetics, General	147	Antihypotensives	513
Aniline	161	Anti-inflammatory –	
Anthelmintics	177	Antirheumatic Drugs	521
Anthracene	193	Antimony and Antimony Compounds ..	547
Anthraquinone	197	Antimycotics	581
Anthraquinone Dyes and Intermediates ..	207	Anti-Obesity Drugs	621
Antiallergic Agents	275	Antioxidants	629
Antiarrhythmic Drugs	303		

Vol. 4

Antilucer Drugs	1	Aziridines	323
Arsenic and Arsenic Compounds	21	Azo Dyes	331
Artists' Colors	65	Barium and Barium Compounds	425
Asbestos	79	Basic Principles of Chromatography	447
Asphalt and Bitumen	97	Batteries	475
Atomic Spectroscopy	119	Bearing Materials	633
Automobile Exhaust Control	225	Beer	657
Automotive Fuels	241	Benzaldehyde	701
Aviation Turbine Fuels	277	Benzene	715
Azine Dyes	293		

Vol. 5

Benzenesulfonic Acids and Their Derivatives	1	Bismuth, Bismuth Alloys, and Bismuth Compounds	389
Benzidine and Benzidine Derivatives	41	Bleaching	411
Benzoic Acid and Derivatives	59	Blood	425
Benzoquinone	73	Boric Oxide, Boric Acid, and Borates	463
Benzoquinone and Naphthoquinone Dyes	77	Boron and Boron Alloys	483
Benzyl Alcohol	83	Boron Carbide, Boron Nitride, and Metal Borides	497
Benzylamine	93	Boron Compounds	515
Beryllium and Beryllium Compounds	97	Bread and Other Baked Products	539
Beverages, Nonalcoholic	125	Bromine	597
Biochemical Engineering	171	Bromine Compounds	611
Biochemical Separations	241	Bubble Columns	641
Biocides	269	Butadiene	675
Biological Control	281	Butanals	693
Biomass Chemicals	303	Butanediols, Butenediol, and Butynediol	703
Bioremediation	311	Butanols	713
Biotechnology	321	2-Butanone	725

Vol. 6

Butenes	1	Carbon Dioxide	393
Butyrolactone	15	Carbon Disulfide	413
Cadmium and Cadmium Compounds	23	Carbonic Esters	427
Calcium and Calcium Alloys	41	Carbon Monoxide	457
Calcium Antagonists	53	Carbonylation	473
Calcium Carbide	67	Carboxylic Acids, Aliphatic	493
Calcium Chloride	81	Carboxylic Acids, Aromatic	509
Calcium Sulfate	89	Carcinogenic Agents	521
Cancer Chemotherapy	123	Cardiac Glycosides and Synthetic Cardiotonic Drugs	537
Candles	183	Cardiovascular Drugs	555
Caprolactam	185	Cationic Dyes	585
Carbamates and Carbamoyl Chlorides	207	Cellulose	593
Carbazole	215	Cellulose Esters	647
Carbides	219	Cellulose Ethers	693
Carbohydrates	237		
Carbon	281		

Vol. 7

Cement and Concrete	1	Cesium and Cesium Compounds	301
Cements, Chemically Resistant	73	Charcoal	307
Centrifuges, Filtering	81	Cheese, Processed Cheese, and Whey ...	313
Centrifuges, Sedimenting	89	Chemical and Biochemical Sensors	325
Ceramic Colorants	119	Chemical Conservation	
Ceramics, Advanced Structural Products	133	of Stone Structures	441
Ceramics, Ceramic – Metal Systems	149	Chemical Plant Design	
Ceramics, Electronic	175	and Construction	469
Ceramics, General Survey	191	Chemical Products: Safety Regulations .	557
Cereals and Cereal Products	237	Chemometrics	589
Cerium Mischmetal, Cerium Alloys,		Chemotherapeutics	617
and Cerium Compounds	285	Chitin and Chitosan	679

Vol. 8

Chlorinated Hydrocarbons	1	Choline	429
Chlorine	186	Chromatographic Reactors	433
Chlorine Oxides and Chlorine		Chromium and Chromium Alloys	459
Oxygen Acids	281	Chromium Compounds	485
Chloroacetaldehydes	329	Cinnamic Acid	521
Chloroacetic Acids	341	Citric Acid	525
Chloroamines	359	Clays	531
Chloroformic Esters	365	Cleansing Agents	563
Chlorohydrins	371	Coal	587
Chlorophenols	385	Coal Liquefaction	635
Chlorophenoxyalkanoic Acids	395	Coal Pyrolysis	719
Chlorosulfuric Acid	405	Cobalt and Cobalt Compounds	759
Chocolate	411		

Vol. 9

Coffee	1	Cooling Tower Technology	351
Colloids	31	Copper	361
Combinatorial Chemistry	65	Copper Alloys	429
Combinatorial Methods in Catalysis		Copper Compounds	473
and Materials Science	93	Cork	503
Combustion	137	Coronary Therapeutics	523
Composite Materials	155	Corrosion	535
Confectionery	199	Cough Remedies	617
Construction Ceramics	217	Cresols and Xylenols	631
Construction Materials		Crop Protection	677
in Chemical Industry	257	Crotonaldehyde and Crotonic Acid	701
Continuous Mixing of Fluids	305	Crown Ethers	709
Contraception	333		

Vol. 10

Cryogenic Technology	1	Dental Materials	325
Crystal Growth	47	Dermatotherapeutic Agents	377
Crystallization and Precipitation	99	Design of Experiments	395
Custom Synthesis and Custom Chemicals	151	Dextran	435
Cyanamides	167	Diagnostic Reagents	441
Cyanates, Inorganic Salts	187	Dialkyl Sulfates and Alkylsulfuric Acids	481
Cyano Compounds, Inorganic	191	Diazo Compounds and Diazo Reactions	497
Cyanuric Acid and Cyanuric Chloride ..	229	Dicarboxylic Acids, Aliphatic	519
Cyclodextrins	251	Dimethyl Ether	539
Cyclododecanol, Cyclododecanone, and Laurolactam	261	Dioxane	543
Cyclododecatriene, Cyclooctadiene, and 4-Vinylcyclohexene	267	Direct Heating with Circulating Heat Carriers	549
Cyclohexane	271	Disinfectants	555
Cyclohexanol and Cyclohexanone	279	Disperse Dyes	573
Cyclopentadiene and Cyclopentene	291	Disperse Systems and Dispersants	587
Dairy Products, Imitation	305	Display Technology	613
Dense-Medium Separation	317	Distillation and Rectification	647
		Dithiocarbamic Acid and Derivatives ...	745

Vol. 11

Diuretics	1	Chemical Deposition	365
Drawing and Writing Materials	11	Electrochemistry	425
Dry Cleaning	25	Electroluminescent Materials and Devices	543
Drying Oils and Related Products	31	Electronic Chemicals	553
Drying of Solid Materials	47	Electrophoresis	585
Dry Mortars	83	Electrostatic Separation	615
Dust Separation	109	Elutriation	635
Dyes, General Survey	147	Emulsions	665
Ecology and Ecotoxicology	205	Energy Management in Chemical Industry	713
Electrically Generated Heat	353		
Electrochemical and			

Vol. 12

Environmental Management in the Chemical Industry	1	Ethers, Aliphatic	505
Enzyme and Immunoassays	27	Ethylbenzene	519
Enzymes	55	Ethylene	531
Epoxides	269	Ethylenediaminetetraacetic Acid and Related Chelating Agents	585
Epoxy Resins	285	Ethylene Glycol	593
Esters, Organic	305	Ethylene Oxide	609
Estimation of Physical Properties	329	2-Ethylhexanol	637
Ethanol	397	Evaporation	643
Ethanolamines and Propanolamines	475	Explosives	679

Vol. 13

Fats and Fatty Oils	1	Fibers, 2. Structure	359
Fatty Acids	75	Fibers, 3. General Production Technology	397
Fatty Alcohols	109	Fibers, 4. Synthetic Organic	465
Felts	135	Fibers, 5. Synthetic Inorganic	563
Ferroalloys	145	Fibers, 6. Testing and Analysis	633
Ferroelectrics	149	Films	653
Fertilizers	163	Filtration	683
Fiber Optics	303		
Fibers, 1. Survey	323		

Vol. 14

Fire Extinguishing Agents	1	Fluorine Compounds, Inorganic	395
Fixed-Bed Reactors	11	Fluorine Compounds, Organic	443
Flame Retardants	53	Fluoropolymers, Organic	499
Flavors and Fragrances	73	Fluorosulfuric Acid	539
Flocculants	201	Foamed Plastics	543
Floor Coverings	213	Foams and Foam Control	575
Flotation	239	Foods, 1. Survey	603
Fluidized-Bed Reactors	271	Foods, 2. Food Technology	637
Fluid Mechanics	313	Foods, 3. Food Additives	675
Fluorescent Dyes	365	Foods, 4. Food Packaging	697
Fluorine	379		

Vol. 15

Formaldehyde	1	Gas Production	305
Formamides	35	Gelatin	471
Formic Acid	49	Genetic Engineering	487
Foundry Technology	71	Germanium and Germanium Compounds	523
Fructose	87	Glass	537
Fuel Cells	95	Glass Ceramics	627
Fungicides, Agricultural	119	Gluconic Acid	645
Furan and Derivatives	187	Glucose and Glucose-Containing Syrups	655
Furs	207	Glycerol	677
Gallbladder and Liver Therapy	215	Glyoxal	693
Gallium and Gallium Compounds	235	Glyoxylic Acid	697
Gas Chromatography	241		

Vol. 16

Gold, Gold Alloys, and Gold Compounds	1	Hexamethylenediamine	433
Gout Remedies	55	High-Performance Fibers	439
Gravity Concentration	65	High-Pressure Technology	465
Guanidine and Derivatives	73	High-Temperature Materials	505
Hafnium and Hafnium Compounds	87	High-Throughput Screening	565
Hair Preparations	99	HIV and AIDS Therapeutics	577
Hard Materials	141	Holography	591
Health Value Added Foods	155	Hormones	601
Heat Exchange	167	Hydraulic Fluids	683
Heating Oil	281	Hydrazine	697
Heat Storage Media	297	Hydrazoic Acid and Azides	715
Heterogeneous Catalysis and Solid Catalysts	315	Hydrides	721

Vol. 17

Hydrocarbons	1	Hypnotics	345
Hydrochloric Acid	61	Ice Cream and Frozen Desserts	379
Hydrocyclones	77	Imaging Technology	387
Hydrogen	85	Imidazole and Derivatives	493
Hydrogenation and Dehydrogenation ..	241	Immobilized Biocatalysts	503
Hydrogen Peroxide	253	Immunotherapy and Vaccines	555
Hydrogen Sulfide	285	Inclusion Compounds	637
Hydroquinone	307	Indicator Reagents	645
Hydroxycarboxylic Acids, Aliphatic	315	Indigo and Indigo Colorants	673
Hydroxycarboxylic Acids, Aromatic	327	Indium and Indium Compounds	681
Hydroxylamine	337	Indole	693

Vol. 18

Information Storage Materials	1	Ion Exchangers	331
Infrared and Raman Spectroscopy	81	Iron	405
Inorganic Polymers	127	Iron Compounds	585
Insect Control	159	Isocyanates, Organic	609
Insulation, Electric	223	Isoprene	629
Interferons	273	Isotopes, Natural	649
Intermetallics	291	Ketenes	717
Iodine and Iodine Compounds	319	Ketones	733

Vol. 19

Laboratory Information and Management Systems (LIMS) ..	1	Lead Compounds	383
Lactic Acid	11	Leather	393
Lactose and Derivatives	21	Leather Imitates	419
Lamps	31	Lecithin	433
Laser Analytical Spectroscopy	73	Legal Aspects	439
Laser Dyes	101	Leuco Esters of Vat Dyes	503
Lasers	121	Lignin	509
Laundry Detergents	139	Lime and Limestone	521
Laxatives	313	Liquefied Petroleum Gas	553
Lead	323	Liquid Chromatography	567
Lead Alloys	371	Liquid Crystals	637
		Liquid – Liquid Extraction	673

Vol. 20

Liquid – Solid Extraction	1	Magnetic Separation	451
Lithium and Lithium Compounds	33	Maleic and Fumaric Acids	463
Local Anesthetics	61	Malonic Acid and Derivatives	475
Lubricants and Lubrication	71	Manganese and Manganese Alloys	495
Luminescent Materials	273	Manganese Compounds	543
Magnesium	315	Margarines and Shortenings	565
Magnesium Alloys	343	Mass Spectrometry	585
Magnesium Compounds	357	Matches	637
Magnetic Materials	397	Mathematical Modeling	651

Vol. 21

Mathematics in Chemical Engineering ..	1	Metallic Soaps	443
Meat and Meat Products	163	Metallocenes	459
Mechanical Properties and Testing of Metallic Materials	181	Metallurgical Furnaces	465
Melamine and Guanamines	205	Metallurgy	511
Membrane Reactors	223	Metal-Matrix Composites	525
Membranes and Membrane Separation Processes	243	Metals, Surface Treatment	541
Mercaptoacetic Acid and Derivatives ...	323	Methacrylic Acid and Derivatives	585
Mercury, Mercury Alloys, and Mercury Compounds	327	Methane	599
Metal-Complex Dyes	365	Methanol	611
Metallic Foams	407	Methine Dyes and Pigments	637
Metallic Glasses	417	Methylamines	693
		Methyl Tert-Butyl Ether	701
		Mica	719
		Microencapsulation	733

Vol. 22

Microreactors	1	Mössbauer Spectroscopy	363
Microscopy	33	Mutagenic Agents	381
Milk and Dairy Products	111	Nanostructured Materials	387
Mineral Sorting	173	Naphthalene and Hydronaphthalenes ...	399
Mirrors	179	Naphthalene Derivatives	409
Mixing, Introduction	187	Naphthalimide Dyes and Pigments	463
Mixing of Highly Viscous Media	189	Naphthoquinones	471
Mixing of Solids	207	Natural Gas	477
Model Reactors and Their		Nematicides	531
Design Equations	225	Neuropharmacology	545
Molecular Modeling	273	Nickel	567
Molluscicides	285	Nickel Alloys	633
Molybdenum and Molybdenum		Nickel Compounds	649
Compounds	293	Niobium and Niobium Compounds	665
Monoclonal Antibodies	341	Nitrates and Nitrites	681
Monosodium Glutamate	355		

Vol. 23

Nitric Acid, Nitrous Acid,		Nitrogen Fixation	201
and Nitrogen Oxides	1	Noble Gases	215
Nitriles	51	Noise and Vibration	275
Nitriles	75	Nondestructive Testing	297
Nitrilotriacetic Acid	91	Nonlinear Optics	333
Nitro and Nitroso Dyes	97	Nonwoven Fabrics	359
Nitro Compounds, Aliphatic	117	Nuclear Magnetic Resonance and Electron	
Nitro Compounds, Aromatic	127	Spin Resonance Spectroscopy	383
Nitrogen	175	Nuclear Technology	437

Vol. 24

Nucleic Acids	1	Optical Materials	401
Occupational Health and Safety	39	Oral Hygiene Products	421
Octane Enhancers	101	Organometallic Compounds	
Oil and Gas	117	and Homogeneous Catalysis	429
Oil Refining	205	Oxalic Acid	473
Oil Shale	257	Oxidation	487
On-Line Monitoring		Oxocarboxylic Acids	545
of Chemical Reactions	285	Oxo Synthesis	553
Ophthalmological Preparations	335	Oxygen	561
Optical Brighteners	363	Ozone	581
Optically Active Compounds	387	Paints and Coatings	591

Vol. 25

Paper and Pulp	1	Peptide Synthesis	411
Parasympatholytics		Perfumes	427
and Parasympathomimetics	159	Peroxo Compounds, Inorganic	433
Parkinsonism Treatment	161	Peroxy Compounds, Organic	463
Particle Size Analysis		Petroleum Coke	501
and Characterization		Pharmaceutical Dosage Forms	515
of a Classification Process	183	Pharmaceuticals, General Survey	
Patents	219	and Development	549
Peat	245	Phase-Transfer Catalysis	581
Pentanols	283	Phenol	589
Peptide and Protein Hormones	297	Phenol Derivatives	605

Vol. 26

Phenolic Resins	1	Phosphorus Compounds, Organic	213
Phenothiazine and Derivatives	17	Photochemistry	245
Phenylene- and Toluenediamines	33	Photoelectricity	275
pH Measurement and Control	39	Photography	285
Phosgene	71	Photovoltaic Cells	455
Phosphate Fertilizers	81	Phthalic Acid and Derivatives	499
Phosphoric Acid and Phosphates	127	Phthalocyanines	535
Phosphorus	171	Pigging Technology	569
Phosphorus Compounds, Inorganic	193	Pigments, Inorganic	581

Vol. 27

Pigments, Organic	1	Plastics, General Survey	325
Pilot Plants	47	Plastics, Processing	449
Pinch Technology	57	Plastics, Properties and Testing	549
Plant and Process Safety	65	Plastics, Recycling	607
Plant Growth Regulators	191	Platinum Group Metals and Compounds	623
Plasma Reactions	205	Plutonium and Plutonium Compounds ..	701
Plasticizers	217	Polyacrylamides	
Plastics, Additives	237	and Poly(Acrylic Acids)	711
Plastics, Analysis	289		

Vol. 28

Polyacrylates	1	Polymers, High-Temperature	351
Polyamides	25	Polymethacrylates	377
Polycarbonates	55	Polyolefins	393
Polyester Resins, Unsaturated	65	Polyoxyalkylenes	497
Polyesters	75	Polyoxymethylenes	509
Polyimides	103	Poly(Phenylene Oxides)	523
Polymerase Chain Reaction	125	Polysaccharides	533
Polymer Blends	161	Polystyrene and Styrene Copolymers ...	591
Polymerization Processes	195	Polyureas	643
Polymers, Electrically Conducting	329	Polyurethanes	667

Vol. 29

Poly(Vinyl Chloride)	1	Powder Metallurgy	
Polyvinyl Compounds, Others	31	and Sintered Materials	161
Poly(Vinyl Esters)	49	Principles of Chemical	
Poly(Vinyl Ethers)	61	Reaction Engineering	203
Poly(Vinylidene Chloride)	67	Printing Inks	285
Potassium and Potassium Alloys	81	Process Control Engineering	301
Potassium Compounds	93		

Vol. 30

Process Development	1	Psychopharmacological Agents	397
Process-Scale Chromatography	43	Purine Derivatives	449
Production-Integrated		Pyrazolone Derivatives	455
Environmental Protection	89	Pyridine and Pyridine Derivatives	465
Propanal	193	Pyrimidine and Pyrimidine Derivatives	499
Propanediols	199	Pyrotechnics	505
Propanols	209	Pyrrole	523
Propellants	221	2-Pyrrolidone	527
Propene	247	Quasicrystals	535
Propionic Acid and Derivatives	261	Quinoline and Isoquinoline	549
Propylene Oxide	279	Radiation Chemistry	555
Prostaglandins	305	Radiation Heating	585
Protective Gases	327	Radionuclides	589
Proteins	341	Radionuclides in Analytical Chemistry	691

Vol. 31

Radiopaque Media	1	Resins, Natural	337
Rare Earth Elements	15	Resins, Synthetic	357
Raw Materials and Energy	61	Resorcinol	383
Reaction Columns	89	Rhenium and Rhenium Compounds	389
Reactive Distillation	97	Rheometry	401
Reactive Dyes	109	Rodenticides	431
Reactor Types and Their		Rubber, 1. Survey	443
Industrial Applications	125	Rubber, 2. Natural	447
β -Receptor Blocking Agents	159	Rubber, 3. Synthetic	461
Reduction	185	Rubber, 4. Chemicals and Additives	601
Refractory Ceramics	219	Rubber, 5. Technology	661
Refrigeration Technology	269	Rubber, 6. Testing	705
Reinforced Plastics	313	Rubidium and Rubidium Compounds	717
Release Agents	331	Salicylic Acid	721

Vol. 32

Sample Preparation for Trace Analysis ..	1	Silica	273
Sampling	37	Silicates	361
Saponins	43	Silicon	427
Scale-Up in Chemical Engineering	59	Silicon Carbide	457
Screening	83	Silicon Compounds, Inorganic	469
Sealing Materials	109	Silicon Compounds, Organic	491
Seasonings	125	Silicones	531
Sedatives	129	Silk	571
Sedimentation	135	Silver, Silver Compounds, and Silver Alloys	585
Selenium and Selenium Compounds	203	Single Cell Proteins	665
Semiconductors	217	Sintered Steel and Iron	687
Separation Processes, Introduction	257		
Shoe Polishes	265		

Vol. 33

Size Enlargement	1	Solid – Liquid Separation, Introduction ..	455
Size Reduction	41	Solid – Solid Separation, Introduction ..	463
Skeletal Muscle Relaxants	83	Solids Handling	489
Skin Cosmetics	95	Solids Technology, Introduction	497
Soaps	129	Solvents	509
Sodium Amide	151	Sonochemistry	583
Sodium and Sodium Alloys	163	Sorbic Acid	607
Sodium Carbonates	187	Spasmolytics	617
Sodium Chloride	207	Specialty Plastics	635
Sodium Compounds, Organic	231	Spirits	659
Sodium Hydroxide	235	Sprayforming of Metals	675
Sodium Sulfates	247	Spraying and Atomizing of Liquids	687
Soil	263	Stains, Microscopic	705
Solar Technology	391	Starch	721
Soldering and Brazing	443		

Vol. 34

Steel	1	Sulfamic Acid	515
Steroids	261	Sulfides, Polysulfides, and Sulfanes	519
Stirred-Tank and Loop Reactors	273	Sulfinic Acids and Derivatives	539
Stirring	287	Sulfites, Thiosulfates, and Dithionites ..	559
Strontium and Strontium Compounds	327	Sulfones and Sulfoxides	571
Structure Analysis by Diffraction	335	Sulfonic Acids, Aliphatic	589
Styrene	383	Sulfur	593
Sublimation	401	Sulfur Dioxide	659
Sugar	413	Sulfur Dyes	705
Sugar Alcohols	487	Sulfur Halides	715

Vol. 35

Sulfuric Acid and Sulfur Trioxide	1	Tapes, Adhesive	481
Superabsorbents	73	Tar and Pitch	503
Superconductors	95	Tar Sands	541
Surface and Thin-Film Analysis	139	Tartaric Acid	577
Surfactants	293	Tea	585
Surgical Materials	369	Techniques for DNA Analysis	591
Sustainability and the Chemical Industry – Ethical Aspects and Approaches	393	Tellurium and Tellurium Compounds ...	611
Sweeteners	407	Temperature Measurement	623
Sympatholytics and Sympathomimetics ..	431	Teratogenic Agents	635
Talc	433	Terephthalic Acid, Dimethyl Terephthalate, and Isophthalic Acid .	639
Tall Oil	451	Terpenes	653
Tantalum and Tantalum Compounds	465	Tetrahydrofuran	671

Vol. 36

Textile Auxiliaries	1	Thin Layer Chromatography	585
Textile Dyeing	131	Thiocyanates and Isothiocyanates, Organic	605
Textile Printing	277	Thiocyanates, Inorganic	615
Textile Technology	347	Thiols and Organic Sulfides	625
Thallium and Thallium Compounds	403	Thiophene	653
Thermal Analysis and Calorimetry	417	Thiourea and Thiourea Derivatives	663
Thermoelectricity	443	Thorium and Thorium Compounds	677
Thermoplastic Elastomers	455	Three-Phase Trickle-Bed Reactors	715
Thermosets	489	Thyrotherapeutic Agents	729
Thin-Film Reactors	505	Tin, Tin Alloys, and Tin Compounds ...	739
Thin Films	515		

Vol. 37

Tires	1	Triarylmethane and Diarylmethane Dyes	445
Titanium, Titanium Alloys, and Titanium Compounds	15	Tubular Reactors	501
Tobacco	49	Tungsten, Tungsten Alloys, and Tungsten Compounds	521
Toluene	75	Turpentine	561
Toluidines	87	Ultraviolet and Visible Spectroscopy ...	577
Toxicology	97	Uranium, Uranium Alloys, and Uranium Compounds	625
Trace Analysis	247	Urea	683
Transport, Handling, and Storage	265	Vacuum Technology	719
Transport Phenomena	331		
Transuranium Elements	431		