

PERFORMANCE FLUORINE CHEMICALS AND POLYMERS



CHM024E
January 2017

Charles Forman
Project Analyst

ISBN: 1-62296-418-7



BCC Research
49 Walnut Park, Building 2
Wellesley, MA 02481 USA
866-285-7215 (toll-free within the USA),
or (+1) 781-489-7301
www.bccresearch.com
info@bccresearch.com

TABLE OF CONTENTS

TOPIC	PAGE NO.
CHAPTER 1 INTRODUCTION	2
STUDY GOALS AND OBJECTIVES	2
REASONS FOR DOING THE STUDY	2
INTENDED AUDIENCE	3
SCOPE AND FORMAT	3
CLASSIFICATION OF FLUOROCHEMICALS	7
METHODOLOGY AND INFORMATION SOURCES	8
ANALYST'S CREDENTIALS	8
RELATED BCC RESEARCH	8
BCC RESEARCH WEBSITE	9
DISCLAIMER	9
CHAPTER 2 SUMMARY	11
<i>SUMMARY TABLE U.S. FLUORO-CHEMICAL AND POLYMER MARKET, BY PRODUCT TYPE, THROUGH 2021 (MILLION POUNDS)</i>	12
<i>SUMMARY FIGURE U.S. FLUORO-CHEMICAL AND POLYMER MARKET, BY PRODUCT TYPE, 2016 AND 2021 (MILLION POUNDS)</i>	12
CHAPTER 3 OVERVIEW OF FLUORO-CHEMICALS AND POLYMERS	14
ORGANIC FLUORO-CHEMICALS	14
TABLE 1 HYDRO-CARBON AND HALO-CARBON BOND STRENGTHS	15
TABLE 2 PROPERTIES CONFERRED BY FLUORINE SUBSTITUTION	15
ALIPHATIC (ACYCLIC) FLUORINE COMPOUNDS	16
Chlorofluorocarbons (CFCs)	16
Hydrochlorofluorocarbons (HCFCs)	17
Hydrofluorocarbons (HFCs)	18
Hydrofluoro-olefins	19
Common Commercial Uses	20
TABLE 3 COMMON CHLOROFLUOROCARBONS (CFCS) AND REFRIGERANT MIXTURES	21
TABLE 4 HYDROCHLOROFLUOROCARBONS (HCFCs) AND HCFC-BASED MIXTURES	21
TABLE 5 HYDROFLUOROCARBONS (HFCS) AND HFC-BASED MIXTURES	22
CFC, HCFC and HFC Nomenclature	23
Major Applications	25
Synthesis of CFCs, HCFCs, and HFCs	25
Trifluoroaliphatics	26
Other Fluoroaliphatics	27
Intermediates	27
Fluorosilanes	27
Carbon Tetrafluoride	27
Perfluoroethane (Hexafluoroethane)	28
Selectfluor and Deoxo-Fluor	28
AROMATIC FLUORINE COMPOUNDS	28
Ring-Substituted Fluoroaromatics	29
Fluorobenzene	29
Other Ring-Substituted Aromatics	29

TOPIC	PAGE NO.
Side-Chain Substituted Fluoroaromatics	30
INORGANIC FLUOROCHEMICALS	30
WATER FLUORIDATION CHEMICALS	31
Hydrofluosilicic Acid	31
Sodium Silicofluoride	32
Sodium Fluoride	32
TABLE 6 WATER SOLUBILITY OF WATER TREATMENT FLUORIDE CHEMICALS	33
Other Water Fluoridation Chemicals	33
Ammonium Silicofluoride	33
Magnesium Silicofluoride	33
Potassium Fluoride	34
Calcium Fluoride	34
Hydrofluoric Acid	34
Bifluorides	34
INORGANIC DENTAL FLUORIDES	34
FLUOBORON COMPOUNDS	35
Fluoborates	35
Boron Trifluoride	36
Boron Trifluoride Complexes	37
Uncomplexed Boron Trifluoride	37
GASEOUS PERFORMANCE INORGANIC FLUOROCHEMICALS	37
Fluorine	37
Halogen Fluorides	38
Hydrogen Fluoride	39
Nitrogen Trifluoride	40
Silicon Tetrafluoride	42
Sulfur Tetrafluoride	42
Sulfur Hexafluoride	42
Tungsten Hexafluoride	43
Uranium Hexafluoride	43
OTHER INORGANIC FLUORIDES	44
Cleaners, Dopants and Etchants	44
Others	44
FLUOROPOLYMERS AND FLUOROELASTOMERS	45
FLUOROPOLYMER RESINS	45
TABLE 7 FLUOROPOLYMER NAMES AND ACRONYMS	45
Synthetic Routes and Average Properties	46
TABLE 8 FLUOROPOLYMER RAW MATERIALS AND SYNTHETIC ROUTES	46
TABLE 9 AVERAGE PROPERTIES OF FLUOROPOLYMER RESINS	46
TABLE 10 FLUOROPOLYMER PROPERTIES AND THE EFFECTS OF INCREASING FLUORINE CONTENT	47
Processing	48
Other Characteristics	48
Polytetrafluoroethylene (PTFE)	49
Polyvinylidene Fluoride (PVDF)	50
Fluorinated Ethylene-Propylene Copolymer (FEP)	51
Ethylene-Chlorotrifluoroethylene Copolymer (ECTFE)	52
Ethylene-Tetrafluoroethylene Copolymer (ETFE)	52

TOPIC	PAGE NO.
Polyvinyl Fluoride (PVF)	53
Perfluoroalkyl-Tetrafluoroethylene Copolymer (PFA)	53
Poly-Chlorotrifluoroethylene (PCTFE)	54
Other Fluoropolymer Resins	55
Perfluorinated Ion Exchange/Electrolytic Membrane Resins	55
Solid (Dry) Lubricants	56
Safety, Handling and Regulatory Matters	57
FLUOROELASTOMERS	58
Fluorocarbon Elastomers	58
VF2/HFP (FKM) Fluoroelastomers	58
VF2/HFP/TFE (FKM) Fluoroelastomers	59
TFE/P (FXM) Fluoroelastomers	59
TFE/P/VF2 "Advanced" Fluoroelastomers	59
Perfluoro (or Perfluorinated) (FFKM) Fluoroelastomers	60
VF2/CTFE (CFM) Fluoroelastomers	60
Fluorosilicone (FVMQ) Elastomers	60
Differences and Applications	61
LOW MOLECULAR WEIGHT FLUOROPOLYMERS	61
Synthesis of Low MW Fluoropolymers	61
Electrochemical Synthesis	61
Telomerization	61
Oligomerization	62
Functional Fluids	62
Chlorotrifluoroethylene (CTFE) Fluids	62
Perfluorinated Alkyls	62
Perfluorinated Polyether (PFPE) Fluids	63
Fluorosilicones	63
Surfactants	63
<i>TABLE 11 FLUOROSURFACTANT APPLICATIONS</i>	64
Textile Finishing Chemicals	64
Chemical Intermediates	65
CHAPTER 4 MARKETS BY PRODUCT TYPE OR CLASS	67
MARKET OVERVIEW AND SUMMARY MARKET ESTIMATE AND FORECAST	67
<i>TABLE 12 U.S. FLUORO-CHEMICAL AND POLYMER MARKET BY PRODUCT TYPE, THROUGH 2021 (MILLION POUNDS)</i>	68
ORGANIC FLUORO-CHEMICALS	69
MARKET ESTIMATE AND FORECAST	69
<i>TABLE 13 U.S. ORGANIC FLUORO-CHEMICALS MARKET BY CHEMICAL TYPE, THROUGH 2021 (MILLION POUNDS)</i>	70
<i>TABLE 14 U.S. MARKET FOR ALIPHATIC ORGANIC FLUORO-CHEMICALS BY APPLICATION, THROUGH 2021 (MILLION POUNDS)</i>	70
NON-ELECTRICAL EQUIPMENT	71
ELECTRICAL AND ELECTRONICS MANUFACTURING	71
ELECTRICAL EQUIPMENT	72
CHEMICAL PROCESSING	73
REFRIGERATION	74
COATINGS AND SURFACE TREATMENTS	76

TOPIC	PAGE NO.
PACKAGING AND CONSUMER APPLICATIONS	77
OTHER APPLICATIONS	77
INORGANIC FLUOROCEMICALS	78
MARKET ESTIMATE AND FORECAST	78
<i>TABLE 15 U.S. MARKET FOR INORGANIC FLUOROCEMICALS, THROUGH 2021 (MILLION POUNDS)</i>	78
WATER FLUORIDATION	79
Background	79
Cost Benefits	80
<i>TABLE 16 EFFECTIVENESS OF DIFFERENT DENTAL FLUORIDATION METHODS</i>	80
DENTISTRY	81
NON-ELECTRICAL EQUIPMENT	82
ELECTRICAL AND ELECTRONICS MANUFACTURING	83
Fluoborates	83
Gases	84
ELECTRICAL EQUIPMENT	84
CHEMICAL PROCESSING	85
Hydrogen Fluoride	85
Boron Trifluoride	85
Others	86
COATINGS AND SURFACE TREATMENTS	86
OTHER APPLICATIONS	86
FLUOROPOLYMERS	87
MARKET ESTIMATE AND FORECASTS	87
<i>TABLE 17 U.S. FLUOROPOLYMER MARKET BY TYPE, THROUGH 2021 (MILLION POUNDS)</i>	87
NON-ELECTRICAL EQUIPMENT	88
Resins	88
Elastomers	88
Low Molecular Weight Polymers	89
ELECTRICAL AND ELECTRONICS MANUFACTURING	89
ELECTRICAL EQUIPMENT	89
Wire and Cable	90
Other Fluoropolymer Applications	90
CHEMICAL PROCESSING	90
COATINGS AND SURFACE TREATMENTS	91
Resins	91
Low Molecular Weight Polymers	92
PACKAGING AND CONSUMER APPLICATIONS	92
OTHER APPLICATIONS	93
CHAPTER 5 MARKETS BY APPLICATIONS	96
MARKET OVERVIEW AND SUMMARY MARKET ESTIMATE AND FORECAST	96
<i>TABLE 18 U.S. MARKET FOR FLUOROCEMICALS AND POLYMERS BY APPLICATION, THROUGH 2021 (MILLION POUNDS)</i>	96
WATER FLUORIDATION	97
<i>TABLE 19 U.S. MARKET FOR WATER FLUORIDATION CHEMICALS, THROUGH 2021 (MILLION POUNDS)</i>	98

TOPIC	PAGE NO.
DENTISTRY	99
<i>TABLE 20 U.S. MARKET FOR TOOTHPASTE FLUORIDES, THROUGH 2021 (MILLION POUNDS)</i>	99
NONELECTRICAL EQUIPMENT	100
FLUROCHEMICALS	100
<i>TABLE 21 U.S. MARKET FOR NONELECTRICAL EQUIPMENT FLUROCHEMICALS, THROUGH 2021 (MILLION POUNDS)</i>	100
Organic Fluorochemicals	100
Inorganic Fluorochemicals	101
FLUROPOLYMERS	101
<i>TABLE 22 U.S. MARKET FOR NONELECTRICAL EQUIPMENT FLUROPOLYMERS, THROUGH 2021 (MILLION POUNDS)</i>	102
Resins	102
<i>TABLE 23 U.S. MARKET FOR NONELECTRICAL EQUIPMENT FLUROPOLYMER RESINS BY RESIN TYPE, THROUGH 2021 (MILLION POUNDS)</i>	102
<i>TABLE 24 U.S. MARKET FOR NONELECTRICAL EQUIPMENT FLUROPOLYMER RESINS BY APPLICATION, THROUGH 2021 (MILLION POUNDS)</i>	103
Elastomers	104
Low Molecular Weight Polymers	104
ELECTRICAL AND ELECTRONICS MANUFACTURING	104
FLUROCHEMICALS	104
<i>TABLE 25 U.S. MARKET FOR ELECTRICAL AND ELECTRONICS MANUFACTURING FLUROCHEMICALS, THROUGH 2021 (MILLION POUNDS)</i>	105
Organic Fluorochemicals	105
<i>TABLE 26 U.S. MARKET FOR ELECTRICAL AND ELECTRONICS MANUFACTURING ORGANIC FLUROCHEMICALS, THROUGH 2021 (MILLION POUNDS)</i>	106
Inorganic Fluorochemicals	107
<i>TABLE 27 U.S. MARKET FOR ELECTRICAL AND ELECTRONICS MANUFACTURING INORGANIC FLUROCHEMICALS, THROUGH 2021 (MILLION POUNDS)</i>	107
Fluoborates	107
Gases	107
Others	108
FLUROPOLYMERS	108
<i>TABLE 28 U.S. MARKET FOR ELECTRICAL AND ELECTRONICS MANUFACTURING FLUROPOLYMERS, THROUGH 2021 (MILLION POUNDS)</i>	109
ELECTRICAL EQUIPMENT	109
FLUROCHEMICALS	109
Organic Fluorochemicals	109
Inorganic Fluorochemicals	110
FLUROPOLYMERS	110
<i>TABLE 29 U.S. MARKET FOR ELECTRICAL EQUIPMENT FLUROPOLYMERS, THROUGH 2021 (MILLION POUNDS)</i>	110
Wire and Cable	110
Applications	111
CHEMICAL PROCESSING	112
FLUROCHEMICALS	113
<i>TABLE 30 U.S. MARKET FOR CHEMICAL PROCESSING FLUROCHEMICALS, THROUGH 2021 (MILLION POUNDS)</i>	113
Organic Fluorochemicals	113

TOPIC	PAGE NO.
<i>TABLE 31 U.S. MARKET FOR CHEMICAL PROCESSING ORGANIC FLUOROchemicals, THROUGH 2021 (MILLION POUNDS)</i>	113
Inorganic Fluorochemicals	114
<i>TABLE 32 U.S. MARKET FOR CHEMICAL PROCESSING INORGANIC FLUOROchemicals, THROUGH 2021 (MILLION POUNDS)</i>	114
FLUOROPOLYMERS	115
<i>TABLE 33 U.S. MARKET FOR CHEMICAL PROCESSING FLUOROPOLYMERS, THROUGH 2021 (MILLION POUNDS)</i>	115
REFRIGERATION	116
<i>TABLE 34 U.S. MARKET FOR FLUOROchemical REFRIGERANTS, THROUGH 2021 (MILLION POUNDS)</i>	116
COATINGS AND SURFACE TREATMENTS	118
FLUOROchemicals	118
<i>TABLE 35 U.S. MARKET FOR COATINGS AND SURFACE TREATMENT FLUOROchemicals, THROUGH 2021 (MILLION POUNDS)</i>	118
Organic Fluorochemicals	118
<i>TABLE 36 U.S. MARKET FOR COATINGS AND SURFACE TREATMENT ORGANIC FLUOROchemicals, THROUGH 2021 (MILLION POUNDS)</i>	118
Inorganic Fluorochemicals	120
FLUOROPOLYMERS	120
<i>TABLE 37 U.S. MARKET FOR COATINGS AND SURFACE TREATMENT FLUOROPOLYMERS, THROUGH 2021 (MILLION POUNDS)</i>	120
PACKAGING AND OTHER CONSUMER APPLICATIONS	121
<i>TABLE 38 U.S. MARKET FOR PACKAGING AND OTHER CONSUMER APPLICATIONS FLUOROchemicals AND POLYMERS, THROUGH 2021 (MILLION POUNDS)</i>	122
ORGANIC FLUOROchemicals	122
<i>TABLE 39 U.S. MARKET FOR PACKAGING AND OTHER CONSUMER APPLICATIONS ORGANIC FLUOROchemicals, THROUGH 2021 (MILLION POUNDS)</i>	122
FLUOROPOLYMERS	123
<i>TABLE 40 U.S. MARKET FOR PACKAGING AND OTHER CONSUMER APPLICATION FLUOROPOLYMERS, THROUGH 2021 (MILLION POUNDS)</i>	124
OTHER APPLICATIONS	125
<i>TABLE 41 U.S. MARKET FOR FLUOROchemicals AND POLYMERS IN OTHER MISCELLANEOUS APPLICATIONS, THROUGH 2021 (MILLION POUNDS)</i>	125
ORGANIC FLUOROchemicals	125
INORGANIC FLUOROchemicals	125
FLUOROPOLYMERS	126
CHAPTER 6 FLUOROchemical TECHNOLOGIES	128
CHEMISTRY AND PHYSICO-CHEMICAL PROPERTIES OF FLUOROchemicals	128
CHEMICAL AND BIOREACTIVE PROPERTIES	129
PHYSICAL PROPERTIES AND CHARACTERISTICS	129
ORGANIC FLUOROchemicals	129
INORGANIC FLUOROchemicals	129
FLUOROPOLYMERS	130
COMMERCIAL FLUOROchemical AND FLUOROPOLYMER RAW MATERIALS	131
FLUORSPAR	131
PHOSPHATE ROCK	132
ORGANIC FLUOROchemical AND FLUOROPOLYMER FEEDSTOCKS	133
Chloroform	133

TOPIC	PAGE NO.
Carbon Tetrachloride	133
Methyl Chloroform (1,1,1-Trichloroethane)	134
Perchloroethylene (1,1,2,2-tetrachloroethylene)	134
Trichloroethylene	134
SYNTHESIS OF ORGANOFLUORINE COMPOUNDS	135
HALOGEN EXCHANGE	135
ELECTROCHEMICAL SYNTHESIS	135
DIRECT FLUORINATION	136
CHEMISTRY AND SYNTHETIC METHODS FOR INORGANIC FLUOROCHEMICALS	137
NEWER TECHNOLOGIES	137
CFC (AND NOW ALSO HCFC AND HFC) REPLACEMENTS	137
HCFCs	139
Mixtures and Problems	141
Other Substitute Materials for CFCs	142
Cleaning and Solvent Applications	142
Blowing Agents	142
Refrigeration	143
SUPERCRITICAL SOLVENT EXTRACTION	144
SUPERCRITICAL CARBON DIOXIDE FLUOROPOLYMER PROCESS	144
PERFLUOROCARBON ARTIFICIAL BLOOD AND BREATHING AIDS	145
MELT-PROCESSABLE PTFE	146
CHAPTER 7 INDUSTRY AND MARKET STRUCTURE	149
MARKET SIZE AND GROWTH FACTORS	149
COMMON MARKET FACTORS	149
SPECIFIC PRODUCT MARKET FACTORS	150
MAJOR PRODUCERS AND SUPPLIERS	151
SUPPLIERS AND PRODUCTS	151
Consolidation, Restructuring, etc.	152
Domestic Companies	152
Recent Developments	153
INTERNATIONAL ASPECTS	154
MAJOR FOREIGN COMPANIES	154
IMPORTS AND EXPORTS	155
DISTRIBUTION AND TECHNICAL SERVICE	156
PRICES AND PRICING	157
CHAPTER 8 REGULATION AND PUBLIC POLICY	160
THE OZONE LAYER AND THE GREENHOUSE EFFECT	160
BACKGROUND	160
THE MONTREAL PROTOCOL	162
Carbon Tetrachloride and Methyl Chloroform	163
Transitional Compounds	163
PROGRAMME FOR ALTERNATIVE FLUOROCARBON TOXICITY TESTING (PAFT)	163
Projections of Future Atmospheric CFC Levels	164
CFC PHASEOUT PROGRESS	164
THE GREENHOUSE EFFECT AND GLOBAL WARMING	165

TOPIC	PAGE NO.
Potential Effects of Newer Products	166
Predictions	167
The Kyoto Protocol and Subsequent Climate Conferences	168
WATER FLUORIDATION	170
CONTROVERSY	171
Safety	172
Research	173
CONCERNS OVER FLUORO-CHEMICALS AND PERFLUORO-CHEMICALS	173
PERFLUOROALKYL SULFONATES AND REPLACEMENTS	173
PERFLUORO-OCTANOIC ACID	174
FLUOROPOLYMER BREAKDOWN PRODUCTS	176
CHAPTER 9 SUPPLIER COMPANY PROFILES	179
INTRODUCTION	179
SUPPLIER COMPANIES	179
3M CO. (THE)	179
ACETO CORP.	180
ADVANCE RESEARCH CHEMICALS, INC.	181
ADVANCED SPECIALTY GASES INC.	182
AGC CHEMICALS AMERICAS, INC.	182
AIR PRODUCTS AND CHEMICALS INC./VERSUM PRODUCTS INC.	184
ANDERSON DEVELOPMENT CO.	185
ARKEMA INC.	185
CHEMOURS CO. (THE)	186
DAIKIN AMERICA INC.	188
DOW CORNING CORP.	189
E.I. DUPONT DE NEMOURS AND CO.	190
DYNEON LLC	191
GREEN, TWEED & CO.	192
HALOCARBON PRODUCTS CORP.	193
HONEYWELL INTERNATIONAL INC.	194
KUREHA AMERICA	196
LINDE NORTH AMERICA INC.	196
MEXICHEM FLUOR INC.	197
OMNOVA SOLUTIONS INC.	198
PHIBRO ANIMAL HEALTH CORP.	198
SACHEM, INC.	199
SAINT-GOBAIN PERFORMANCE PLASTICS CORP.	199
SHIN-ETSU SILICONES OF AMERICA INC.	200
SOLVAY NORTH AMERICA LLC	201
W. L. GORE & ASSOCIATES, INC.	202
ZEON CHEMICALS, L.P.	203
CHAPTER 10 APPENDIX	205
GLOSSARY OF IMPORTANT TERMS, ABBREVIATIONS, ACRONYMS, ETC.	205

LIST OF TABLES

TABLE HEADING	PAGE NO.
SUMMARY TABLE U.S. FLUORO-CHEMICAL AND POLYMER MARKET, BY PRODUCT TYPE, THROUGH 2021 (MILLION POUNDS)	12
TABLE 1 HYDROCARBON AND HALOCARBON BOND STRENGTHS	15
TABLE 2 PROPERTIES CONFERRED BY FLUORINE SUBSTITUTION	15
TABLE 3 COMMON CHLOROFLUOROCARBONS (CFCS) AND REFRIGERANT MIXTURES	21
TABLE 4 HYDROCHLOROFLUOROCARBONS (HCFCS) AND HCFC-BASED MIXTURES	21
TABLE 5 HYDROFLUOROCARBONS (HFCS) AND HFC-BASED MIXTURES	22
TABLE 6 WATER SOLUBILITY OF WATER TREATMENT FLUORIDE CHEMICALS	33
TABLE 7 FLUOROPOLYMER NAMES AND ACRONYMS	45
TABLE 8 FLUOROPOLYMER RAW MATERIALS AND SYNTHETIC ROUTES	46
TABLE 9 AVERAGE PROPERTIES OF FLUOROPOLYMER RESINS	46
TABLE 10 FLUOROPOLYMER PROPERTIES AND THE EFFECTS OF INCREASING FLUORINE CONTENT	47
TABLE 11 FLUOROSURFACTANT APPLICATIONS	64
TABLE 12 U.S. FLUORO-CHEMICAL AND POLYMER MARKET BY PRODUCT TYPE, THROUGH 2021 (MILLION POUNDS)	68
TABLE 13 U.S. ORGANIC FLUORO-CHEMICALS MARKET BY CHEMICAL TYPE, THROUGH 2021 (MILLION POUNDS)	70
TABLE 14 U.S. MARKET FOR ALIPHATIC ORGANIC FLUORO-CHEMICALS BY APPLICATION, THROUGH 2021 (MILLION POUNDS)	70
TABLE 15 U.S. MARKET FOR INORGANIC FLUORO-CHEMICALS, THROUGH 2021 (MILLION POUNDS)	78
TABLE 16 EFFECTIVENESS OF DIFFERENT DENTAL FLUORIDATION METHODS	80
TABLE 17 U.S. FLUOROPOLYMER MARKET BY TYPE, THROUGH 2021 (MILLION POUNDS)	87
TABLE 18 U.S. MARKET FOR FLUORO-CHEMICALS AND POLYMERS BY APPLICATION, THROUGH 2021 (MILLION POUNDS)	96
TABLE 19 U.S. MARKET FOR WATER FLUORIDATION CHEMICALS, THROUGH 2021 (MILLION POUNDS)	98
TABLE 20 U.S. MARKET FOR TOOTHPASTE FLUORIDES, THROUGH 2021 (MILLION POUNDS)	99
TABLE 21 U.S. MARKET FOR NONELECTRICAL EQUIPMENT FLUORO-CHEMICALS, THROUGH 2021 (MILLION POUNDS)	100
TABLE 22 U.S. MARKET FOR NONELECTRICAL EQUIPMENT FLUOROPOLYMERS, THROUGH 2021 (MILLION POUNDS)	102
TABLE 23 U.S. MARKET FOR NONELECTRICAL EQUIPMENT FLUOROPOLYMER RESINS BY RESIN TYPE, THROUGH 2021 (MILLION POUNDS)	102
TABLE 24 U.S. MARKET FOR NONELECTRICAL EQUIPMENT FLUOROPOLYMER RESINS BY APPLICATION, THROUGH 2021 (MILLION POUNDS)	103
TABLE 25 U.S. MARKET FOR ELECTRICAL AND ELECTRONICS MANUFACTURING FLUORO-CHEMICALS, THROUGH 2021 (MILLION POUNDS)	105
TABLE 26 U.S. MARKET FOR ELECTRICAL AND ELECTRONICS MANUFACTURING ORGANIC FLUORO-CHEMICALS, THROUGH 2021 (MILLION POUNDS)	106
TABLE 27 U.S. MARKET FOR ELECTRICAL AND ELECTRONICS MANUFACTURING INORGANIC FLUORO-CHEMICALS, THROUGH 2021 (MILLION POUNDS)	107
TABLE 28 U.S. MARKET FOR ELECTRICAL AND ELECTRONICS MANUFACTURING FLUOROPOLYMERS, THROUGH 2021 (MILLION POUNDS)	109
TABLE 29 U.S. MARKET FOR ELECTRICAL EQUIPMENT FLUOROPOLYMERS, THROUGH 2021 (MILLION POUNDS)	110

TABLE HEADING	PAGE NO.
TABLE 30 U.S. MARKET FOR CHEMICAL PROCESSING FLUOROCHEMICALS, THROUGH 2021 (MILLION POUNDS)	113
TABLE 31 U.S. MARKET FOR CHEMICAL PROCESSING ORGANIC FLUOROCHEMICALS, THROUGH 2021 (MILLION POUNDS)	113
TABLE 32 U.S. MARKET FOR CHEMICAL PROCESSING INORGANIC FLUOROCHEMICALS, THROUGH 2021 (MILLION POUNDS)	114
TABLE 33 U.S. MARKET FOR CHEMICAL PROCESSING FLUOROPOLYMERS, THROUGH 2021 (MILLION POUNDS)	115
TABLE 34 U.S. MARKET FOR FLUOROCHEMICAL REFRIGERANTS, THROUGH 2021 (MILLION POUNDS)	116
TABLE 35 U.S. MARKET FOR COATINGS AND SURFACE TREATMENT FLUOROCHEMICALS, THROUGH 2021 (MILLION POUNDS)	118
TABLE 36 U.S. MARKET FOR COATINGS AND SURFACE TREATMENT ORGANIC FLUOROCHEMICALS, THROUGH 2021 (MILLION POUNDS)	118
TABLE 37 U.S. MARKET FOR COATINGS AND SURFACE TREATMENT FLUOROPOLYMERS, THROUGH 2021 (MILLION POUNDS)	120
TABLE 38 U.S. MARKET FOR PACKAGING AND OTHER CONSUMER APPLICATIONS FLUOROCHEMICALS AND POLYMERS, THROUGH 2021 (MILLION POUNDS)	122
TABLE 39 U.S. MARKET FOR PACKAGING AND OTHER CONSUMER APPLICATIONS ORGANIC FLUOROCHEMICALS, THROUGH 2021 (MILLION POUNDS)	122
TABLE 40 U.S. MARKET FOR PACKAGING AND OTHER CONSUMER APPLICATION FLUOROPOLYMERS, THROUGH 2021 (MILLION POUNDS)	124
TABLE 41 U.S. MARKET FOR FLUOROCHEMICALS AND POLYMERS IN OTHER MISCELLANEOUS APPLICATIONS, THROUGH 2021 (MILLION POUNDS)	125

LIST OF FIGURES

FIGURE TITLE	PAGE NO.
SUMMARY FIGURE U.S. FLUORO-CHEMICAL AND POLYMER MARKET, BY PRODUCT TYPE, 2016 AND 2021 (MILLION POUNDS)	12