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FINAL SUMMARY REPORT

CONTRACT NO. NAS8-5352

CONTROL NO. TP 3-84117 (IF)

CPB 02-1163-63

GEORGE C. MARSHALL SPACE FLIGHT CENTER

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

For the Period
May 1963 through May 1969

DEVELOPMENT OF VULCANIZABLE ELASTOMERS SUITABLE FOR USE IN CONTACT WITH LIQUID OXYGEN

ANNOTATED BIBLIOGRAPHY

October 1969

Peninsular ChemResearch
Calgon Corporation
Post Office Box 1466
Gainesville, Florida 32601

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APPENDIX

ANNOTATED BIBLIOGRAPHY

June 1963 through May 1969

This bibliography was prepared from references obtained mainly from Chemical Abstracts, but contains, in addition, references taken from a number of primary sources. Major emphasis was placed on references to fluorine-containing monomers and polymers and to thermal properties of all classes of polymers.

The great number of references in the categories covered necessitated selecting references which were considered to be of most significance to the present investigation. The choice of references is somewhat subjective, but it is felt that the cross-section given is a useful representation of the literature to date.

The references listed have been categorized with respect to the general subdivisions shown below. For the sake of brevity, no cross-referencing has been done; hence, where a paper was concerned with more than one sub-division the reference, in general, was placed in the category of greatest importance. Copolymers were placed in the earliest listed monomer category with the exception of the vinyl ethers and thioethers, the copolymers of which were included under the main heading of vinyl ethers.

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I. Reviews on Fluorine-Containing Polymers

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Elastomers by radical and redox mechanisms. E. Fluorine-containing elastomers. A review with 53 references.

Coulter, D. J. B., C. A. 59, 14179f (1963)
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Fluorine chemistry. V. Poly(tetrafluoroethylene)

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Poly(vinyl fluoride) film soluble in DMSO

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Bruk, M.A., et al., C.A. 59, 4039 (1963)
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C_2F_4/CF_3CHCH_2

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$S_2O_8^=$ polymerization of TFE, $CF_3CF=CFH$, $CH_2=CF_2$

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Barr, John T. (to Pennsalt Chem. Co.) U.S. 3,379,773. (Cl. 260-615) C.A. 68, 115540X
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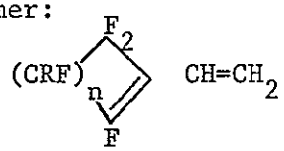
C.A. 55, P 1047d (1961)
Copolymers of $CF_2CHCFCH_2$ with $CH_2CFCHCH_2$

Bolstad, Archibald, N.; Hoyt, John M. (to 3 M Co.) U.S. 3,398,138 (Cl. 260-87) C.A. 69 (18), 68146g
Copolymers of fluorine-containing dienes comprising 1,1,2-trifluorobutadiene-1,3 and some other fluorine-containing diene.

Brown, D., et al., C.A. 62, 16391_f
Polymerization of perfluoropentadiene at high pressure with γ-ray.

Butler, A.J., et al. (to Dow-Corning) French Pat. 1,423,548, C.A. 65, 17084h
Fluorinated monomers and polymers
Monomer:



R = H, F
n = 2 or 3

Cook, Edward W. (FMC Corp) U.S. 3,391,118 (Cl 260-61)
C.A. 69 (10), 36886g
The reaction of perfluoro-dienes with KOH Salts of highly fluorinated diols gives poly-ethers. The polymer of 4-chloro-perfluoro-1,6-heptadione with hexafluoropentanediol gives an elastomer having T_g -50°C.

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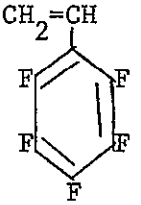
$CH_2=CHCH=CFCF_3$ copolymerized with $CH_2=CH$
S_2O_8 initiator



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E. Frisch and O. Steward, Fr. 1,361,256, (to Dow Corning Corp.); C.A. 61, 13445b
u.v. initiated polymerization of $CF_3CF=CFCH=CH_2$ gave a tough flexible polymer with a softening point of 170°.

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Polyfluoro-substituted butadienes

Honn, F.J., (to 3M), U.S. 2,949,446. C.A. 55, P 1048f (1961)
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Copolymerization of $CF_2CHCF_2CHCF_2$, $CF_2=CFCF_2CFClCF_2Cl$

$CF_2=CFCF_2CF-CF_2$, $EtOC=CFCF_2CF_2$

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$CF_2CFCFCH_2$, $CF_2CFCClCHCl$, $CF_2{=}CFC{=}CFCF_2CF_2$

last three polymerize with difficulty

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Copolymers of allyl fluoroalkyl ethers

Air Reduction Company, Brit. 811,037. C.A. 53, 10849g(1959)
Copolymer of $CF_3CH_2OCHCH_2$ and vinyl esters

Barr, J.R., (to Pennsalt Chem. Co.), U.S. 2,813,848. C.A. 52, 3406e (1958)
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Polymers of $CH_2=CHOCF_2CF_2H$

Darby, R.A., Fr. 1,341,087 (to E.I. du Pont de Nemours and Co.); C.A. 60, 9151a (1964)
Copolymer of C_2F_4 with $CF_3CF_2CF_2OCF(CF_3)CF_2OCF=CF_2$ using N_2F_4 as initiator gave a high MW polymer

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$RONa + CF_2CF_2 \longrightarrow ROCFCF_2$

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Polymers of vinylperfluoroalkyl sulfides

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Terpolymers of fluorocarbon vinyl ethers and other fluorine-containing monomers

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Terepolymers of $CF_3OCF=CF_2/C_2F_4/CF_2CH_2$ using

Durell, W. S., et al., J. Pol. Sci . Pt. A 3, 4065(1965)
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Synthesis of perfluoroalkyl trifluorovinyl ethers, including $CF_3OCF=CF_2$

Gorden, J., and Woolf, C., (to Allied Chem. Co.) U. S. 2,870,222. C.A. 53, 8709h(1959)
Low polymers from $BF_3 + CF_2CHOCH_3$

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Polymers from CF_2CFOR

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Vinyl perfluoroalkylsulfides and their polymers

Holly, E. D., and Nummy, W.R., (to Dow Chem), U. S. 2947,730. C.A. 54, 26010h(1960)
Polymer of vinylpentachlorophenylsulfide

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Reactivity of vinyl ethers in copolymerization

Lo, E. S. (3M), U.S. 2,975,163. C.A. 55, 16004i(1961)
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Polymers of CH_2CHOR, where R=CH_2CF_3, CF_2CF_2H, CF_2CFHCF_3, $CH_2C_3F_7$, and $CH_2C_5F_{11}$

3M Company, U. S. Army Contract No. DA-19-129-QM-1043. Report for the period October 16, 1957 to August 16, 1960.
Polymers of $CF_3CH_2OCH=CH_2$

Okuhara, K., Baba, H., and Kojima, R., C.A. 57, 5784c (1962)
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Pennsalt Chem. Co., WADC TR 57-436. ASTIA Doc. No. AD 142116, Novermber 1957
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C.A. 51, 7054a(1957)
Copolymer of monochlorotrifluoroethylene and an alkyl vinyl ether.

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Polymers derived from fluoroketones: III Monomer synthesis, polymerization, and wetting properties of poly (fluoroalkyl allyl ethers) and (fluoroalkyl vinyl ethers)

Pummer W. and Wall, L. C.A. 61, 2999d
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CF_2CFO and $CF_2CFOC_6F_5$

Ray, N. H., Brit. 931,919. C.A. 59, 10258b(1963)
Polymers of $SF_5CH=CH_2$

Robertson, James J., (to Firestone Tire and Rubber Co.), U.S. 2,905,660 C.A. 54, 2823b(1960)
Copolymers of CF_2CFCl with vinyl alkyl ethers

Schildknecht, C.E., (to Air Reduction), U.S. 2,820,025. C.A. 52, 5872c (1958)
$(CF_3CH_2OCHCH_2)_n$

Schildknecht, C.E., (to Air Reduction Co.(, Brit. 810,515, C.A. 53 23044h(1959)
Copolymers of $CF_3CH_2OCHCH_2$ and chloroolefins

Schildknecht, C.E., (to Air Reduction Co.), U.S. 2,851,499. C.A. 53 2694h(1959)
Copolymers of $CF_3CH_2OCHCH_2$ and vinyl esters

Schildknecht, C.E., (to Air Reduction Co.), U.S. 2,991,278. C.A. 55. P 27988g(1961)
Copolymers of $CF_3CH_2OCH=CH_2$ with haloolefins

Schuman, P.D.; Stump, E.C., Westmoreland, G.
Development of vulcanizable elastomers suitable for use in Contact with liquid oxygen. In "Proceedings of the NASA-case conference on the properties of polymers at cryogenic temperatures, Cleveland, Ohio, April 25027, 1967. pp263-278.' Marcel Dekker, 1968 NASA ref Co6 A69-16497
Synthesis, polymerization, and evaluation of perfluoropoly-(vinyl ethers) as elastomers for use in contact with liquid oxygen.

Sorkin, H., et. at., C.A. 64, 5274
Dielectric properties of some poly(fluoroalkyl vinyl ethers)

Sorkin Howard (to Air Reduction Co.) U.S. 3,394,116(Cl 260-91.1) CA 69, 58825P
Preparation and polymerization of trifluoroethoxyethyl vinyl ether.

Vandenberg. E. J., Heck, R. F., and Breslow, D.S., J. Polymer Sci., 28, 249(1958). C.A. 54, 11552b(1960)
Crystalline polymers of $CF_3CH_2OCHCH_2$ from Ziegler catalysts

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Perfluorovinyl phenyl ethers and their polymers

$$C_2F_4 + \begin{matrix}\text{PhONa}\\ \text{or}\\ \text{PhOK}\end{matrix} \longrightarrow PhOCF{=}CF_2$$

Polymerization of I with Co^{60}

Wall, Leo A.; Pummer, Walter J,: C.A. 68, 87760y, U.S. 3,371.064 (Cl. 260-47), February 27, 1968.

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The crystallization of polyCTFE films: rates and nucleation mechanisms for isothermally crystallized 96% CTFE - 4% VF_2

Aldrich, P.E. (to duPont), U.S. 3,162,622. C.A. 62, 7968h

$$\left\{ \begin{array}{l} CH=CH_2 \\ | \\ OCF_3 \end{array} \right\}_x$$

Allied Chem. Co., Neth. Appl. 6,503.339. C.A. 64, 6783
Perfluorocyclobutene polymers

Allied Chem. Corp. Neth. Appl. 6,412,462, C.A. 64, 8377f

$CH_2=CHCOCH(CFX_2)_2$ X-F, Cl polymerized with Bz_2O_2

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Perfluorocyclobutene polymers

Anello, L.G.; Sweeney, R.F. (to Allied Chemical Co.) U.S. 3,384,627 (Cl. 260-89.5) C.A. 69, 19787h
Polyfluoroalkyl acrylate monomers, polymers, and intermediates

Anspon, H.D., (to GAF) U.S. 2,956,939. C.A. 55 P 6923a (1961)
Methyl α-fluoroacrylate

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Preparation and properties of 2,2-difluoro-2-nitroethyl acrylate polymers.

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3,3,3-Trifluoropropene polymers

Bolstad, A.N., and Honn, F.J., (to 3M), U.S. 2,966,482. C.A. 55, 8916e (1961)

$CF_3C=CCF_3$: CH_2CFCl copolymers

Borland, J.W., Miller, C.G. and Pearson, J.H., (to Allied Chem. Co.) U.S. 2,865,824. C.A. 53, 5749c (1959)
Produces polymers for resistance to corrosive substances.
CF_2CFCl, CH_2CFCl, CH_2CF_2, CF_2CFH, CF_2CHCl

Brehm, W.J., and Millıan, A.S., (to du Pont), U.S. 3,053,823. C.A. 57, 16890d (1962)
Copolymers of hexafluoropropylene and fluoranil, basically $(C_3F_6)_n$

Bro, M.I., Convery, R.J., and Schreyer, R.C., U.S. 2,988,542. C.A. 55, 22917a (1961)
Fluorine-contaıning 1-olefins polymerized in a halogenated solvent with $R_f\overset{O}{\overset{\|}{C}}OOH$

Brown, H.C., and Gewanter, H.L., J. Org. Chem. 25, 2071 (1960). C.A. 55, 14283i (1961)
Polymerization of $CF_3C{\equiv}CCF_3$

Calfee, J.D., Wildı, B.S., (to Monsanto) U.S. 3,252,954
Polymerization of CH_2-CFCl and subsequent dehydrochlorination

Ching-Hung Chem. C.A. 63, 2888d
Radical polymerızation of fluoroalkenes

Chow, Sui-Wu, and Pilato, L.A. (to UCC) Fr. 1,395.586. C.A. 63, 18295a
Poly(α,α,α',α'-tetrafluoro-p-xylylenes)

Coleman, L.E., Jr., and Burrell, W.S., J.Org. Chem. 23, 1211-13 (1958) C.A. 53, 2124a (1959)
Reactivity ratıos of trifluoromethyl substituted styrenes with methyl methacrylate and styrene

Coleman, L.E., Jr., Rausch, D.A., and Griffin, W.R., Chem. and Eng. Data Ser. 3, 113-15 (1958). C.A. 53, 12734d (1959)
Polymerization of some 1-alkyl-1-hydroperfluoroalkyl acrylates

Coleman, L.E., and Durrell, W. A., C.A. 55, 18173f (1961)
Synthesis and characteristıcs of new vinyl polymers. Substitution of CF_3 on styrene increased polymerization reactivity.

Colombo, P., Steinberg, M., and Chapman, R.N., J.Polymer Sci. Part B, Polymer Letters 1, 435 (1963)
Explosive decomposition of the mixture ethylene and CF_2CFCl

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Co^{60} gamma-ray induced copolymerization of ethylene in presence of other monomers

Crawford, G. H., U. S. 3,089,866. C. A. 59, 1776h (1963)
Ziegler polymerization of fluoroolefins

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Fluorine containing polymers. Prep of $CF_2=CFCO_2H$, $CF_2=CFCF_2CO_2H$, $CF_2=CF(CF_2)_3CO_2H$ and copolymerization with C_2F_4, CTFE, C_3F_6-C_2F_4, CF_3NO-C_2F_4, C_2HF_3, $C_2Cl_2F_2$, etc.

Daikin Kogyo Co., Ltd., Japan. C.A. 64, 3722b
Perfluoro-olefin polymers

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Fluorohydrocarbon polymers

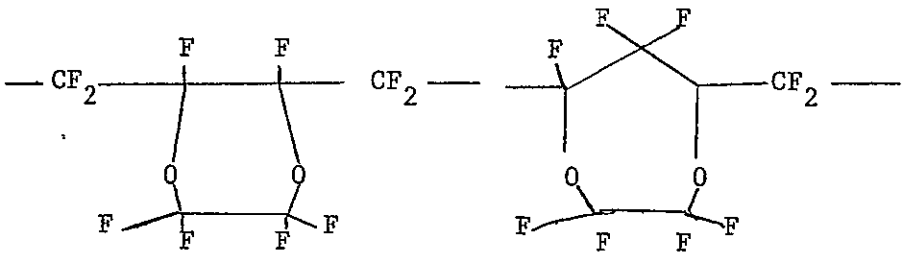
Dennstedt, I., and Becker, W., Ger. 959,060. C.A. 53, 13670e (1959)
Polymerization of CF_2CFCl

Dittman, A. L., Passino, H.J., and Wrightson, J.M., U.S. 2,689,241 C. A. 49, 11681a (1955)
Redox system for CF_2CFCl

Dittman, A. L., Passino, H. J. and Wrightson, J.M., (to 3 M) U. S. 2,837,505. C. A. 52, 15130b (1958)
Polymerization of $CHF=CF_2$ in H_2O

E. I. duPont de Nemours & Co., U.S. 3,342,777.
Addition copolymers of polyfluoroketones and ethylenic compounds.

duPont, French Patent 1,428.964. C.A. 65, 20243a
Polymers of perfluorinated cyclic ethers



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Bis(pentafluoroalkyl) ketenes are copolymd. with ethylenically unsatd. monomers by using free radical initiators.

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Copolymers of 1,3-butadiene and 1,1-difluoro-2,2-dichloro-ethylene. Increase of $CF_2=CCl_2$ diminishes flexibility.

Duck, E.W., Brit. 853,355. C.A. 55, 10969f (1961)
Ziegler polymerization of perfluoroolefins.

Eleuterio, H.S., (to du Pont), U.S. 2,958,685. C.A. 55, P6041c (1961) C_3F_6 polymers

Eleuterio, H.S., and Moore, E.P., 2nd International Fluorine Symposium, Estes Park, Colorado, July 17-20, 1962
$(C_3F_6)_n$

Elliot, J.R., Myers, R.L., and Roedel, G.F., I and EC 45, 1786 (1953)
Polymer of CF_2CFCl

Fear, E.J.P., et al., C.A. 65, 7079d
Perfluoropolyphenylenes from pentafluorophenyl magnesium bromide

Florin, R.E., and Wall, L.A., J. Research NBS 65-A, 375 (1961)
Gamma irradiation of fluorine-containing polymers

$$CF_2CFH \xrightarrow[60\text{-}80°]{\text{persulfate}} +CF_2CFH+_n$$

Fokin, A.V., et al., U.S.S.R. 125,678. C.A. 54, 14791c (1960)
Gamma radiation in Cl containing solvent.

Geigy, J.R., A.-G., C.A. 68 79609r, Neth. Appl. 6,611,407 (Cl. C. 08f), February 14, 1967
Copolymers of 1,1-dihydroperfluoroalkyl α-trifluoro-methacrylates.

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Properties of solutions of the fluorine-containing rubber SKF - 26, including osmometric and viscometric methods.

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Low polymers formed

Haas, H. C., Emerson, E.S., and Schuler, N.W., J. Polymer Sci., 22, 291-302 (1956). C.A. 51,3179d (1957)
Poly(vinyl trifluoroacetate) homopolymers and copolymers with vinylacetate

Hamilton, J.M., Jr., I and EC 45, 1347 (1953)
Polymer of CF_2CFCl

Hann, F.J., and Hoyt, J.M., U.S. 3,053,818. C.A. 58, 3584e (1963)
CF_2CFCl interpolymers

Harris, J. F. Jr., (to duPont), U.S. 3,037,010. C.A. 57, 7465e (1962)
Polymeric perfluoro-2-butyne

Haszeldine, R.N., Fields, R., U. S. 3,234.149 C.A. 64, 17803b
Poly[(perfluoroalkyl)methylene]

Hauptschein, M., et al. (to Pennsalt). U.S. 3,240,825
C.A. 58, 13815h
Homotelomers of $CF_3CF=CH_2$

Hoyt, J.M., (to 3M), U.S. 2,836,582. C.A. 52, 14223f (1958)
Redox system used

Hoyt, J.M., (to 3M), U.S. 2,843,575. (C.A.53, 26756 (1959)
Copolymer of fluoroprene and perhalogenated ethylene

Imperial Chem. Ind., Ltd., Neth. Appl. 6,505,550 C.A. 64, 14309c
Perfluorophenylene polymers

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$CF_2=CFCF=CH_2$ elastomeric below 0°

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Tetrafluoroallene. Prep and polymerization

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Synthesis and polymerization of tetrafluoroallene

Jones, F.B., and Coleman, L.E., J.Polymer Sci. 28, 242 (1957) C.A. 55, 6025f (1961)
Copolymerization of $CF_2CHCF_2CHCF_2$, $CF_2=CFCF_2CFClCF_2Cl$

$CF_2=CFCF_2CF=CF_2$, $EtO\overbrace{C=CFCF_2CF_2}$

Kahrs, K.H., et al., U.S. 2,919,263. C.A. 54, 7237i (1960)
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Polymerization of vinylene carbonate in aqueous soln.

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Study of rubbers containing fluorine by NMR

Khachaturov, A.S.; Vol'kenshtein, M.V.; Dokukina, A.F.: Vysokomol. Soedin. Ser. A, 9(12), 2574 (1967), C.A. 68, 60016y.
Molecular motion in p-(perfluorovinyl) toluene-styrene copolymer.

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Polymers and copolymers of α-olefins containing the CF_3 group.

Klebanskii, A.L., and Timofeev, O.A., C.A. 54, 8131e (1960)
Polymerization of hexafluorobutadiene

Kliman, N., and Lazar, M., C.A. 54, 10390d (1960)
Copolymers of DTFE with vinyl chloride and vinylidene chloride

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Polymers and copolymers of N-(1,1-dihydroperfluoroalkyl) acrylamides

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$CHF=CCl_2$, CHFCHCl, $CHFCBr_2$ polymers

Koleshikov, G.S. and Mateera, N.G., C.A. 54, 17941b (1960)
Polymers of CH_2CHCF_2Cl

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Khramchenkov, V.A., C.A. 59, 4039c (1963)
Radiation-induced polymerization of fluorolefins.
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T_g of some acrylic polymers

Krbekyan, G.E., Sinanyam, E.G., and Akopyan, A.N., C.A. 59, 12927e (1963)
Copolymerization of trans-2,3,4,5-tetrachlorohexa-1, 3,5-triene

Krespan, C. G., (to Du Pont), U.S. 2,938,889. C. A. 54, 20327g (1960)
Use of PbF_4, AgF_2, CoF_3 in AsF_3 to polymerize CF_2CF_2 and copolymerize with $F(CF_2)_nCF=CF_2$.

Landrum, B. F., and Herbst, R.L., Jr., (to 3M), U.S. 2,951,783. C. A. 55, P 1090h (1961)
CTFE - diallyl maleate copolymers as adhesives

Lazar, M., J. Polymer Sci. 29, 573 (1958)
Effect of solvent on the polymerization of chlorotrifluoro-ethylene.

Lo, E. S., (to 3M), U.S. 2,837,503. C.A. 53, 1805b (1959)
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Lo, E.S., (to 3M), U.S. 2,970,988. C.A. 55, 12938a (1961)
Polymers of $CF_3CF=CH_2$

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Synthesis of m-trifluoromethylstyrene and its polymerization with the presence of Bz_2O_2.

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Fluorine-containing vinyl compounds with Ziegler catalysts. CF_2CFCl; 1,1,3-trifluorobutadiene; 1,1-difluorobutadiene, CH_2CF_2

3M, WADS TR 52-197, Pts 1-6. 1952-1956.
Polymers containing $CF_2=CFH$, CF_2CFBr, $1\text{-}C_4F_8$, $1\text{-}C_9F_{18}$

3M, U. S. Army Contract No. DA-19-129-ZM-1043. Report for period October 15, 1957 - August 15, 1960
Studies included C_3F_6 and $CF_3CH=CH_2$

3M, (by James D.Groves) FR. 1,473,451, March 17, 1967, C.A. 67, 100963t.
Fluorine-containing acrylate esters.

Madorsky, S.L., Hart, V.E., Strauss, S., and Sedlak, V.A., J. Res. NBS 51, 327 (1953)
Thermal degradation of $(CF_2CF_2)_n$, $(CF_2CHF)_n$, $(CF_2CH_2)_n$, $(CFHCH_2)_n$

Maillochaud, J., and Riou, M., Fr. 1,140,964. C.A. 53, 20913b (1959)
Purification of poly(fluoroolefins) and poly(chlorofluoroolefins). Treat aqueous suspension of polymer with oxidizer.

Maksimov, V. L., et al., C.A. 65, 9044f
Molecular structure and NMR spectra of fluorinated polystyrenes

Malkevich, S.G., and Chereshkwich, L.V., C.A. 55, 2176a (1961)
p-Fluorostyrene and 2,5-difluorostyrenes

Manno, P.J., C.A. 63, 1878h
Radiation induced polymerization of fluorine-containing monomers. CF_2CFCl/C_2H_4 copolymer

Mantell, R.M. and Hoyt, J.M., (to 3 M), U.S. 3,043,823. C.A. 57, 12719b (1962)
Emulsion polymerization of fluorinated monoolefins. Standard system, except that 5 pts/150 of CS_2 added.

McBee, E.T., Hill, H.M., and Bachman, G.B., I and EC 41, 70 (1949)
Polymerization of CH_2CF_2 and CF_2CCl_2

Morton, M., Inst. of Rubber Research, AF 04(611)-9694
Project No. 750G
Irradiation of fluorine-containing olefins

Muramatsu, H., Iwasahi, M., and Baba, H., C.A. 57, 13975c (1962)
Polymerization of trifluorochloroethylene. Carboxylic end groups in poly(trifluorochloroethylene)

Natta, G., et al., J. Pol. Sci. Pt. A. 3, 4263 (1965)
Isomorphism phenomena in systems containing fluorinated polymers and in new fluorinated copolymers

Noland, J.S., (to Am. Cy.) U.S. 3,207,733. C.A.63, 1829f
Homopolymers of α-fluorostyrene

Overberger, C.G., and Davidson, E.B., J. Poly. Sci. 62, 23 (1962)
Monomer and polymers containing the CF_3-group $CF_3CH{=}CH_2$, $CF_3CH_2CH{=}CH_2$, $CF_3(CH_2)_2CH{=}CH_2$, $CH_3CH(CF_3)CH{=}CH_2$, and $CH_3CH(CF_3)CH_2CH{=}CH_2$

Panov, E.M., et al., Doklady, 145, 1028 (1962)
Fluorine-containing divinyl benzenes

Parrod, Jacques; Hugelin, Christiane. C.R.Acad.Sci., Paris,Ser.C. 267(6), 464(1968). C.A. 69 (24), 927248x
Polymerization of β-fluorostyrene and properties of the polymer.

Pautrat, R., Marteau, J., C.A. 65, 5632d
Reaction of fluoral with cis-1,4-polyisoprenes

Pennsalt, WADC TR 57-436. ASTIA Doc. No. AD 142116, November 1957
Polymers containing CH_2CFCl, $CHFCFCl$, CF_2CHCl, CF_2CCl_2 $C\text{-}C_4F_6$, CF_2CMe_2, vinyl and trifluorovinyl halocyclobutanes (which copolymerized only with reluctance)

Powell, J.A. and Graham, R.K., J.Pol. Sci., Pt. A. 3(10) 3451 (1965)
Polymerization studies on methyl and ethyl α-fluoromethylacrylate

Pritchard, J.G., et al., C.A. 64, 16008a
Fluorine NMR of poly(vinyltrifluoroacetate)

Prober, M., J. Am. Chem. Soc. 72, 1036 (1950)
Decreasing reactivity to polymerization in the series: CF_2CFCl, CF_2CCl_2, $CFClCFCl$, CCl_2CClCF_3, $CF_3CClCClCF_3$, $C\text{-}C_4F_6$, $\overline{CF_2CF_2CF_2CCl{=}CCl}$

Pummer, W.J., and Wall,L.A. SPE.Trans. 3(3), 220 (1963)
$CF_2CFO\phi$ and $CF_2CFOC_6F_5$

Pummer, W.J., Wall, L.A., C.A. 65, 7279b
Perfluoropolytolylenes

Rausch, D.A., Coleman, L.E. Jr., and Lovelace, A.M., J.Am.Chem. Soc. 79, 4983-4 (1957)
The preparation and polymerization of perfluoroalkyl propenyl ketones

H. L. Roberts, J.Chem.Soc. 4538-40 (1964)
Addition of $(CF_3O)_2$ to C_3F_6 to give mainly telomers.

E. Rostonskii and L. Rubinovitch, C.A. 61, 1950c
Acrylates with omega-H fluoro-alcohols.

Schertler, Paul H. Nat.Acad.Sci.-Nat.Res.Counc.Publ. No.1578 53-9(1968) C.A. 69(6), 19708h
The relation between dielectric constant and nature of the fluoroalkyl group in poly(fluoroalkyl acrylates) was studied.

Shashkov, A.S., et al., C.A. 64, 16007h
NMR study of CF_2=CFH and CH_2=CF_2 copolymers

Sianesi, D., and Caporiccio, G., C.A. 58, 9237c (1963)
Stereospecific polymerization of perfluoroolefins

Sianesi, D., and Caporiccio, G., Belg. 618,320. C.A. 58, 9247g (1963)
Stereopolymerization of fluoroolefins

Sianesi, D., and Caporiccio, G., C.A. 62, 13249c
Polymerization of CH_2=$CHCF_3$ with $Ti(OR)_4$

Skinner, W.A., Bishop, E., Tieszen, D., and Johnston, J.D., Ind. Eng. Chem. 51, 1359-60 (1959)
Synthesis and polymerization of 3,3,3-trichloro-1-propene

Sorkin, Howard (to Air Reduction Co.) U.S. 3,394,115 (Cl.260-89.5) C. A. 69(16), 59694g
Preparation and polymerization of 2-(2,2,2-trifluoroethoxy) ethyl acrylate.

Sterling, G. B., (to Dow Chemical Co.), U.S. 3,025.277. C.A.57, 1015b (1962)
Trichlorostyrene copolymers

Sterling, G.B., (to Dow Chemical Co.), U.S. 3,069,388. C.A. 58, 5852b (1963)
$CF_3CH=CH_2$ copolymers

Sterling, G.B. (to Dow) U. S. 3,240,757 C.A. 64, 17800h
Copolymers of $CF_3C(CF_3)=CH$ and vinyl monomers

Thanos, W.M., and O'Shaughnessy, M.T., J.Polymer Sci. 11, 455 (1953)
Kinetics of $(CF_2CFCl)_n$ formation

Timmerman, Robert, SPE Tech. Papers 7, Session 24, Paper No.3 (1961)
Irradiation of $(CF_2CF_2)_n$, $(CH_2CF_2)_n$, and $(CH_2CHF)_n$

Tumac, F., Harriman, L.W., (to Dow) U. S. 3,244,684
C.A. 64, 17803c
Polymerization of CTFE

Votinov, M.P.; Kosobutskii, V.A.; Gorshkova, I.A. Zh.Strukt. Khim. 9(4), 698 (1968); C.A. 70(2), 4735m
NMR spectra were determined for styrene copolymers with $p\text{-}CH_2=C(CH_3)C_6H_4CF=CFCl$, $p\text{-}C_6H_5OC_6H_4CF=CFCl$, or $p\text{-}CFCl=CFC_6H_4CF=CFCl$ in CCl_4 solution.

Wakefield, L.B., IEC 43, 2363 (1951)
$CH_2=CFCFCH_2$, Syntheses, polymerization, T_g = 1°C

Wall, L.A., and Straus, S., J.Research NBS 65-A, 227(1961).
C.A. 55, 19428f (1961)
Pyrolysis of fluorocarbon polymers. $(CF_2CF_2)_n$, $(C_3F_6)_n$, and $(CF_2CFCl)_n$

Wilson, C.W., and Santee, E.R., C.A. 63, 694d
NMR analysis of poly(VF_2) and poly(CH_2CHF)

Wall, L., U.S. 3,192,190. C.A. 63, 7135g
Poly(perfluorostyrene)

Yakubovich, A. Ya., et al., C.A. 59, 11377c (1963)
Polymers and copolymers of $CF_2CF\Phi$

III. A. Fluorine-Containing Polysiloxanes

Dolgoplosk, et al., C.A. 60, 745h (1964)
SiO- or SiOSiO in backbone, $-CH_2CH_2CF_3$ side group. Amyl groups raise T_g (from -70 to +10°), increase tensile strength.

Dow-Corning Corp., Belg. 658,944. C.A. 64, 11249g
Fluoroalkyl siloxanes. Siloxane polymers

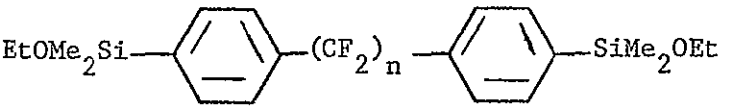
Dow-Corning Corp., Brit. 1,014,156. C.A. 64, 6783d
Organosilicon compounds

Dow-Corning Corp., Germ. 1,208,890. C.A. 64, 12839b
Polysiloxanes and halogenated polysiloxanes

Dow-Corning Corp., Neth. Appl. 6,503,248. C.A. 64, 6871e
Heat stable organosilicon elastomers

Dow-Corning Corporation., Neth. Appl. 6,604,898 (C1.C.08g), October 17, 1966, C.A. 66, 38694e
Fluorinated siloxane copolymers

Fugua, S.A., and Silverstein, R.M., NASA, Doc. N63-15, 280, 39 pp (1962) C.A. 60, 741d (1964), J.Org.Chem. 29(2), 395(1964)



n = 2,3

Fuqua,S and R. Silverstein, C.A. 61, 10849b
Rigid polymer obtained from 1,2-bis [p-(ethoxydimethylsilyl) phenyl] - tetrafluoroethane

G.E. Brit. 980,109 . C.A. 63, 18306h .
Trifluoromethylphenyl polysiloxanes

Holbrook, G.W. Gordon, A.F., and Pierce, O.R., J.Am.Chem. Soc. 82, 825-6 (1960). C. A. 54, 12641f (1960)
Cyclodimerization of vinyl silicon compounds with CF_2CFCl and subsequent polymerization

Holbrook, G.W. (to Dow-Corning Corp.) Fr. 1,359,397; C.A. 62, 4181c
Siloxane polymers containing trifluoropropyl substituents.

Kanner, B., and Reid, W.G., Am. Chem. Soc., Div. Polymer Chem., Preprints 2, No. 1, 99-104(1961). C.A. 57, 15349c (1962)
Graft copolymers of fluoroolefins with dimethylsilicones

Molchanov, B.V., et al., C.A. 65, 7287b
Synthesis and properties of poly[phenyldimethylmethyl (γ trifluoropropyl)] siloxanes

Nametkin, N.S., Vdovin, V.M. and Zav'yalov, V.I., C.A. 63, 4489e
Poly(dimethylsilylene) T_g = -100°

Pierce, O.R., et al., I.E.C. 52, 783 (1960). C.A. 54, 25933a (1960)
Synthesis and polymerizations. LS-53 $T_{brittle}$ -90°F

Pierce, O.R., Holbrock, G.W., Johannson, O.K., Saylor, J.C., and Brown, E.D., Ind. Chem. Eng. 52, 783-4 (1960). C.A. 54, 25933a (1960)
Polymerization of $(RCH_2CH_2SiMeO)_3$ where R is CF_3-, C_2F_5-, or C_3F_7- wide temp. range

Polmanteer, K.E., et al., U.S. 3,050,492 (to Dow-Corning Corp.), C.A. 57, 13948i (1962)
Incorporation of fluoroalkyl substituted organosiloxane units into conventional organosiloxane rubbers low temp. flex retained.

Schiefer, H.M., C.A. 64, 19269g
Trifluoropropyl halophenyl substituted silicone copolymers

Steward, O.W., Pierce, O.R., J.Org. Chem. 26, 2943 (1961)
3-(Fluoroalkoxy)propylpolysiloxanes

Schweiker, G.C. and Robitschek, Paul, U.S. 3,016.360. C.A. 56, 7480c (1962)
Stable carboxylic elastomers containing fluorine

B. Fluorine-Containing Polyesters

Fein, Marvin M.; O'Brien, Eugene L. (to Thiokol)
U.S. 3,332,902 (Cl. 260-31.2) July 25, 1967, Appl November 30, 1964, 3 pp., C. A. 68, 50809v.
Fluorine-containing polyesters.

Freeman, Ronald R., U.S. Dept. Com. Office Tech. Service. AD 275,520, 17 pp(1962). C.A. 60, 739e (1964)
Aromatic diacids (or chloride) and hexafluoro-1,5-pentanediol-, rubbery polymer

Gouinlock, E.V., Jr., Verbanic, C.J., and Schweiker, G.C., J. Appl. Polymer Sci. 1, 361-70 (1959). C.A. 53, 23035g (1959)
Dibasic acids with hexafluoropentanediol

Hollander, J. and Woolf C. to Allied. U.S. 3,177,187. C.A. 63, 500h
Polymers of CH_2=CHCOOCH(CF_2Cl)$_2$

Korshak, V.V., et al., C.A. 64, 8321g
Heterochain polyesters. Fluorine-containing polyarylates

Marden, H.L., C.A. 63, 13444a
Perfluoroalkylmethacrylate polymers

Ottmann, G.F., (to Olin Mathieson Chem. Co.) U.S. 3,044,988. C.A. 57, 12724i (1962)
Fluorinated glycol polyesters

Polmanteer, K.E., and Brown, E.D., (to Dow Corning Corp.) U.S. 3,050,492. C.A. 57, 13948i (1952)

Schweiker, G.C., and Robitschek, P., J.Polymer Sci. 24, 33-41 (1957)
Increase in fluorine content raises brittle temperature

Schweiker, G.C., and Robitschek, P., U.S. 3,016,360. C.A. 56, 7480c (1962)
Stable carboxylic elastomers containing fluoride

Severson, W.A. (to 3M) U.S. 3,240,800, C.A. 64, 17839a
Fluorinated diol polesters based on $(HOCH_2CF_2CF_2)_nO$

C. Miscellaneous Polymers

Gosnell, R.; Hollander, J., J.Macromol.Sci.Phys. 1(4) 831 (1967) C.A. 69(6), 19645k
Synthesis of monomers, and polymerizations leading to LOX-resistant, fluorine-containing polyurethane elastomers.

Gosnell, R.; Hollander, J.
Synthesis of Fluorinated Polyurethanes in "Proceedings of the NASA-Case Conference on the Properties of Polymers at Cryogenic Temperatures,Cleveland, Ohio, Apr. 25-27, 1967." pp 279-298, Marcel Dekker, Inc. 1968
NASA reference C06 A69-16498
Synthesis, compounding, curing, and evaluation of highly fluorinated polyurethanes as adhesives for use in contact with liquid oxygen.

Kercha, Yu. Yu., Ryabokon, L.I.; Malichenko, B.F. Sin. Fiz.-Khim. Polim. 1968(5), 198 C.A. 70(2), 4917x
The effect of F in polyurethanes [-$HNCH_2(CF_2)_4CH_2NHCO_2$-$(CH_2)_6O_2C$-] and [-$HN(CH_2)_6NHCO_2H_2(CF_2)_4CH_2O_2C$-]$_n$ on the ability to crystallize was studied by DTA.

Malichenko, B.F.; Sopina, I.M. Vysokomol. Soedın., Ser.B. 10(6), 468 (1968). C.A. 69 (14), 52541W
Fluorine-containing polyureas by interfacial polycondensation of $H_2NCH_2(CF_2)_4CH_2NH_2$ and a diisocyanate

Yakubovich, A. Ya., Gitina, R.M., C.A. 65, 9033e
Preparation of fluorinated polyamides

IV. Polymers with Heteroatoms in Backbone

A. C - O

Allied Chem. Corp., C.A. 62, 11782f
Oxetanes. $CF_3COCF_3 + CF_2=CXY \rightarrow$

Allied Chem., Belg. Patent 671,439, C.A. 65, 8875b
Telomers for C-O-C in backbone. Polyfluoro-oxetanes

Allied Chem. Corp., Neth. Patent 6,503,339
Copolymers of $(CF_3)_2C=O$ and $c\text{-}C_4F_6$

Barnaba, P., et al., C.A. 64, 3699e
Poly(tetrafluoroethylene oxide)

Barney, Arthur L., U.S. 3,067,173. C.A. 59, 10310b (1963)
Hydroperfluorovaleraldehyde polymer

Bureau of Industrial Technics, Japan. C.A. 64, 5233a
Aldehyde polymerization

Burnop, V., C.A. 63, 13425g
Polyacetone

Cairns, T.L., Cline, E.T., and Grahm, P.J., (to duPont)
U.S. 2,828,287 C.A. 52, 10641e (1958)
Fluoroaldehyde-modified polyoxymethylene

Case, L.C., and Todd, C.C., J.Poly.Sci. 58, 633 (1962)
Polyperfluoroalkyl oxetanes

Castille, Y.P., Stannett, V., J.Pol.Sci., Pt. A-1 (4)
2063 (1966)
Radiation-induced copolymerization of formaldehyde and styrene

Castillo, Y.P. and Stannett, V., Pol. Prev. 2(2) 39(1966)
Radiation-induced copolymer of styrene and CH_3CH_2O

Cook, E.W.; Erickson, C.A.; Gannon, J.A. (FMC Corp.)
Synthesis of High-Strength Chemical Resistant Elastomers for Extreme Temperature Service, Contract DA 19-129-AMC-147(N).
Synthesis of new fluorinated elastomers serviceable at low temperature. Condensation products of polyfluorinated diols with fluorocarbon diene.

du Pont, Brit. 809,754. C.A. 53, 19452 g (1959)
Produced an acetylated fluorinated (by copolymerizing with CF_3CHO) polyoxymethylene with good mech.prop. from -78 to 200°

Belg. 616,256 (to duPont), C.A. 59, 11169f
Poly(propylene epoxide)

duPont, Neth. Appl. 6,413,124, C.A. 64, 12837g
Polyfluoroketone polymers

duPont, Neth. Appl. 6,514,549, C.A. 65, 12,356g
New copolymers of polyfluoroaldehydes and alkenes radically initiated

duPont, Brit. 1,034,495, C.A. 65, 9123c
Polyfluoroketone-epoxide copolymers and dioxolanes

E.I. duPont de Nemours & Co., Neth. Appl. 6,607,679, December 5, 1966, C.A. 67, 100588z.
Fluorocarbon ethers and their polymers.

Etienne, Y., C.A. 51, 15992e (1957)
Polymerization of 3,3-bis(fluoromethyl)oxetane

FarbwerkeHoechst A.-G. , Fr. 1,391,539. C.A. 63, 11809b
Chlorine-containing polyacetals

Furukawa, J. and Saegusa, T., U.S. 3,183,210. C.A. 63, 18299d
Polymerization of aldehydes of organometallic compounds

Furak'awa, et al., C.A. 64, 8317a
Copolymerization of CO with alkyleneoxides

G.E., Jaquiss, D.B.G. U.S. 3,220,978. C.A. 64, 8427h
Fluorine-containing organic polycarbonates

V. Ginsburg, et al, C.A. 59, 5008f

$C_2F_4 + O_2 + (CF_3)_2N_2 \qquad (C_2F_4O)_n$ oil

Howard, E.G. (to duPont) Brit. 1,020,678, C.A. 64, 17740d
Fluoro ketone copolymers

Howard, E.G. and P.B. Sargeant. J.Macromol. Sci. Chem. 1(6), 1011 (1967) C.A. 68, 114997q
The free radical chemistry of fluoroketones II Reaction with unsaturated compounds.
Copolymerization through CO gives polyethers

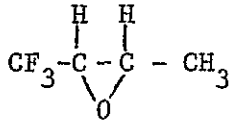
Husted, D. and Ahbrecht, A., Brit. 719,877. C.A. 49, 10667b
Poly(fluorocarbon aldehydes)

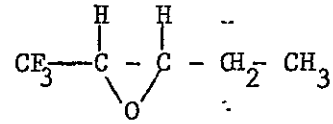
Ilyina, D.E., Krentsel, B.A., and Seminido, G.E., Int'l. Symposium of Macromolecular Chemistry, Paris July 1-6, 1963. Paper No. 38

$$CCl_3CHO \xrightarrow[n\text{-buLi}]{-78^\circ} \left[\begin{array}{c} CCl_3 \\ | \\ C-O \\ | \\ H \end{array}\right]_n$$

Japan Synthetic Chemical Ind. Co., C.A. 63, 18299b and f, 18300c
Polyacetaldehyde

Jones, F.B., Stickney, P.B., Coleman, L.E., Jr., Rausch, D.A., and A.M. Lovelace, J. Polymer Sci., 26, 81-8 (1957). C.A. 52 5875d (1958)
Polymerization of some fluorine-containing olefin oxides





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Krespan, C.C.,Cand E. N. 43(41), 80(1965)
Free radical reaction of fluoroketones

Lett, M.H., Bauer, F.W., to Allied Chem. Corp.
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N. Madison and D. Miller, Research on the Synthesis of Fluorine-containing Polymers. Part I Apr. 1964. Dow Chemical Company. AF 33(657)11254
Copolymerization of CH_2O with CF_3CF-CF_2, $(CF_3)_2C=CF_2$,

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3 M Company, U. S. Army Contract No. DA-19-129-QM-1043. Report for the period October 15, 1957-august 15, 1960.
Polymerization of $CF_3\underline{CHCH_2}O$, $C_5F_{11}\underline{CFCF_2}O$, C_3F_7CHO

3 M French Patent 1,410,554, C.A. 65, 2371h
Perfluorinated polyethers. The Hg^{++} salt of

$$O(CF_2CF_2CO_2H)_2 \xrightarrow{300\text{-}400^\circ} \{O(CF_2)_4-\}_n$$

V. McLaughlin and J. Thrower, Chem. Ind. (London) 1557 (1964) C.A. 62, 5347f
Polymers of $p\text{-}CF_3C_6F_4OK$

Milian, A.S., Jr., (to duPont), U.S. 3,214,478. C.A. 63, 1830b
Perfluoro-olefin epoxide polyethers

Miller, D.L.; Madison, N. L.; Rausch, D.W. (to Dow Chemical Co.), U. S. 3,330,808, C. A. 67, 64909u.
Copolymers of perfluoroolefins and aldehydes.

Minister of Technology, London (by V.C.R. McLoughlin and John Thrower) Brit. 1,110,232 (Cl.C. 07c) C. A. 68 (25) 114245t

Salts of perfluoro(alkyl phenols) are prep'd, and on heating convert to polymers consisting of benzene nuclei linked by p-difluoromethyleneoxy or alkylfluoromethyl-eneoxy bridges.

Moore, E.P., et al. (to duPont), Fr. Pat. 1,275,799(1961)

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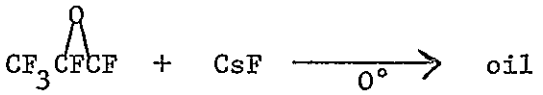
Moore, E.P. (to E.I. duPont de Nemours and Co.), Fr. 1,359,526; C.A. 62, 4181a



Moore, E.P. (to duPont), Fr. 1,362,548. C. A. 63, 7897b

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Morton, M., AF Contract 04(611)-9694

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Moyer, W. W., Grev., D. S., J.Pol.Sci. B, 1, 29(1963)

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Ponomarenko, V.A.; Khomutov, A.M.; Zadorazhnyi, N.A. Izv.Akad.Nauk SSSR,Ser.Khim. 1968 (8), 1847 C.A. 69(26), 107110n

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Pummer, W. L. and Wall, L.A., J.Research Nat'l. Bur. Std. A68(3)277-86(1964); C. A. 61, 1951g (1964)

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Rees, R. W., U. S. 3,182,101. C. A. 63, 4477b

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Rice, David E. J. Polym. Sci. Part B 6(5), 335(1968) C.A. 69(4), 10806f

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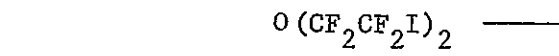

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Stamatoff, G. S., and Wittmann, J.W. (to duPont), Fr. 1,394,897. C.A. 63, 18297b
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Trischler, Floyd D.; Hollander, Jerome, Amer. Chem. Soc. Div. Polym. Chem., Preprints 8(1), 491-6 (1967) (Eng.), C. A. 66 105261b.
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Warnell, J. L., Ger. 1,191,576. C. A. 63, 7135a
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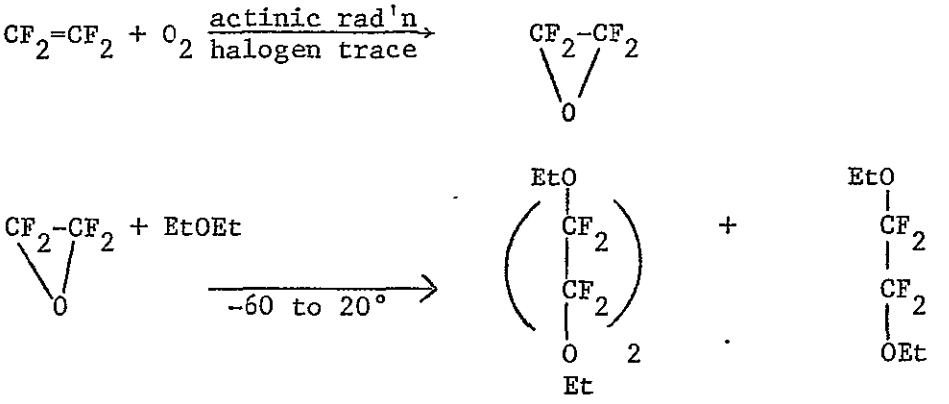

Weissermel, K., and Frischkarn, H., U. S. 3,210,298, C.A. 64, 6618d
Polymers of substituted oxacyclobutanes

Wolf, C. N., C. A. 63, 160504f
H_2CO copolymers with butadiene

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Anderson, B.C., C.A. 64, 19802f
Preparation of poly(perfluorothioisobutyraldehyde)

Asahi Chem. Co., Fr. 1,400,828. C.A. 64, 2196c
Polythioacetals

Barney, A.L., et al., C.A. 65, 18686e
Free-radical polymerization of thiocarbonyl fluorides

Belg. Patent 656,508, C.A. 64, 19949c
Polymers by reaction of mono and dialdehydes and derivatives with sulfur chloride or bromides

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Low polymer of CF_2S

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Andreades, S. (to duPont) U.S. 3,248,394, C.A. 65 15392c
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Barr, D.A., Haszeldine, R.N., and Willis, C.J., C.A. 54, 2797e (1960)
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A study of perfluoroalkyl and perfluoroaklylene 1,2,4- and 1,3,4-oxadiazoles and derivative thermally stable polymers.

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Nitroso rubber.

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CF_3NO-C_2F_4 copolymerized in aqueous suspension at -50° -0° using LiBr solvent

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Rose, J.B., (to I.C.I.), Brit. 789,254. C. A. 52, 9644a (1958)
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Mantell, R.M. and Hoyt, J.M., (to 3M), U.S. 3,043,823. C.A. 57, 12719b (1962)
Emulsion polymerization of fluorinated monoolefins. Standard system, except that 5 pts/150 of CS_2 added.

Marsel, C. J., Prince, M., C. A. 62, 11913a
High pressure polymerization

Montecatini Edison S. P. A., C.A. 67, 44294m, Neth. Appl. 6,613,478 (Cl. C. 08f), April 5, 1967
Fluorine-containing polymers.

Morton, Maurice (Akron Univ., Ohio. Inst. of Rubber Research) Low Temperature Polymerization Studies Progress Report, Apr. 1 - June 30, 1965, Contract AF 04(611)-9694, PR-6; AD 618228.
Exploratory polymerizations or attempted polymerizations of tetracyanoethylene, perfluorobutene-2, hexafluoropropylene, vinyl triethoxysilane, p-nitrostyrene, and benzaldehyde were conducted.

Morton, Maurice (Akron Univ., Ohio Inst. of Rubber Research) Low temperature Polymerization Studies Progress Report. Jul. 1 - 30 Sept. 1965, Contract AF 04(611)-9694.
Polymerization of the fluorovinyl monomers is probably caused by the high energy radical cation formed as a result of primary radiolysis.

Mulvaney, J.E., Markham, R. E., C. A. 65, 812c
Anionic initiation of vinyl polymerization by dimsylsodium in aprotic solvents.
Dimsylsodium = CH_3SOCH_2Na

Neth. Appl. 6,408,152. C. A. 64, 511e
Poly(1-octene)

Plyusnin, A.N., Chirkov, N.M., C. A. 65, 9025d
Anomalous dependence of the polymerization of TFE on initiator concentration.

Plyusnin, A. N.; Chirkov, N.M. Vysokomol Soedin, Ser.A. 10(5), 1058(1968) C. A. 69(8), 27855u
Kinetics of TFE polymerization in aqueous persulfate solutions.

Ponomarenko, V.A.; Khomutova, N.M. USSR patent 219,194 (Cl. C 08f). C. A. 69(22), 87583p
High molecular weight fluorine-containing polyethers prepared by cationic polymerization of F-contg epoxides.

Relyea, Douglas, I.; Smith, Homer P.; and Johnson, Arnold N. (U.S. Rubber Co., Wayne, N.J.), Polymerization Studies Leading to High Strength Chemical Resistant Elastomers Serviceable at Temperature Extremes, Semiannual Report. 1 Dec. 1966 - 31 May 1956, Contract DA-19-129-AMC-487(N).
Rhodium compounds were found to give good conversion of fluorinated dienes to polymers in aqueous emulsion systems.

Relyear, D.I.; Smith, H.P. Johnson, A.N. (U.S.Rubber Co.) Semi Annual Rept. No. 2 15 Dec 1965 Contract DA-19-129-AMC-487(N) AD 480 181
Polymerization studies on fluoro-olefins, leading to high strength, chemical resistant elastomers for service at extreme temperatures.

Secrist, D.R., Mackenzie, J.D., C.A. 65, 18701h
Glow-discharge of a fluorosiloxane polymer

$$SiF_4 + \text{dry } O_2 \xrightarrow{\text{glow discharge}} \left[-O-\overset{O}{\overset{|}{Si}}-O-\overset{F}{\overset{|}{Si}}-O-\overset{O}{\overset{|}{Si}}- \right]_n$$

Sianesi, Dario; Bernardi, Gian C. (to Montecatini Societa Generale per l'Industria Mineraria & Chemica) French Pat. 1,485,420 (Cl. C 08f); C.A. 68(8), 30380V
Polymerization or copolymerization of halogenated olefins (including C_2F_4, $CF_2=CFH$, $CF_3CF=CF_2$, $CF_3CH=CF_2$, $CF_3CH=CH_2$ CTFE, BTFE, $CF_2=CFCF=CF_2$) by means of U.V. in the presence of a macromol. perfluorinated polyperoxide,

Sianesi, D., and Caporiccio, G., Belg. 618,320. C. A. 58, 9247g (1963)
Stereopolymerization of fluoroolefins

Sianesi, D., and Caporiccio, G., C. A. 58, 9237c (1963)
Stereospecific polymerization of perfluoroolefins.

Sprynger, J.M., C. A. 65, 7301d
Radiolysis of propylene, hexafluoropropylene and acrylate.

Stamicarbon, N.V., Neth. Appl. 6,408,845, C. A. 65, 829f
Formaldehyde polymerization

Stefanovich, N.N.; Krotova, N.A. Issled. Obl. Poverleh.Sil., Sb.Dokl. Konf., 3rd 1966 (Pub.1967), 448-452 C. A. 70(10), 4853y.
Styrene and methyl methacrylate were grafted onto poly(tetrafluoroethylene) film which had been subjected to a silent discharge.

Usmanov, Kh.U.; Yul'chibaev, A.A.; Asamov, M.K. Dokl.Akad.Nauk Uzb. SSR 25(4), 24(1968).
Radiation grafting (by ^{60}Co) of vinyl fluoride to poly(methylmethacrylate) in the presence of solvents.

Valkova, E.V., et al.: C. A. 67, 22304n, Radiats.Khim.Polim., Mater. Simp. Moscow, 1964, 109-13.
Radiation polymerization of fluoroolefins.

Valkova, E.V., et al., C. A. 64, 8318a
Radiation polymerization of fluoroolefins

Volkora, E.V. and A. Shobina, C. A. 61, 5772h (1964)
Polymerization of C_3F_6 by gamma initiation in liquid and solid phases. 50 to 600 rads/sec from 263 to 195°K. Only liquids obtained.

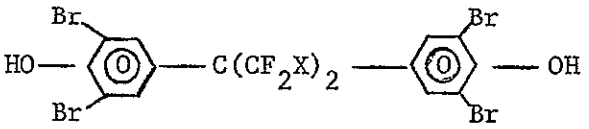
Wall, L.A. and Brown, D.W., J.Polymer Sci., Pt C (4), 1151-60 (1964); C. A. 60, 6929h (1964)
Radiation induced polymerization at high pressures. 5 to 17 x 10^3 atm at 20 to 275°, gamma dose rate 0.13 mrad to 3 mrad./hr. Polymers of $C_6H_5OCFCF_2$ and $C_6F_5OCFCF_2$.

Wilson, W., May, H., Brit. 1,022,562, C. A. 64, 17741f
Formaldehyde copolymers

II. Fluorine-Containing Monomer Synthesis and Miscellaneous Reactions

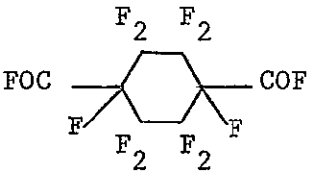
Afanas'ev, I.B.; Safronenko, E.D.; Beer, A.A. Vysokomol. Soedin, Ser. B. 9(11), 802(1967) C. A. 68 (8), 30099k
Kinetics of radical telomerization of tetrafluoroethylene with alcohols.

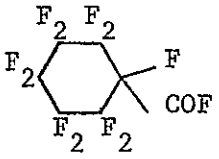
Allied Chemical Corp. Neth. Appl. 6,505,412, C. A. 64, 14131h
Prep of



H = F, Cl

Allied Chem. Corp., Neth. Appl. 6,511,438, C. A. 65, 7076e

Prep. of  and its 1,2-deriv.

Also: 

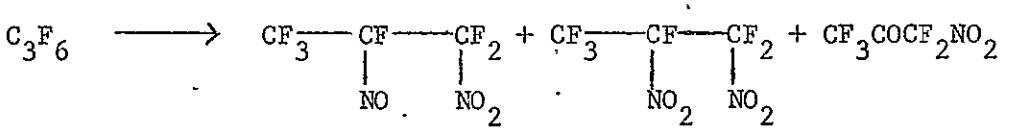
Andrianov, K.A., et al., C. A. 63, 18268d
Synthesis of trifunctional cross-linked ester acids and polyesters of regular ladder structure

Banks, R. E. Haszeldine, R. N., et al., C. A. 64, 19433a
Isomerization of the dimer of tetrafluoroallene to perfluoro-2-methyl-3-methylenecyclobutene

Banks, R. E., et al., C. A. 66, 2245p
Polyhaloallenes. Thermal co-dimerization of tetrafluoroallene with hexafluorobut-2-yne

Banks, R. E., et al., C. A. 66, 2262q
Polyfluorocyclopentadienes. Thermal dimer of perfluorocyclopentadiene perfluoro(tricyclo[5.2.1.$0^{2,6}$]deca-3,8-diene)

Bagley, E., et al., C. A. 65, 5352h



Barlow, M.G., et al., C. A. 65, 13523h
Perfluoroalkyl derivatives of nitrogen. Perfluoroalkylnitroso compounds from perfluoroacyl nitrites

Barna, P. M.: Chem. Ind. (London) 1966(49), 2054 (Eng.), C. A. 66, 37525p.
Interest in temperature-resistant polymers led to synthesis of α-(trifluoromethyl)-β,β-difluorostyrene, b_{44} 44-45°.

Bergomi, A., et al., C. A. 65, 18504h
1H- and 2H-pentafluorocyclopentadiene

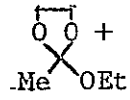
Bloechl, W., Neth. Appl. 6,414,504. C. A. 64, 3349gh
Perfluoroalkyl iodides.

Bloechl, W., Neth. Appl. 6,506,069, C. A. 64, 17421c

$$R_fI + C_2H_4 \longrightarrow R_fCH_2CH_2I + \text{Rxns. of adducts}$$

Bloechl, W., Neth. Appl. 6,511,871, C. A. 65, 3907b
Fluoroalkyl chlorosilane monomers

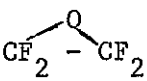
Braun, R.A., C. A. 66, 2008k
Reaction of hexafluoroacetone with orthoesters



$$+ (CF_3)_2CO \longrightarrow EtOC(CF_3)_2OCH_2CH_2O_2CCH_2C(CF_3)_2OH$$

Butler, A. J., et al. (to Dow) Fr. 1,423,584, C. A. 65, 20243d
Fluorinated monomers and polymers. Correction of pat. no. (C. A. 65, 17084h)

Caglioti, V., Lenzi, M. and Mele, A., Nature, 201(4919), 610-11 (1964); C. A. 60, 11522e (1964)

Prep. of  by oxidation of C_2F_4 with O_2

Carlson, D.P., C. A. 64, 6617e
Preparation of tetrafluoroethylene epoxide

Case, J.R. and Pass, G., J.Chem.Soc. 946-8, (1964); C. A. 60, 10533g(1964)
Pentafluorosulfuroxy derivatives of C_3F_6.

$SF_5O(C_3F_6)_nOSF_5$, n=2,3 and 4.

Castellano, J.A., et al., C. A. 64, 12589e
Aromatic polyfluoronitroso compounds

Cessna, L.C., Jr., Sternstein, S. S., Pol. Let. 3, Pt. B, 825-29 (1965)
The fracture strengths of glassy polymers. Mathematical treatment.

Cheburkov, Y.A., et al., C. A. 64, 11077c
Perfluorodimethylketone rxn. with HNO_2.

Cleaver, C. S., U. S. 2,853,531 (1958) to duPont.
Prep. of $(R)_3C\text{-}O\text{-}CF{=}CF\text{-})\text{-}CF_1,R_2,R_3$ by reaction of $(R)_3CONa$ with CF_2 HCl

Critchley, J.P.; Pippett, J.S. (Royal Aircraft Establishment, Farnborough, England) Report No. RAE-TR-68026 (Avail CFSTI) STAR (4), 625(1969) NASA Accession No. N69-14770
The products of the reaction of arylamidoximer with perfluorodiacyl chlorides were characterized anc converted into 1,2,4-axadiazolyl perfluoroolefins. Attempts to polymerize the olefins were described.

Diakin Kagyo Co., Ltd., Brit. 1,027,435, C.A. 65, 5366c
Recovery of C_2F_4 and C_3F_6 from CHClF pyrolysis

Dammont, F. P., et al., J.Pol.Sci., Pt.B, 3, 1021-3(1965)
Fluorinated diepoxides

Davis, H. R. (to 3M) U. S. 3,284,516, C. A. 66, 10568n
Reaction products of halogenated ketones with unsaturated hydrocarbons

$$(ClF_2C)_2CO + MeC{=}C{=}CH_2 \xrightarrow[18\ hrs]{140^\circ} H_2C{=}CMeC(=CH_2)C(CF_2Cl)_2OH$$

Day, R. I. (to duPont) U. S. 3,283,012, C. A. 66, 18507t
Process forpreparing perfluoroalkylethanol

$$n\text{-}C_6F_{13}CH_2CH_2I \xrightarrow[H_2O\ NaHSO_3]{25\%\ oleum} n\text{-}C_6F_{13}CH_2CH_2OH$$

Dogopol'skii, I. M., et al., Lieturas TSR Mokslu Akad. Darbei, Ser B, 1965, 95-101.
Synthesis of vinyl fluoride, using a suspended catalyst

Fr. 1,366,119 (to duPont). C. A. 62, 9313g
Perfluoropolyethers

duPont, Neth. Appl. 6,508,807, C. A. 64, 17427d

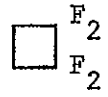
$$CCl_3CHO + HF \xrightarrow[240\text{-}260^\circ]{Activ.\ Cr_2O_3} CF_3CHO.HF \xrightarrow{NaF} CF_3CHO$$

Brit. 1,001,352 (to duPont). C. A. 64, 3791d
Fluorine-containing polymers.

duPont, Neth. Appl. 6,607,056, C. A. 65, 20028f

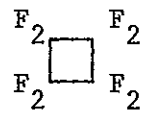
$$C_2F_4 \xrightarrow[C_2H_4]{3.8\text{ wt }\%} C_2F_4 + C_4F_8 + CF_3CF{=}CF_2 + CF_3CF{=}CFCF_3 +$$

55% 40% .026% .0013%



2.3%

duPont, Neth. Appl. 6,609,057, C. A. 65, 20028g

$$C_2F_4 \xrightarrow[\text{d-limonene}]{400\text{-}75^\circ} \text{  } + C_2F_4 + CF_3CF{=}CF_2$$

54% 45.6% .072%

E. I. duPont de Nemours & Co., Neth. Appl. 6,605,656 (Cl. C. 07e) October 31, 1966, C. A. 66, 65088s.
Preparation of perfluorodivinyl ether.

E. I. duPont de Nemours & Co., U. S. 3,282,905 (Cl. 260-89.5) November 1, 1966, C. A. 66, 85490v.
Fluorine-containing esters and polymers.

E. I. duPont de Nemours & Co., Brit. 1,033, 919 (Cl. C. 07c) June 22, 1966, C. A. 66, 65087r (1967)
Preparation of fluorinated vinyl ethers.

Dyatkin, B. L., et al., C. A. 63, 17882h
Oxydation of $(CF_3)_2C{=}NOH$ in anhydrous HF

Dyatkin, B.L., et al., C. A. 65, 5320h

$$C_3F_6 + FNO \xrightarrow[(CsF + KF)\quad 35\text{-}40^\circ]{} (CF_3)_2CFNO$$

Dyatkin, B.L., et al., C. A. 65, 12102c
Reactions of nitryl fluoride with alkyl perfluorovinyl ethers. Synthesis of α-nitroperfluorocarboxylic acid esters.

Durant, E., et al., C. A. 65, 20000h
α-Haloalkyl esters. RCO_2CHXR'

R = H, Me, CH_2X, CX_3

X = halogen

R'= H, Me, Et, iso. Pr

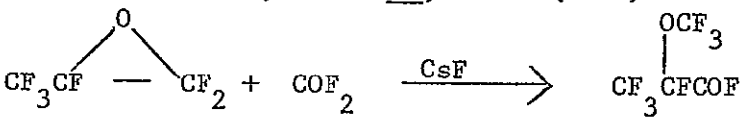
Fearn, James E. and Wall, Leo A. (National Bureau of Standards) Fluorocarbon Polymers. Polymers of perfluorohexadiene, perfluoroheptadiene, and perfluorooctadiene. (NBS-8623; AD 617256).
Perfluoro-1,5-hexadiene,perfluoro-1,6-heptadiene and perfluoro-1,7-octadiene were prepared and preliminary polymerization studies on the three monomers carried out.

Fein, Marvin M. and Green, Joseph (Thiokol Chem. Corp.), Quarterly Report No. 1, 27 Feb. 1963 - 31 May 1963, Contract DA-19-129-AMC-69(X)0.1.9044.
Nitroso rubber research, development, and production.

Firth, Wm.C.Jr., J.Org.Chem. 33(1), 441(1968) C. A. 68, 39048a
The reaction of isocyanic acid with trifluoroacetic anhydride preparation of trifluoroacetyl isocyanate.

Frisch, E.E., Fr. 1,361,255 (to Dow Corning Corp.); C.A. 61, 9401f (1964)
Preparation of perfluoroisoprene

Frits, C. G. and Moore, E.P., Fr. 1,342,515 (to E.I. duPont de Nemours and Co.); C. A. 61, 9406d (1964)



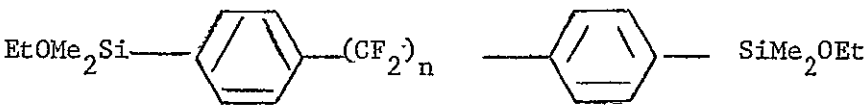
Fritz, C.G., Moore, E.P., Jr., and Selman, S., (to duPont), U.S. 3,114,778 C. A. 60,67501 (1964)
Synthesis of perfluoroalkyl trifluorovinyl ethers, including $CF_3OCF=CF_2$

Fritz, C. G., Moore, E P. (to duPont) U.S. 3,250,807, C. A. 65, 13553h
Dicarboxylic acids of fluorocarbon ethers and fluorides and their esters, amides, and salts.

Fritz, Charles G. and Selman, Stanley (to E.I.duPont de Nemours & Co.), C. A. 66, 37427h., U. S. 3,291,843 (Cl. 260-614) December 13, 1966.
Description of synthesis of fluorinated vinyl ethers.

Fuller, G. (to Imperial Smelting Corp.) Brit. 1,047,318, C.A. 66, 18585s
s-Pentafluorophenylethanol

Fuqua, S.A., and Silverstein, R.M., NASA, Doc. N63-15, 280, 39 pp (1962) C.A. 60, 741d (1964), J.Org.Chem. 29(2), 395 (1964)



Gambaryan, N.P., et al., C.A. 66, 18477h
Reactions of the carbonyl group in fluorinated ketones. A review.

Gannon, J. A. (FMC Corp.), Q. M. Elastomer Contract Progress Report 1, 26 June - 26 Sept. 1963, Contract DA-19-129-AMC-147(N).
The reaction between tetrafluoroethylene and fluoro-olefinic silanes has been shown to occur at elevated temperatures to form products containing a perfluorinated cyclobutane ring.

Ginsburg, V.A.; Vasil'eva, M.N. Zh.Obshch.Khim. 37(11), 2493(1967) C.A. 68, 95598s
The preparation and some chemical properties of tetrafluoro-ethylene oxide.

Graham,D.P., Weinmayer, V., J.O.C. 31, 957(1966)
F-initiated reactions of perfluoro α-olefins

Harris, J., McCane, D., U.S. 3,180,895. C. A. 63, 1701e
Fluorocarbon vinyl ethers. Pyrolysis of salts

Haszeldine, R.N., Brit. 963,634; C. A. 61, 13313d (1964)
Fluorovinyl oxazetidines

Haszeldine, R. N., et al., Brit. 1,014,221. C. A. 64, 8033d
Perfluorinated organic nitroso compounds

Hauptschein, M., Braid, M., U.S. 3,219,712. C.A. 64, 8031d
Telomer Iodides

Henry, J.P., Moore, L.O., (to UCC) U.S. 3,215,746. C. A. 64, 6492e
Fluoroallyl chloride

Inukai, Kan, and Hiroshige Muramatsu (Japan, Bureau of Industrial Technics), Japan 19,403 (1966) (Cl. 1613463), Nov. 10, C. A. 66, 463172.
Preparation of fluorochloro ethers and fluorochloroallyl ethers.

Isaacson, Wm.B.; et al. (3M Co) Contract No. F33615-68-1561, Interim Report No. 1 (IR-372-8(1).
Manufacturing methods and processes to produce difunctional perfluorinated monomers; e.g. $NC(CF_2)_nCN$ and $NCCF_2O(CF_2)_nOCF_2CN$.

Henry, J.P., Moore, L. O., (to UCC) U. S. 3,215, 746. C.A. 64, 6492e
Fluoroallyl chloride

Inukai, Kan, and Muramatsu, Hiroshige, (Japan, Bureau of Industrial Technics), Japan 19,403 (1966) (Cl. 1613463), Nov. 10, C. A. 66, 463172.
Preparation of fluorochloro ethers and fluorochloroallyl ethers.

Janz, G. J., Flannery, J. B., C. A. 65, 7013f

$$CF_3CN + CH_2{=}CHF \longrightarrow CF_3CH_2CHFCN + 13\% \text{ higher}$$

Johnson, R. L., Burton, D. J., C. A. 64, 4240f
Gas Chromatographic analysis of some polyfluorinated alicyclic olefins.

Kato, Kaoru; Wade, Hiroyuki; Kawakami, Yasumasa. Japan 68 07,202 (Cl. 16 B 211). C. A. 69, 58822k
Production of vinyl fluoride and 1,1-difluoroethane from acetylene.

Katsushima, Atsuo; et al. (to Daikin Kogyo Co. Ltd.) Japan 67 21,331 (Cl 16B 81) C. A. 69(4), 11065a.
Fluorine-containing polyisocyanates from R_fROH and organic polyisocyanates.

Kirk-Othmer Encycl. Che. Technol., 2nd Ed., C. A. 65, 13534h.
Fluorinated carboxylic acids

Knunyants, I.L., et al., C. A. 65, 8749b
Nitration of C_3F_6 by NO_2 and a study of the nitration products.

Knunyants, I.L., et al., C. A. 65, 10482b

$$(CF_2)_n(CONHNH_2)_2 \xrightarrow[(2)\quad \Delta]{(1)\quad HNO_2} (CF_2)_n(NCO)_2$$

n = 3,4

Knunyants, I.L., et al., C. A. 65, 12100h
Fluorinated monocarboxylic acids

Kopnova, N. L., et al., C. A. 64, 6677c
Synthesis of fluorine-containing silanes with reactive atoms of groups at Si

Kresta, J., Ambroz, L., C. A. 65, 15514g
Study of the physiochemical properties of vinyl fluoride

Kureha Chem. Ind. Co., Japan, C. A. 64, 3349g
Vinylidene fluoride

Lawlor, F.E. et al, U.S. 3,129,250 (to Pennsalt Chemicals Corp.); C. A. 61, 2974c (1964)
Preparation of $CF_3(CH_2)_xOCH{=}CH_2$ by pyrolysis of the corresponding acetal.

Lester, G. R., Adams, C. J. (Univ. Oil Prd. Co.)
U. S. 3,274,273, C. A. 66, 10551g
Dehydrohalogenation of halo hydrocarbons. Catalyst of oxide of Mg, Ca or Zn plus oxide Cu or Ce

Linn, W. J. (to duPont) U. S. 3,271,419
Fluoro-containing lactones and unsaturated acids.

Lovejoy, E., et al., C. A. 62, 9304f
Irradiation of fluorine-containing polymers

Madai, H., East Ger. 42,730, C. A. 64, 17421b

$$CH_3Cl + CF_2Cl_2 \xrightarrow{500^\circ - 1100^\circ} CH_2CF_2,\ C_2F_4,\ CF_2HCHClCF_2H,\ \text{etc.}$$

Manno, P. J., Snavely, W. H. (to Continental Oil Co.) Ger. 1,210,799.
Prep. of vinyl fluoride from C_2H_2 or CH_3CHF_2

Martynov, I. V., Kruglyak, Yu, L., C. A. 64, 8022g
Halo-α-nitrocarboxylic acids

Mashburn, T. A. (to duPont) U. S. 3,257,466 C. A. 65, 13544e
Linear dimers of perfluoro(alkylvinyl ethers)

Mastrangelo, S.V.R., (to duPont) U. S. 3,228,864

$$\underset{\substack{96.4\\ \text{mole \%}}}{C_2F_4} + C_2H_4 \xrightarrow{h\nu} CF_2 + F + \underset{47.4\%}{\text{polymer}}$$

$$CF_2 = CF_2$$
51.7%

Mazalov, B.I., et al., C. A. 66, 10545n
Reaction of some derivatives of ω,ω,ω-trichlorohexafluoro-valeric acid with copper

$$CCl_3CF_2CF{=}CF_2 \xrightarrow{Cu} \text{polymer + dimer}$$

McBee, E. T., et al., J.O.C. 30, 3698(1965)
Reaction of amines with cyclic fluorinated olefins

Mitsch, R. A., Neuvar, E. W., C. A. 64, 11049a
Perfluoro(vinylcyclopropane) and perfluoro(allylcyclopropane)

Miville, M. E., Earley, J. J. (to Pennsalt)
U.S. 3,246,041, C. A. 64, 19410e

$$CH_3CF_2Cl \xrightarrow{\Delta} CH_2{=}CF_2$$

Mod, W. A., et al. (to Dow) U. S. 3,278,406, C. A. 65 20004f

$$CF_2H_2 + Cl \xrightarrow[\text{low temp.}]{\text{U. V.}} C_2F_4 \quad \begin{matrix}89.6\%\ \text{conv.}\\ 46.9\%\ \text{yield}\end{matrix}$$

Mod, W. A. (to Dow) U. S. 3,278,616, C. A. 66, 2182z
Tetrafluoroethylene from difluoromethane

$$CH_2F_2 + Cl_2 \xrightarrow[50\text{-}500^\circ]{\text{Cat.}} CF_2{=}CF_2$$

Montecatini Edison S.P.A. British 1,130,836 (Cl. C 08f) C. A. 70 (2), 4795f.
Oxidation of C_2F_4 with O_3-containing oxygen gives tetrafluoroethylene epoxide and poly(oxyperfluoromethylene) in net yields of 46% and 18.7%, resp.

Montecatini, Neth. Appl. 6,504,428, C. A. 64, 14360g
Prep. of $CF_3\overline{CFCF_2O}$

Montecatini, Brit. 1,020,716, C. A. 64, 15740c
Prep. of vinyl fluoride from CH_2=CHCl

Moore, E. P., (to duPont) Fr. 1,362,548. C. A. 62, 7897b
Reaction of R_fCOF with $CF_3\overline{CFCF_2O}$

Moore, E.P., Milan, A. S. (to duPont) Brit. 1,019,788
Fluoroketones and fluoroalkanoyl fluorides

Moore, E. P., et al. (to duPont) U. S. 3,250,808
C. A. 65, 13554b
Fluorocarbon ethers from hexafluoropropylene oxide

Mueller, R., Reichel, S., C.A. 64, 6677f
Fluorination of $(Cl_3Si)_3CH$, $(CL_3Si)_3CCl$, $(CL_3Si)_4C$, and the synthesis of certain corresponding organopentafluorosilicates.

Mueller, R., Dressler, M., East Ger. 43,698, C. A. 65, 7057a
Prep. of CTFE by dechlorination of $CF_2ClCFCl_2$

Muramatsu, H., et al., C. A. 64, 15723a
Synthesis of fluorine-containing dienes

Muramatsu, H., et al., C. A. 65, 3723c
Synthesis of fluorine-containing butadienes

Neth. Appl. 6,414,768. C. A. 64, 3481g
Fluorine-containing epoxides

Neth. Appl. 6,506,200 (to duPont). C. A. 64, 11083g
$(CF_3)_2CHCl \xrightarrow{725+^\circ} CF_2$=$CFCF_3$

Noguchi, H., et al., Pol. Let. 3, 271(1965)
CH_2=$C(OEt)_2$

Park, J.D., and Lacher, J.R. (Colorado U., Boulder), The Synthesis of Special Fluorine-Containing Monomers, Quarterly Report No. 8, 1 Jul. - 1 Oct. 1963, Contract DA-19-129-QM-1926.
Synthesis of new olefins and diolefins; preparation of fluorinated carbocyclic and heterocyclic three-membered rings and others.

Park, J.D. and Lacher, J. R. (Colorado U., Boulder) Fifth Quarterly Progress Report, Oct. 1 1962 - Jan. 1 1963, Contract DA-19-129-QM-1926.
Rubber Research. The synthesis of special fluorine-containing monomers.

Park, J.D., Cook, E. W., C. A. 64, 12513a
Stereochemistry of nucleophilic substitution of unsaturated fluorocarbons.

Park, J.D. and Lacher, J.R. (Colorado Univ., Boulder) The Synthesis of Special Fluorine-Containing Monomers, Final Report 1 Oct. 1963 - 1 Oct. 1965, Contract DA-19-129-QM-126
Various α,ω-diolefins included.

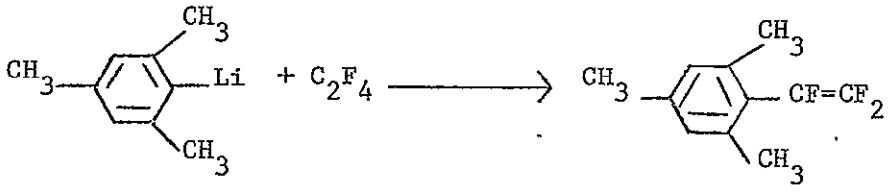
Park, J.D. and Lacher, J. R. (Colorado Univ., Boulder) The synthesis of Special Fluorine-Containing Monomers, Semiannual Report June 1 - Dec. 1, 1966, Contract DA-19-129-AMC-869(N).
Further work on synthesis of fluorine-containing olefins and diolefins is reported.

Park, J. D. and Lacher, J.R. (Colorado Univ., Boulder) The Synthesis of Special Fluorine-Containing Monomers, Semiannual Report, 1 Dec. 1966 - 1 June 1967.
Research on fluorine-containing olefins and diolefins, dimerization reactions producing dibox compounds.

Pennsalt Chemical Corp., Vinylidene Fluoride, Neth. Appl. 6,508,619 (Cl. C. 07c), January 6, 1967, Appl. July 5, 1965, C. A. 67, 11182v.
$CH_2=CF_2$ is prepared in good yields at lower temperatures from $MeCF_2Cl$ in the presence of a small amount of Cl.

Pennsalt, Neth. Appl. 6,512,899, C. A. 65, 5366d
Prep. C_2F_4 and C_3F_6 by pyrolysis of HCF_3

Petrii, O. P., et al., C. A. 64, 19462d



Pittman, A. G., Sharp, D., C. A. 63, 559e
Fluoroalkyl glycidyl ethers from fluoroketones

Pittman, A.G., Wasley, W. L., Neth. Appl. 6,512,238, C. A. 65, 7362g
Fluoroesters with ketone group

Pittman, A. G., et al., C. A. 65, 17056d
Polymers derived from fluoroketones. Preparation of fluoroalkyl acrylates and methacrylates.

Pittman, Allen G.; Sharp, Dennis L.; Ludwig, Barbara A. J.Polymer Sci.Part A-1 6(6), 1729 (1968)C.A. 69(2), 3267c
Polymers derived from fluoroketones II wetting properties of fluoroalkyl acrylates and methacrylates.

Pittman, Allen G.; Wasley, Wm.L. U.S. 3,382,222 (Cl. 260-91.1) C. A. 69(4), 10962d.
Fluorinated allyl ethers and their polymerization.

Posta, A., Paleta, O., C. A. 65, 3724h
The addition reaction of CCl_4 to CTFE

Prager, J.H. and Thompson, P.G., J.Amer.Chem.Soc., 87(2), 230(1965)
Prep. of fluorocarbon hypofluorites

Produits Chimiques Pechiney-Saint-Gobain, Fr. 1,453,455, (Cl. C. 08f), September 23, 1966, C. A. 66, 95827z.
Fluorination of organic polymers.

Proskow, S., U. S. 3,121,734 (to E. I. duPont de Nemours and Co.); C. A. 60, 10557b
Prep. of $NCCF_2CF_2CN$

Pummer, W. J., Wall, L.A., C. A. 65, 5390f
Pentafluorophenyl alkyl and vinyl ethers

Rabinowitz, R., U.S. 3,225,106, C. A. 64, 8078h
Process for prep. terminal halogenated olefins

Ray, N.H., Brit. 982,214. C. A. 62, 10340b
$CH_2=CHSF_5$ by dehydrohalogenation with cyclohexylamine

Riera, J., Stephens, R., C. A. 65, 18506a
Fluorination of aromatic polyfluorocompounds. Could be used as a route to difficultly accessible polyfluoroolefins.

Ruff, J.K., et al.
Synthesis of fluoroxyperfluoroalkyl compounds.

$$XYC{=}O + F \xrightarrow[KF,\ CsF,\ RbF]{-78^\circ} XYFCOF \qquad X \& Y = F \text{ or fluoroalkyls}$$

Salinovich, O., et al ., C. A. 65, 11747a
The gas phase fluorination of carbonyl sulfide

Saunders, D., Heicklen, J., C. A. 65, 3731d

$$O(3p) + C_2F_4 \longrightarrow CF_2O$$

$$O(3p) + C_3F_6 \longrightarrow CF_2O + CF_3CFO$$

Schecter, H., Conrad, F., J.A.C.S., 72, 3371 (1950)
CF_3CHO

Scherer, O., et al., C. A. 65, 5375h
Prep. and rxns. of perhalogenated α,β-unsaturated ketones

Scherer, Otto; Rammelt, Peter P. Ger. 1,265,732 (Cl C 07c)
C. A. 69(9), 35481j
Purification of CF_3COF: crude material, containing HCl & HF, is bubbled through 65% oleum, condensed, and distilled, b.p. -61 to -57°.

Sedlak, J. A., et al., U. S. 3,207,797. C. A. 63, 17963h
Prep. of α-fluorostyrene

Sedlak, J. A.,Matsuda, K., (to Am. Cy.)
U. S. 3,262,967, C. A. 65, 12112a
α-fluoroacrylates

Selman, S. (to duPont) U.S. 3,274,239, C.A. 65, 20029a
Perfluorocarbonyl compounds + perfluoropropylene oxide + $RO[CF(CF_3)CF_2O]_nCF(CF_3)COF$ n = 0 to 6

Shen, M., Tobolsky, A. V., C.A. 63, 5872a
Thermoelasticity and chain configuration of rubber-like net work polymers.

Shokina, V.V. (Army Missile Command, Huntsville, Ala.), Linear Polyfluorinated Analogously Bifunctional Compounds as Potential Monomers, Transl. into English from Usp. Khim. (USSR). 32(9), 1052-86 (1963)
Production methods and properties of potential monomers for the production of new fluorine-containing polycondensation polymers.

Sianesi, D., et al., C. A. 64, 6474f
Fluoroolefins III. The synthesis of $CF_2=CHCF_3$

Sianesi, D., et al., C. A. 65, 7004e
The chemistry of hexafluoropropylene epoxide

Slichter, W.P., Davis, D.D., Rubber Chem. and Tech., 38, 3517(1965)
NMR studies of molecular motion in some elastomers

Societa Edison, S.p.A. -Settore Chimico, Neth. Appl. 6,516,825, C.A. 65, 20099c
Tetrafluoroethylene oxide $O_2 + CF_2=CF_2 \xrightarrow{\text{Ag cat.}}$

Tarrant,Paul; Perry, Doug; Tandon, Jai; Wright Alan; and Misaki, Susumu (Univ. of Florida, Gainesville), Research on Synthesis of Unsaturated Fluorocarbon Compounds, Semi-annual Report, April 1 - September 30, 1965, contract DA-19-129-AMC-79(N).
Progress is reported in preparation of unsaturated organic compounds containing fluorine.

Tarrant, Paul, et al. (Univ. of Florida, Gainesville), Research on Synthesis of Unsaturated Fluorocarbon Compounds, Army Natick Lab., Mar. 1967, Contract DA-19-129-AMC-79(N).
Synthesis of a variety of fluorine-containing compounds including some fluorinated dienes.

Tarrant, Paul: C. A. 68, 93047n, U. S.Clearinghouse Fed. Sci. Tech. Inform., AD 662712, Research on Synthesis of Unsaturated Fluorocarbon Compounds.
A series of F monomers were prepared including several new fluorinated nitroso monomers.

Tatlow, J.C., et al., C. A. 65, 5350c
Reductive coupling of perfluorovinylhalides in the presence of copper-bronze

Tedder, J. M., Walton, J.C., C. A. 65, 2107a
Addition of trichloromethyl radicals to fluoroethylenes

Thiokol Chemical Corporation, U. S. 3,300,538 (Cl. 260-653.3), January 24, 1967, C. A. 66, 75647r.
Purification of perfluoro and chloroperfluoro olefins.

Timofeyuk, G. V., et al., C. A. 65, 8947b
Synthesis of para-substituted α,β,β-trifluorostyrenes

Trasick, R. W. (to duPont) U. S. 3,239,557, C. A. 64, 14098c

Prep. $Z(C_nF_{2n})CH_2CH_2O\overset{O}{\overset{\|}{C}}R$

Z = F or $R\overset{O}{\overset{\|}{C}}-OCH_2CH_2$

R = alkyl or alkenyl
n = 1-16

Tumanova, A., et al., C.A. 63, 478f
Prep. of $CF_3OCF_2CF_2X$ X=I, Cl, Br

UCB (Union Chimique - Chemische Bedrijuen), S.A., C. A. 67, 63829f, Neth. Appl. 6,609,240 (Cl. C. 07c), January 9, 1967.
Unsaturated fluorinated diesters.

Belg. 658,186 (Union Carbide). C. A. 64, 8031h
Ferric oxide catalysts for chloroalkane to fluoroalkane conversion.

Usmanov, Kh.U. et al. Nauch. Tr. Tashkent. Gos.Univ. 1967, No. 284, 117-22 C. A. 69(9), 35310c
Synthesis of vinyl fluoride

VEB Fluorwerke Dohna., East Ger. 43,244, C. A. 64, 19408h

$$CHClF_2 + CHClFCF_3 \xrightarrow[Pt]{800^\circ} C_3F_6$$

Wall, L. A., Antonucci, J.M. (to U.S.Dept. of Navy) U.S. 3,265,746, C. A. 65, 13602b
Perfluorostyrene

Wall, Leo A.; Antonucci, Joseph M. (U.S.Dept.Navy) U.S. 3,394,190 (Cl.260-609) C. A. 69, 58939d.
Preparation of perfluoro-p-cresol and perfluoro-p-thiocresol. Polymers are obtained by heating with mild alkali.

Warnell, J. L., (to duPont) French 1,410,444.
Perfluorovinyl ethers

Warnell, J. L. (to duPont) U. S. 3,250,806, C.A. 65, 15230f
Fluorocarbon ethers of tetrafluoroethylene oxide

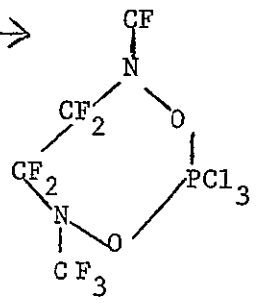
Warnell, J. L. (to duPont) U.S. 3,277,169, C. A. 66,11304r
Fluorocarbon-hydrocarbon polyethers. Hexafluoropropylene oxide, or tetrahydrofluoroethylene epoxide with ethylene oxide, propylene oxide, oxetane or tetrahydrofuran

Yakobson, G. G., et al., C.A. 64, 1424h

Prep. of HO_2C—C$_6$H$_4$(F)—CO_2H and esters

Yakubovich, A.Ya., et al., C. A. 64, 14079c

$$C_2F_4 + PCl_3 + 2CF_3NO \longrightarrow$$



Yakubovich, A.Ya., et al., C. A. 65, 12205c
Syntheses in the 1,3,5-triazine series. Esters of iminoperfluorocarboxylic acids; synthesis, properties, mechanism of cyclopolymerization into 1,3,5-triazine derivatives.

Yakubovick, A. Ya.; Belyaena, I.N.; Gitel, P.O.; Smolyanitskaya, V.V.; and Sankina, L. V.: C. A. 67, 63660u, Zh. Obshch. Khim. 37(4), 847-52 (1967) (Russ.)
Reaction of direct fluoroalkenylation. V. Fluorovinyl alkyl ethers and fluorovinyl alkyl thio ethers. Synthesis and polymerization of the ethers is given.

Yarwood, J., Orville-Thomas, W. J., J.Chem.Soc. 7481(1965)
IR and Raman spectra of CCl_2=CFH.

VIII. Vulcanization of Fluorine-Containing Polymers

Acker, Donald S. and Arthur L. Barney (to E.I.duPont de Nemours & Co.) U.S. 3,378,604(Cl.260-874) C.A. 68, 115548f
Vulcanizable composition containing a thiocarboxylic acid fluoride polymer and a polyunsaturated compound, e.g. poly(thiocarbonyl fluoride) with divinylbenzene.

Gilinskaya, N.S., et al., C. A. 64, 900c
Vulcanization of fluorine-containing polymers using Schiff bases.

Goldsmith(to Gen.Plastics Corp.) U. S. 3,281,511, C.A. 66, 3358f
Process for increasing tensile strength and flexing of poly(TFE).

Griffin, Warren R., Library of Congress Science and Technology Div., Washington, D. C., Charles J. Cleary Awards for papers on material sciences, 1962, p. 125-135, 14 refs.
A room temperature vulcanization system for selected fluorine-containing polymers. Test data are given for a hexafluoropropylene-vinylidene fluoride copolymer.

Honn, F. J. and Sims, W. M. (to 3M Co.) U. S. 3,318,854, C. A. 67, 22731z
Vulcanization of CTFE-VF_2 copolymers.

Lanza, V. L., Belg. 670,761, C.A. 65, 13925h
Vinylidene fluoride polymers cross-linked with trialkyl cyanurate

Nagelschmidt, Rudolf and Goecke, Max, Deutsche Gold and Silber-Scheideanstalt, Ger. 1,234,983 (Cl. C. 98g), February 23, 1967.
The condensation products of aldehydes or ketones with polyamines and polyisocyanates are used as crosslinking agents for halogen-containing polymers.

Nodar-Blanco, A.; Yarsley Research Labs, Ltd. (Gt.Brit) Report No. D-MAT-150; AD-669684 (USGRDR) NASA AD No. N68-29746.
Vulcanization of fluorine-containing elastomers.

Novikov, A.S., et al., FTD-TT-65-1371
Study of vulcanization of fluoro-copolymers with polyamines by IR spectroscopy method

Novikov, A.S., et al., C. A. 62, 9329c
Study of cure of fluorine-containing elastomers with Shiff bases.

Nonikov, A.S.; Stolyarova, L.G.; Gilinskaya, N.S.; Galil-Ogey, F.A.; and Nudel'man, Z.N.: C. A. 68, 79342y, Kauch. Rezina, 26(10), 21-4 (1967) (Russ.).
Vulcanizing fluoroelastomers by alkali metal derivatives of bisphenols.

Sands, George D. and Pezdirtz, George F. (NASA Langley Research Center) Cross-linking of polyvinylidene fluoride by gamma radiation. Presented as the 150th National Meeting of the American Chemical Society, Atlantic City, 12-17 September, 1965.
After polymer was irradiated, tensile strength was found to increase, which is typical of polymers undergoing crosslinking. Elongation was found to decrease.

Smith, F., Albin, J., C.A. 63, 7186e
Vulcanization of fluoro elastomers with difluorodiazine

Terentseva, A.P., et al., C. A. 63, 15079d
Vulcanization of fluoroorganic elastomers

Yarsley Research Laboratories, Ltd.(by A.W. Flavell & A. Nodar-Blanco) Brit. 1,095,836 (Cl. C 08f) C. A. 68, 40795y
Curing fluoro-rubbers; trialkylquaternary ammonium salts to cure.

Yarsley Research Laboratories Ltd. (Arthur W. Flanell, Angel Nodar - Blanco), C.A. 68, 40795y., Brit. 1,095,836 (Cl. C. 08f), December 20, 1967.
Curing of fluoro-rubbers. Trialkyl quaternary ammonium salts were used as curing agents for vinylidene fluoride-Hexafluoropropene copolymers or vinylidene fluoride-Hexafluoropropene-tetrafluoroethylene terpolymers.