3M™ Dyneon™
Fluoropolymers

Product Information

Dyneon solutions for the Chemical Processing Industry

3M™ Dyneon™ Fluoroplastics

Chemical Resistance

(Aging Duration of 1000 Hours)

		Chemicals	Concen. %	Temp. °C	PTFE & TFM™ Modified PTFE	PFA	FEP	ETFE	THV 500	PVDF
Acids	Organic	Trichloroacetic Acid		23	+	▲	+	+	▲	+
		Trichloroacetic Acid		50	+	▲	+	•	–	+
		Trichloroacetic Acid		100	+	+	▲	▲	▲	▲
	Inorganic	Hydrochloric Acid	36	23	+	▲	+	+	+	+
		Hydrochloric Acid	36	100	+	–	▲	•	+	+
		Hydrochloric Acid	36	155	+	–	•	▲	▲	+
		Sulfuric Acid	96	23	+	▲	+	+	▲	+
		Sulfuric Acid	96	100	+	+	▲	+	+	–
		Sulfuric Acid	96	155	+	+	+	▲	▲	–
		Phosphoric Acid	conc.	100	+	+	▲	+	+	+
		Phosphoric Acid	conc.	165	+	+	•	▲	▲	+
		Hydrofluoric Acid	40	100	+	+	+	▲	•	+
		Hydrofluoric Acid	40	155	•	+	▲	▲	▲	▲
		Hydrofluoric Acid	49	35	+	▲	+	▲	+	+
		Hydrofluoric Acid	49	155	•	+	▲	▲	▲	▲
		Nitric Acid	conc.	23	+	▲	+	+	▲	•
		Nitric Acid	conc.	100	+	▲	▲	+	+	–
		Nitric Acid	conc.	155	+	•	•	▲	▲	–
		Fluorosulfonic Acid		100	•	•	▲	+	▲	▲
		Chlorosulfonic Acid		100	+	+	▲	–	▲	•
		Chromosulfonic Acid		100	+	+	▲	•	▲	–
Alcohols		Ethylene Glycol		100	+	+	▲	▲	▲	+
		Methanol		23	+	+	+	+	•	+
		Methanol		50	+	+	▲	+	•	•
Amides		Dimethylacetamide		50	+	▲	+	–	–	–
		Dimethylacetamide		100	+	+	▲	•	▲	–
		Dimethylformamide		23	+	▲	+	▲	▲	–
		Dimethylformamide		50	+	▲	+	+	–	–
		Dimethylformamide		100	+	•	▲	+	▲	–
		N-methylpyrrolidone		23	▲	▲	+	▲	–	–
		N-methylpyrrolidone		50	+	▲	▲	▲	–	–
		N-methylpyrrolidone		100	+	+	+	▲	–	–
Amines		Benzyl Amine		23	+	▲	▲	+	▲	▲
		Benzyl Amine		100	+	▲	▲	•	▲	▲
		N-Butyl Amine		100	+	▲	▲	•	▲	▲
Bases		Ammonia	25	23	+	+	+	▲	–	–
		Sodium Hydroxide	25	23	+	▲	+	▲	▲	–
		Sodium Hydroxide	50	23	+	+	+	▲	+	–
		Potassium Hydroxide	50	23	+	+	+	▲	+	+
		Potassium Hydroxide	50	100	+	+	▲	–	▲	+

To be continued on the next page ->

	Chemicals	Concen. %	Temp. °C	PTFE & TFM™ Modified PTFE	PFA	FEP	ETFE	THV 500	PVDF
Esters	Ethyl Acetate		23	+	▲	•	•	–	•
	Ethyl Acetate		50	+	▲	▲	▲	–	–
	Ethyl Acetate		100	+	▲	▲	•	▲	–
Ethers	Tetrahydrofuran		23	+	+	+	–	–	•
	Tetrahydrofuran		50	▲	•	–	–	–	•
Halogens	Chlorine gas		23	+	•	▲	+	+	•
	Iodine		23	+	+	▲	▲	▲	+
	Bromine		23	+	+	▲	+	▲	+
Halogenated Hydrocarbons	1,1 - Dichloroethane		23	•	▲	▲	+	▲	▲
	1,1 - Dichloroethane		50	•	▲	▲	+	▲	▲
	1,2 - Dichloroethane		23	•	▲	▲	+	▲	+
	1,2 - Dichloroethane		50	•	▲	▲	+	▲	+
	1,2 - Dichloroethane		100	•	▲	▲	+	▲	+
	1,4 - Dichlorobutane		23	+	▲	▲	+	▲	▲
	1,1,2 - Trichloroethane		23	•	▲	▲	•	▲	▲
Hydrocarbons Aliphatic	Iso Octane		23	+	+	+	+	+	▲
	Iso Octane		50	+	+	▲	▲	+	▲
	Hexane		23	+	▲	•	▲	+	+
Aromatic	Toluene		23	+	+	+	•	•	+
Ketones	Acetone		23	+	+	+	+	–	–
	Acetone		50	+	▲	▲	▲	–	–
	Acetone		100	+	▲	▲	•	▲	–
	Methyl Ethyl Ketone		23	+	▲	+	▲	–	–
	Methyl Ethyl Ketone		50	+	▲	▲	–	▲	–
	Methyl Ethyl Ketone		80	+	+	▲	▲	▲	–
Other Heterocycles	Benzyl Chloride		23	•	▲	+	▲	▲	+
	Pyridine		23	+	▲	+	–	▲	+

+ Weight change <0.5%, change in mechanical properties[1] <10%
• Weight change 0.5% - 1.0%, change in mechanical properties[1] 10% - 20%
– Weight change >1.0%, change in mechanical properties[1] >20%
▲ No information available
★ Mechanical properties are defined as tensile strength and percent elongation

3M™ Dyneon™ Fluoroplastics
Typical Properties

	Test Method	Unit	3M™ Dyneon™ PTFE	3M™ Dyneon™ TFM™ Modified PTFE
Physical Properties				
Specific Gravity	ASTM D792, ISO 1183	g/cm3	2.16	2.16
Melting Point	ASTM D4591	°C	327	327
Service Temperature				
minimum		°C	-200	-200
maximum		°C	260	260
Mechanical Properties	DIN EN ISO 527			
Tensile Strength at Break				
@23 °C		MPa	36	35
@100 °C		MPa	22	25
Elongation at Break				
@23 °C		%	400	560
@100 °C		%	520	590
Tensile Modulus	DIN EN ISO 527			
@23 °C		MPa	600	630
@100 °C		MPa	210	255
Yield Strength				
@23 °C		MPa	12.4	13.2
@100 °C		MPa	7.5	8.2
Flexural Modulus	ASTM D790 3pt bend	MPa	▲	▲
Deformation Under Load after 100h stress & 24h recovery	ASTM D621			
@23 °C / 15 MPa		%	11	4
@150 °C / 8.8 MPa		%	34.5	20
@205 °C / 5.2 MPa		%	18.5	5.5
Hardness	ISO 868	ShD	56	59
Surface Roughness			0.9	0.3
Electrical Properties				
Dielectric Constant	ASTM D150 @ 1MHZ		2.1	2.1
Dissipation Factor	ASTM D150 @ 1MHZ	10^{-4}	0.7	0.7
Dielectric Strength	ASTM D149	kV/mm	60 (0.20 mm film)	80 (0.20 mm film)
Flame Resistance				
Limiting Oxygen Index	ASTM D2863	%	96	96
Flammability Rating	UL 94		V-0	V-0
Permeation Properties				
HCl	DIN 53380 Part 4.1.2	$(cm^3*1000\mu m)/(m^2*d*bar)$		
@23 °C			630	445
@100 °C			1600	1150
H_2O (Permeation)	DIN 53122 Part 2	$(g*1000\mu m)/(m^2*d)$		
@23 °C			0.02	0.017
@100 °C			3.5	2.43

Explanation

+ Weight change <0.5%, change in mechanical properties* <10%
• Weight change 0.5% - 1.0%, change in mechanical properties* 10% - 20%
– Weight change >1.0%, change in mechanical properties* >20%
▲ No information available
★ Mechanical properties are defined as tensile strength and percent elongation

[1] Nominal value for extrusion grade resin
[2] Dyneon manufactures a variety of THV materials which differ in composition, melt flow index and properties. Please consult us for further information on additional grades.

Dyneon PFA[1]	Dyneon FEP[1]	Dyneon ETFE[1]	Dyneon THV 500[2]	Dyneon PVDF[2]
2.15	2.15	1.73	1.98	1.78
310	260	266	165	174
-200	-200	-190	▲	▲
260	205	150	130	▲
30	30	46	28	35-50
24	14	20	12	▲
380	350	450	500	20-50
440	320	600	590	▲
530	600	1200	240	2500
160	85	250	27	▲
16	14	26	8	53-57
7	6	10	3	▲
550	580	1100	210	2100
2	▲	▲	▲	▲
10	▲	▲	▲	▲
14.5	▲	▲	▲	▲
60	57	69	54	78
0.34 (UHP grades <0.1)	0.044	▲	▲	▲
<2.15	<2.15	2.58	4.82	▲
<5	<9	▲	100	▲
75	63	59	48	▲
(0.25 mm film)	(0.25 mm film)	(0.25 mm film)	(0.25 mm film)	
>95	>95	>30	>75	44
V-0	V-0	V-0	V-0	V-0
160	n/a*	190	90	▲
1400	n/a*	2700	5600	▲
0.018	n/a*	0.11	0.17	< 0.04
4.54	n/a*	7.00	33.0	▲

3M™ Dyneon™ Fluoroelastomers
Typical Properties

	Test Method	Unit	3M™ Dyneon™ Fluoroelastomers Dipolymers	3M™ Dyneon™ Fluoroelastomers Terpolymers	3M™ Dyneon™ PO Cure Fluoroelastomers	3M™ Dyneon™ PFE PO Cure*	3M™ Dyneon™ LTFE	3M™ Dyneon™ PFE High Temp*
Continuous Service Temperature								
minimum		°C	-30	-20	-20 to -30	-10	-50	-10
maximum		°C	210	210	200	220	200	320
Physical Properties								
Specific Gravity	ASTM D792	g/cm3	1.81	1.84-1.89	1.8-1.9	1.98	1.86	2.0
Low Temperature Performance								
TR-10	ASTM D1329	°C	-18	-13	-6 to -20	-2	-40	-1
Mechanical Properties*	ASTM D412							
Elongation								
@23 °C		%	180-310	180-310	150-250	150	150-200	150
Tensile Strength								
@23 °C		MPa	13-17	13-17	>18	>18	10-12	12-20
Tensile Modulus (M100)		MPa	3.5-6	3.5-6	3-7	8-14	4-8	8-16
Hardness	ASTM D2240	ShA	70-80	70-80	70-80	75-80	65-75	75-80
Compression Set Resistance*	ASTM D395							
(70h@ 200 °C)		%	9-40	20-40	20-30	29	25	14
Electrical Properties*								
Dielectric Constant	ASTM D150							
@23 °C; 1 MHZ			19.3	18.5	▲	▲	▲	▲

Approvals

Regulatory Compliance Status of Dyneon Fluoroelastomers for Food Contact

The following Dyneon products are in compliance with FDA 21 CFR 177.2600 (c)(4)(i): Dyneon FG 5630Q; Dyneon FG 5690Q
The following Dyneon products have received Star-K Kosher certification: Dyneon FC 2178, Dyneon FC 2230, Dyneon FG 5630Q, Dyneon FG 5690Q

Compliance with regulations: It is the responsibility of the user to determine whether its specific formulation and intended use comply with applicable laws and are suitable for its intended application.
For food contact applications, fillers and ingredients utilized must be in compliance with applicable regulations for repeated food contact use.

***Important Notice:** The values indicated represent standard compound formulations which have been designed for quality control purposes. By adjusting filler type, filler content, crosslink density or other parameters, significant changes in properties may be obtained. For additional information, consult your Dyneon representative.

Explanation

+ Excellent Resistance (little or no effect)
• Good to Excellent Resistance (moderate effect)
− Not Recommended (substantial effect)
▲ No information available

Superscript 1: denotes compounds of 70% fluorine incorporated cure terpolymer
User is responsible for determining that all fillers and ingredients utilized in formulations comply with applicable regulations.

3M™ Dyneon™ Fluoroelastomers
Chemical Resistance of Dipolymers (Unless Specified

	Rating
Acetamide	
100 °C, 7 days	+
150 °C, 7 days	–
Acetic Acid (Glacial)	
25 °C, 7 days	–
Acetone	
25 °C, 7 days	–
Acrylonitrile	
50 °C, 7 days	–
Ammonia, Anhydrous	
25 °C, 1 day	–
Ammonium Hydroxide, Sat.	
25 °C, 28 days	+
Amyl Alcohol	
25 °C, 21 days	•
Aniline	
25 °C, 7 days	+
70 °C, 28 days	•
ASTM Reference Oil IRM 902	
150 °C, 21 days	+
ASTM Reference Oil IRM 903	
150 °C, 21 days	+
Benzaldehyde	
25 °C, 3 days	–
Benzene	
25 °C, 14 days	•
25 °C, 7 days[1]	+
Bromine	
25 °C, 5 days	+
100 °C, 5 days	+
Butadiene, 40psi	
25 °C, 3 days	•
Butyl Acetate	
25 °C, 3 days	–
Butyl Acrylate	
50 °C, 3 days	–
Iso-Butyl Alcohol	
25 °C, 21 days	+
Butyl Amine	
25 °C, 3 days	–
Carbon Disulfide	
25 °C, 28 days	+
Carbon Tetrachloride	
25 °C, 7 days	+
Chlorine, Dry	
100 °C, 5 days	+

	Rating
Chlorotrifluoride (ClF_3)	
25 °C, 30 min.	+
Chlorobromomethane	
25 °C, 7 days	–
Chlorobutadiene	
–20 °C, 2 days	+
Chloroform	
25 °C, 7 days	+
Cod Liver Oil	
25 °C, 7 days	+
Cottonseed Oil	
70 °C, 28 days	+
150 °C, 28 days	+
Creosote Oil	
25 °C, 7 days	+
100 °C, 7 days	+
Cyclohexanone	
25 °C, 7 days	–
Cyclohexane	
25 °C, 7 days	+
O-Dichlorobenzene	
25 °C, 3 days	+
70 °C, 28 days	+
150 °C, 28 days	•
Difluoroethylene	
25 °C, 7 days	•
N-N-Dimethyl Formamide	
25 °C, 7 days	–
Dioctyl Sebacate	
150 °C, 3 days	+
150 °C, 14 days	–
1,4-Dioxane	
25 °C, 3 days	–
Epichlorohydrin	
50 °C, 7 days	–
Ethyl Acetate	
25 °C, 7 days	–
25 °C, 7 days[1]	•
Ethyl Acrylate	
25 °C, 7 days	–
Ethyl Ether	
25 °C, 3 days	–
Ethylene Dichloride	
25 °C, 7 days	+
Ethylene Gas, 800psi	
25 °C, 3 days	+
Ethylene Glycol	
100 °C, 14 days	+

	Rating
Ethylene Glycol/Water (50/50)	
100 °C, 3 days[1]	+
100 °C, 7 days	•
Ethylene Oxide	
70 °C, 5 days	–
Formaldehyde (37%)	
25 °C, 7 days	–
Formic Acid	
70 °C, 7 days	–
Furfural	
70 °C, 28 days	•
N-Hexane	
25 °C, 21 days	+
Hydrochloric Acid, 37%	
25 °C, 7 days	+
Hydrofluoric Acid, 48%	
25 °C, 7 days	+
Hydrofluoric Acid, Anhyd.	
25 °C, 3 days	•
Hydrogen Peroxide (90% Active)	
25 °C, 7 days	+
Iso-octane	
25 °C, 21 days	+
Methane Gas	
500psi, 3 days	+
Methanol	
25 °C, 7 days	–
25 °C, 7 days[1]	•
Methyl Acrylic Acid	
50 °C, 3 days	•
Methyl Ethyl Ketone	
25 °C, 7 days	–
25 °C, 7 days[1]	•
Methyl Tertiary Butyl Ether (MTBE)	
25 °C, 7 days	–
Methylene Chloride	
25 °C, 3 days	–
25 °C, 3 days[1]	•
Monochlorobenzene	
25 °C, 30 days	•
Naptha	
25 °C, 7 days	+
70 °C, 28 days	+
Nitrogen Dioxide (NO_2)	
25 °C, 1 day	–

Otherwise)

	Rating
Nitrogen Tetra Oxide (N_2O_4)	
25 °C, 1 day	–
N-Octyl Alcohol	
25 °C, 35 days	+
Olive Oil	
25 °C, 7 days	+
Perchloroethylene	
25 °C, 7 days[1]	+
Petroleum Ether	
25 °C, 7 days	+
Phenol	
25 °C, 3 days	+
100 °C, 28 days	+
150 °C, 28 days	•
Propane	
125psi, 3 days	+
160psi, 3 days	•
N-Propyl Alcohol	
25 °C, 21 days	•
Propyl Nitrate	
25 °C, 7 days	–
Pyranol	
150 °C, 7 days	+
Pyridine	
25 °C, 3 days	–
Seawater	
25 °C, 30 days	+
Sodium Hydroxide, 50%	
25 °C, 7 days	+
38 °C, 6 months	•
70 °C, 7 days	•
Sodium Vapor (Nitrogen Atmosphere)	
177 °C, 7 days	+
Sour Gas	
25 °C, 7 days	+
70 °C, 3 days	–
Styrene	
25 °C, 7 days	•
Sulfuric Acid, Fuming (20% Oleum)	
25 °C, 7 days	+
Sulfuric Acid, Oleum 25% SO_3	
25 °C, 36 days	+
Tetrachloroethane	
25 °C, 21 days	+

	Rating
Toluene	
25 °C, 14 days	•
25 °C, 7 days[1]	+
93 °C, 4 days[1]	•
Tributyl Phosphate	
100 °C, 7 days	–
Trichloroethane	
25 °C, 21 days	•
100 °C, 28 days	•
Trichloroethylene	
25 °C, 7 days	+
70 °C, 28 days	•
Tricresyl Phosphate	
150 °C, 7 days	+
38 °C, 3 years	+
Turpentine	
70 °C, 28 days	+
Vinyl Fluoride	
25 °C, 7 days	•
Xylene	
25 °C, 14 days	+
70 °C, 28 days	•

3M™ Dyneon™ Perfluoroelastomers
Chemical Resistance

Volume swell in % (black compounds)	Time	% volume swell	Rating
	1 week	<= 10 (7)	++
	1 week	11-20	+
	1 week	>20	•

Temperature Resistance Compression set in %	°C	E-20657 (PFE 90z)	PFE 7502BZ	E-20659
70 hrs	200	29	15	14
70 hrs	275	▲	40	30
70 hrs	316	▲	▲	41
Continuous		220 °C	275 °C	320 °C
TR10		-2 °C	1 °C	-1 °C

Chemical Resistance / Volume swell		°C	E-20657 (PFE90z)	PFE 7502BZ	E-20659
Acids	Glacial Acetic Acid	100	+	++	++
	Hydrochloric Acid (37%)	80	+	++	++
	Nitric Acid (65%)	85	+	++	++
	Sulfuric Acid (98%)	175	++	++	++
Amines	Ethylene Diamine	60	++	+	+
	Triethanolamine	40	++	++	++
Bases	Ammonia (30%)	100	++	++	++
	NaOH (50%)	100	++	++	++
Esters	Ethylacetate	40	++	++	++
Ethers	Methyl t. Butylether	23	++	++	++
Gases	Ethylene Oxide	50	++	▲	+
	Propylene Oxide	50	++	▲	++
Hydrocarbons	Toluene	100	++	++	++
	Trichloroethylene	40	▲	++	++
Ketones	Acetone	40	++	++	++
	Methyl Ethyl Ketone	40	++	++	++
Steam		230	++	++	+
Water		230	+	++	•

Technical Information and Test Data

Technical information, test data and advice provided by 3M Dyneon personnel are based on information and tests we believe are reliable and are intended for persons with knowledge and technical skills sufficient to analyze test types and conditions, and to handle and use raw polymers and related compounding ingredients. No license under any 3M Dyneon or third party intellectual rights is granted or implied by virtue of this information.

General recommendations on health and safety in processing, on work hygiene and on measures to be taken in the event of accident are detailed in our material safety data sheet.

You will find further notes on the safe handling of fluoropolymers in the brochure "Guide for the safe handling of Fluoropolymers Resins" by PlasticsEurope, Box 3, B-1160 Brussels, Tel. +32 (2) 676 17 32.

Important Notice

All information set forth herein is based on our present state of knowledge and is intended to provide general notes regarding products and their uses. It should not therefore be construed as a guarantee of specific properties of the products described or their suitability for a particular application. Because conditions of product use are outside 3M Dyneon's control and vary widely, user must evaluate and determine whether a 3M Dyneon product will be suitable for user's intended application before using it. The quality of our products is warranted under our General Terms and Conditions of Sale as now are or hereafter may be in force.

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