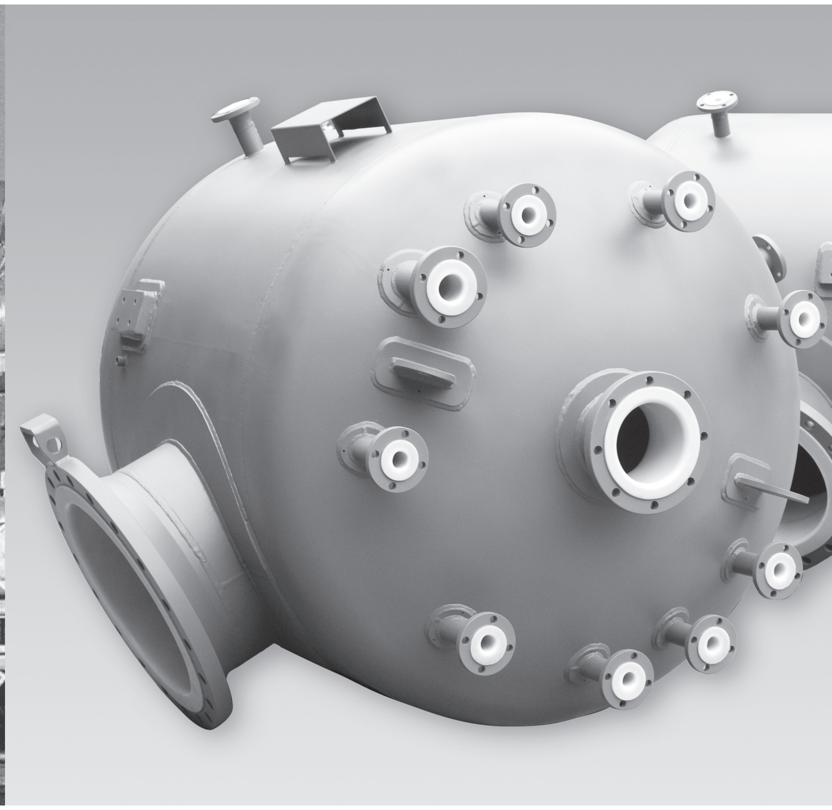
ChemResist ROTATIONAL SINTER LINING

Benchmark for Surface Protection

Gutbrod



ChemResist

ROTATIONAL-LINING

RESISTANCE LIST

COATING TECHNOLOGY TO MEET THE HIGHEST EXPECTATIONS

Rudolf Gutbrod GmbH in Swabian Dettingen/Erms sets new standards in innovative coating technology. The company is leading in Europe as a processor of fluorinated polymers.

The enterprise was founded in 1964 and is a pioneer in Germany in surface coating technology with fluoropolymers. And as a licensee of well-known raw material manufacturers to some of Europe's top addresses, as far as functional coatings with non-stick effect, low friction, chemical

protection and corrosion protection are concerned. State-of-the-art technology is ensured through continuous development work.

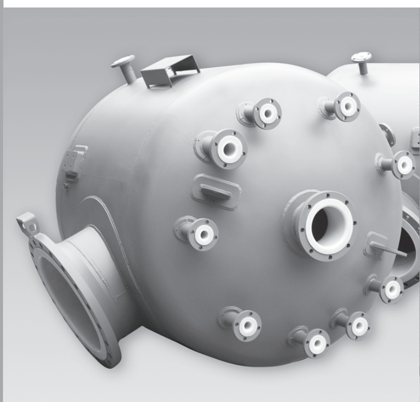
Raw material procurement is undertaken on a worldwide basis. International and permanent exchange of ideas will ensure that the highest possible quality will be maintained in solving the different requirements of our customers also in the future.

PERFECT SOLUTION FOR SINTER LINING PROJECTS

ChemResist puts a new emphasis in this case using a process and computer-controlled lining technology according to the rotational sinter lining process. This procedure creates a seamless lining with virtually uniform coating thickness.

High-quality partially and fully fluorinated materials, such as ETFE und PFA, and the high performance polymers PE, PP and PA, are used by ChemResist. ETFE and PE are also available as electrically conducting versions. ChemResist can also supply with FDA-conform certification upon request. This also applies to electrically conductive specifications.

Partly and fully fluorinated polymers offer universal and permanent resistance to acids, alkalis, solvents and chlorides. ChemResist possesses an extremely smooth and anti-adhesive surface and thus prevents bacterial adherence or growth. In the manufacture of highly pure products (chip industry, high purity grade chemicals) ChemResist prevents impaired quality from foreign substances or dissolved metallic ions.



ChemResist
ROTATIONAL-LINING

FLEXIBLE AND ECONOMICAL

If special parts are to be lined, ChemResist possesses distinct advantages both from an economic as well as a qualitative point of view. The process can be adapted flexibly to the circumstances or requirements (preparation of tooling is not required). Even rigid construction specifications can be solved economically with ChemResist.

Mechanical preliminary work, as well as the use of adhesives, can be avoided. Chemical resistance and high temperature resilience remain unaffected. The permanent and homogeneous lamination to the substrate means new and interesting perspectives in use under vacuum.

More detailed information are available in our ChemResist brochure and on the internet at **www.gutbrod-ptfe.de/produkte/chemresist.**

Table 1
Chemical compatibility – taking DuPont Teflon® ETFE as an example (based on tests of representative materials and engineering judgment)

The data is based on long-term experience and the results from the development department and is not binding.

	Chemical	Maximum Use Temperature °F	°C
A	Acetaldehyde	200	95
	Acetamide	250	120
	Acetic Acid (50%)	250	120
	Acetic Acid (Glacial)	230	110
	Acetic Anhydride	300	150
	Acetone	150	65
	Acetone (50% H_2O)	150	65
	Acetonitrile	150	65
	Acetophenone	300	150
	Acetylchloride	150	65
	Acetylene	250	120
	Acetylene Tetrabromide	300	150
	Acetylene Tetrachloride	300	150
	Acrylonitrile	150	65
	Adipic Acid	275	135
	Air	300	150
	Allyl Alcohol	212	100
	Allyl Chloride	212	100
	Aluminum Ammonium Sulfate	300	150
	Aluminum Chloride	300	150
	Aluminum Fluoride	300	150
	Aluminum Hydroxide	300	150
	Aluminum Nitrate	300	150
	Aluminum Oxychloride	300	150
	Aluminum Potassium Sulfate	300	150
	Amino Acids (H_2O)	212	100
	Ammonia (Anhydrous)	300	150
	Ammonia (Aqueous 30%)	230	110
	Ammonium Bifluoride	300	150
	Ammonium Bromide (50%)	275	135
	Ammonium Carbonate	300	150
	Ammonium Chloride	300	150
	Ammonium Dichromate	275	135
	Ammonium Fluoride	300	150
	Ammonium Hydroxide	300	150
	Ammonium Nitrate (Conc.)	230	110
	Ammonium Perchlorate	275	135
	Ammonium Persulfate	150	65
	Ammonium Phosphate	300	150
	Ammonium Sulfate	300	150
	Ammonium Sulfide	300	150
	Ammonium Thiocyanate	300	150
	Amyl Acetate	250	120
	Amyl Alcohol	300	150
	Amyl Chloride	300	150
	Aniline	230	110
	Aniline Hydrochloride (10%)	150	65
	Anthraquinone	275	135
	Anthraquinone-Sulfonic Acid	275	135
	Antimony Trichloride	212	100
	Aqua Regia	212	100
	Arsenic Acid	300	150
B	Barium Carbonate	300	150
	Barium Chloride	300	150
	Barium Hydroxide	300	150
	Barium Sulfate	300	150
	Barium Sulfide	300	150
	Battery Acid	250	120
	Benzaldehyde	212	100
	Benzene	212	100
	Benzene Sulfonic Acid	212	100
	Benzoic Acid	275	135
	Benzoyl Chloride	150	65
	Benzyl Alcohol	300	150
	Benzyl Chloride	300	150
	Bismuth Carbonate	300	150
	Black Liquor	300	150
	Bleach (12.5% Cl_2)	212	100
	Borax	300	150
	Boric Acid	300	150
	Brine	300	150
	Bromic Acid	250	120
	Bromine (Dry)	150	65
	Bromine Water (10%)	230	110
	mono-Bromobenzene	212	100
	Bromoform	212	100
	m-Bromotoluene	212	100
	Butadiene	250	120
	Butane	300	150
	Butanediol	275	135
	Butyl Acetate	230	110
	Butyl Acrylate	230	110
	n-Butyl Alcohol	300	150
	sec-Butyl Alcohol	300	150
	tert-Butyl Alcohol	300	150
	n-Butylamine	120	50
	sec-Butylamine	120	50
	tert-Butylamine	120	50
	di-n-Butyl Amine	230	110
	tri-n-Butyl Amine	230	110
	Butylene	300	150
	Butyl Bromide	300	150
	Butyl Chloride	300	150
	n-Butyl Mercaptan	300	150
	Butyl Phenol	230	110
	Butyl Phthalate	150	65
	Butyraldehyde	212	100
	Butyric Acid	250	120
C	Calcium Bisulfate	300	150
	Calcium Bisulfide	300	150
	Calcium Carbonate	300	150
	Calcium Chlorate	300	150
	Calcium Chloride	300	150
	Calcium Hydroxide	300	150
	Calcium Hypochlorite	300	150
	Calcium Nitrate	300	150
	Calcium Oxide	275	135
	Calcium Sulfate	300	150
	Calcium Sulfide	250	120
	Caprylic Acid	212	100

Source: www.dupont.com. Rudolf Gutbrod GmbH has been a DuPont licensee in Germany since 1967

(continued)

Table 1 (continued)
Chemical compatibility – taking DuPont Teflon® ETFE as an example
(based on tests of representative materials and engineering judgment)

The data is based on long-term experience and the results from the development department and is not binding.

	Chemical	Maximum Use Temperature °F	°C
	Carbon Dioxide (Dry)	300	150
	Carbon Dioxide (Wet)	300	150
	Carbon Disulfide	150	65
	Carbon Monoxide	300	150
	Carbon Tetrachloride	150	65
	Carbonic Acid	300	150
	Castor Oil	300	150
	Caustic Potash (10 and 50%)	212	100
	Caustic Soda (10 and 50%)	212	100
	Cellosolve®	300	150
	Chloral Hydrate	212	100
	Chlorinated Brine	250	120
	Chlorinated Phenol	212	100
	Chlorine (Dry)	212	100
	Chlorine (Wet)	250	120
	Chlorine Dioxide	250	120
	Chloroacetic Acid (50% H_2O)	230	110
	Chlorobenzene	212	100
	Chlorobenzyl Chloride	150	65
	Chloroform	212	100
	Chlorohydrin (Liquid)	150	65
	Chlorosulphonic Acid	75	25
	Chromic Acid (50%)	150	65
	Chromic Chloride	212	100
	Chromyl Chloride	212	100
	Clorox Bleach Solution (5-1/2% Cl_2)	212	100
	Coal Gas	212	100
	Copper Chloride	300	150
	Copper Cyanide	300	150
	Copper Fluoride	300	150
	Copper Nitrate	300	150
	Copper Sulfate	300	150
	Cresol	275	135
	Cresylic Acid	275	135
	Crotonaldehyde	212	100
	Crude Oil	300	150
	Cyclohexane	300	150
	Cyclohexanol	250	120
	Cyclohexanone	300	150
D	DDT	212	100
	Decalin	250	120
	Decane	300	150
	Dextrin	300	150
	Diacetone Alcohol	212	100
	1,2-Dibromopropane	200	95
	Dibutyl Phthalate	150	65
	Dichloroacetic Acid	150	65
	o-Dichlorobenzene	150	65
	Dichloroethylene	150	65
	Dichloropropionic Acid	150	65
	Diesel Fuels	300	150
	Diethyl Benzene	275	135
	Diethyl Cellosolve	300	150
	Diethyl Ether	212	100
	Diethylamine	230	110
	Diethylene Triamine	212	100
	Diglycolic Acid	212	100
	Diisobutyl Ketone	230	110
	Diisobutylene	275	135
	Dimethyl Formamide	250	120
	Dimethyl Phthalate	212	100
	Dimethyl Sulfate	150	65
	Dimethyl Sulfoxide	212	100
	Dimethylamine	120	50
	Dimethylaniline	275	135
	Dioctyl Phthalate	150	65
	p-Dioxane	150	65
	Diphenyl Ether	175	80
	Divinyl Benzene	175	80
E	Epichlorhydrin	150	65
	Ethyl Acetate	150	65
	Ethyl Acrylate	212	100
	Ethyl Alcohol	300	150
	Ethyl Chloride	300	150
	Ethyl Chloroacetate	212	100
	Ethyl Cyanoacetate	212	100
	Ethylacetoacetate	150	65
	Ethylamine	100	40
	Ethylene Bromide	300	150
	Ethylene Chloride	300	150
	Ethylene Chlorohydrin	150	65
	Ethylene Diamine	120	50
	Ethylene Glycol	300	150
	Ethylene Oxide	230	110
F	Fatty Acids	300	150
	Ferric Chloride (50% in H_2O)	300	150
	Ferric Hydroxide	300	150
	Ferric Nitrate	300	150
	Ferric Sulfate	300	150
	Ferrous Chloride	300	150
	Ferrous Hydroxide	300	150
	Ferrous Nitrate	300	150
	Ferrous Sulfate	300	150
	Fluorine (Gaseous)	100	40
	Fluoroboric Acid	275	135
	Fluosilicic Acid	275	135
	Formaldehyde (37% in H_2O)	230	110
	Formic Acid	275	135
	FREON® 11	230	110
	FREON® 12	230	110
	FREON® 22	230	110
	Fuel Oil	300	150
	Fumaric Acid	200	95
	Furane	150	65
	Furfural	212	100
G	Gallic Acid	212	100
	Gas—Manufactured	300	150
	Gas—Natural	300	150
	Gasoline—Leaded	300	150
	Gasoline—Sour	300	150
	Gasoline—Unleaded	300	150

Source: www.dupont.com. Rudolf Gutbrod GmbH has been a DuPont licensee in Germany since 1967

(continued)

Table I (continued)
Chemical compatibility – taking DuPont Teflon® ETFE as an example
(based on tests of representative materials and engineering judgment)

The data is based on long-term experience and the results from the development department and is not binding.

	Chemical	Maximum Use Temperature °F	°C
	Glycerol	300	150
	Glycol	275	135
	Glycolic Acid	250	120
H	Heptane	300	150
	Hexane	300	150
	Hydrazine	100	40
	Hydrazine Dihydrochloride	125	50
	Hydriodic Acid	300	150
	Hydrobromic Acid (50%)	300	150
	Hydrochloric Acid (20%)	300	150
	Hydrochloric Acid (Conc.)	300	150
	Hydrochloric Acid (Gas)	300	150
	Hydrocyanic Acid	300	150
	Hydrofluoric Acid (35%)	275	135
	Hydrofluoric Acid (70%)	250	120
	Hydrofluoric Acid (100%)	230	110
	Hydrofluorosilicic Acid	300	150
	Hydrogen	300	150
	Hydrogen Cyanide	300	150
	Hydrogen Peroxide (30%)	250	120
	Hydrogen Peroxide (90%)	150	65
	Hydrogen Phosphide	150	65
	Hydrogen Sulfide (Dry)	300	150
	Hydrogen Sulfide (Wet)	300	150
	Hydroquinone	250	120
	Hypochlorous Acid	300	150
I	Inert Gases	300	150
	Iodine (Dry)	230	110
	Iodine (Wet)	230	110
	Iodoform	230	110
	Isobutyl Alcohol	275	135
	Isopropylamine	120	50
J	Jet Fuel—JP4	230	110
	Jet Fuel—JP5	230	110
L	Lactic Acid	250	120
	Lard Oil	300	150
	Lauric Acid	250	120
	Lauryl Chloride	275	135
	Lauryl Sulfate	250	120
	Lead Acetate	300	150
	Linoleic Acid	275	135
	Linseed Oil	300	150
	Lithium Bromide (Saturated)	250	120
	Lithium Hydroxide	300	150
	Lubricating Oil	300	150
M	Magnesium Carbonate	300	150
	Magnesium Chloride	300	150
	Magnesium Hydroxide	300	150
	Magnesium Nitrate	300	150
	Magnesium Sulfate	300	150
	Maleic Acid	275	135
	Maleic Anhydride	200	95
	Malic Acid	275	135
	Mercuric Chloride	275	135
	Mercuric Cyanide	275	135
	Mercuric Nitrate	275	135
	Mercury	275	135
	Methacrylic Acid	200	95
	Methane	250	120
	Methane Sulfonic Acid (50%)	230	110
	Methyl Alcohol	300	150
	n-Methylaniline	250	120
	Methyl Benzoate	250	120
	Methyl Bromide	300	150
	Methyl Cellosolve®	300	150
	Methyl Chloride	200	95
	Methyl Chloroform	150	65
	Methyl Chloromethyl Ether	175	80
	Methyl Cyanoacetate	175	80
	Methyl Ethyl Ketone	230	110
	Methyl Isobutyl Ketone	230	110
	Methyl Methacrylate	175	80
	Methyl Salicylate	200	95
	Methyl Sulfuric Acid	212	100
	Methyl Trichlorosilane	200	95
	Methylene Bromide	212	100
	Methylene Chloride	212	100
	Methylene Iodide	212	100
	Mineral Oil	300	150
	Monochlorobenzene	230	110
	Monoethanolamine	150	65
	Morpholine	150	65
N	Naphtha	300	150
	Naphthalene	300	150
	Nickel Chloride	300	150
	Nickel Nitrate	300	150
	Nickel Sulfate	300	150
	Nicotine	212	100
	Nicotinic Acid	250	120
	Nitric Acid (50%)	221	105
	Nitric Acid (Conc. 70%)	248	120
	Nitric Acid—Sulfuric Acid (50/50)	212	100
	Nitrobenzene	300	150
	Nitrogen Dioxide	212	100
	Nitrogen Gas	300	150
	Nitromethane	212	100
	Nitrous Acid	212	100
O	Octane	300	150
	Octene	300	150
	Oleic Acid	275	135
	Oleum	120	50
	Oxalic Acid	230	110
	Oxygen	300	150
	Ozone (<1% in Air)	212	100
P	Palmitic Acid	275	135
	Perchlorethylene	275	135
	Perchloric Acid (10%)	230	110
	Perchloric Acid (72%)	150	65
	Petrolatum	300	150

Source: www.dupont.com. Rudolf Gutbrod GmbH has been a DuPont licensee in Germany since 1967 (continued)

Table 1 (continued)

Chemical compatibility – taking DuPont Teflon® ETFE as an example
(based on tests of representative materials and engineering judgment)

The data is based on long-term experience and the results from the development department and is not binding.

Chemical	Maximum Use Temperature °F	Maximum Use Temperature °C
Petroleum	300	150
Petroleum Ether	212	100
Phenol (10%)	230	110
Phenol (100%)	212	100
Phenolsulfonic Acid	212	100
Phenylhydrazine	212	100
Phenylhydrazine Hydrochloride	212	100
o-Phenylphenol	212	100
Phosgene	212	100
Phosphoric Acid (30%)	300	150
Phosphoric Acid (85%)	275	135
Phosphorus Oxychloride	221	100
Phosphorus Pentachloride	212	100
Phosphorus Pentoxide	230	110
Phosphorus Trichloride	250	120
Phthalic Acid	212	100
Phthalic Anhydride	212	100
Picric Acid	125	50
Polyvinyl Acetate	300	150
Polyvinyl Alcohol	300	150
Potassium Aluminum Chloride	300	150
Potassium Aluminum Sulfate (50%)	300	150
Potassium Bicarbonate	300	150
Potassium Borate	300	150
Potassium Bromate	300	150
Potassium Bromide	300	150
Potassium Carbonate	300	150
Potassium Chlorate	300	150
Potassium Chloride	300	150
Potassium Chromate	300	150
Potassium Cyanide	300	150
Potassium Dichromate	300	150
Potassium Ferrocyanide	300	150
Potassium Fluoride	300	150
Potassium Hydroxide (50%)	212	100
Potassium Hypochlorite	275	135
Potassium Nitrate	300	150
Potassium Perborate	275	135
Potassium Perchlorate	212	100
Potassium Permanganate	300	150
Potassium Persulfate	150	65
Potassium Sulfate	300	150
Potassium Sulfide	300	150
Propane	275	135
Propionic Acid	212	100
Propyl Alcohol	300	150
Propylene Dibromide	212	100
Propylene Dichloride	212	100
Propylene Glycol Methyl Ether	212	100
Propylene Oxide	150	65
Pyridine	150	65
Pyrogallol	150	65
S		
Salicylaldehyde	212	100
Salicylic Acid	250	120
Salt Brine	300	150
Sea Water	300	150
Silicon Tetrachloride	250	120
Silver Chloride	300	150
Silver Cyanide	300	150
Silver Nitrate	300	150
Sodium Acetate	300	150
Sodium Benzene-Sulfonate	300	150
Sodium Benzoate	300	150
Sodium Bicarbonate	300	150
Sodium Bisulfate	300	150
Sodium Bisulfite	300	150
Sodium Borate	212	100
Sodium Bromide	300	150
Sodium Carbonate	300	150
Sodium Chlorate	300	150
Sodium Chloride	300	150
Sodium Chromate	300	150
Sodium Cyanide	300	150
Sodium Dichromate (Alkaline)	212	100
Sodium Ferricyanide	300	150
Sodium Ferrocyanide	300	150
Sodium Fluoride	300	150
Sodium Glutamate	275	135
Sodium Hydroxide (10%)	230	110
Sodium Hydroxide (50%)	230	110
Sodium Hypochlorite	300	150
Sodium Hyposulfite	300	150
Sodium Iodide	300	150
Sodium Lignosulfonate	300	150
Sodium Metasilicate	300	150
Sodium Nitrate	300	150
Sodium Nitrite	300	150
Sodium Perborate	212	100
Sodium Perchlorate	150	65
Sodium Peroxide	300	150
Sodium Persulfate	175	80
Sodium Phosphate	300	150
Sodium Silicate	300	150
Sodium Silicofluoride	300	150
Sodium Sulfate	300	150
Sodium Sulfide	300	150
Sodium Sulfite	300	150
Sodium Thiosulfate	300	150
Sorbic Acid	275	135
Sour Crude Oil	300	150
Stannic Chloride	300	150
Stannous Chloride	300	150
Stannous Fluoride	250	120
Stearic Acid	300	150
Stoddard's Solvent	275	135
Styrene Monomer	212	100
Succinic Acid	275	135
Sulfamic Acid	212	100
Sulfur (Molten)	250	120
Sulfur Dioxide	230	110
Sulfur Trioxide (Liquid)	75	25
Sulfuric Acid (60%)	300	150

Source: www.dupont.com. Rudolf Gutbrod GmbH has been a DuPont licensee in Germany since 1967

(continued)

Table 1 (continued)
Chemical compatibility – taking DuPont Teflon® ETFE as an example
(based on tests of representative materials and engineering judgment)

The data is based on long-term experience and the results from the development department and is not binding.

	Chemical	Maximum Use Temperature °F	°C
	Sulfuric Acid (Conc.)	300	150
	Sulfuric Acid (Fuming—Oleum)	120	50
	Sulfurous Acid	230	110
T	Tall Oil	300	150
	Tannic Acid	275	135
	Tartaric Acid	275	135
	2,3,4,6-Tetrachlorophenol	212	100
	Tetraethyl Lead	300	150
	Tetrahydrofuran	212	100
	Tetramethyl Ammonium Hydroxide (50%)	212	100
	Thionyl Chloride	212	100
	Tin Tetrachloride	230	110
	Titanium Dioxide	300	150
	Titanium Tetrachloride	212	100
	Toluene	250	120
	Tributyl Phosphate	150	65
	Trichloracetic Acid	212	100
	Trichloroethylene	275	135
	Trichloromethane	212	100
	2,4,5-Trichlorophenol	212	100
	Triethylamine	230	110
	Trisodium Phosphate	275	135
	Turpentine	275	135
U	UDMH-Hydrazine (50/50)	120	50
	Urea (50% H_2O)	275	135
V	Varsol	275	135
	Vinyl Acetate	275	135
	Vinyl Chloride (Monomer)	150	65
W	Water	300	150
	Water Sewage	275	135
	Wax	300	150
X	Xylene	250	120
Z	Zinc Acetate	250	120
	Zinc Chloride	300	150
	Zinc Hydrosulfite (10%)	250	120
	Zinc Nitrate	300	150
	Zinc Sulfate	300	150
	Zinc Sulfide	300	150
	PLATING SOLUTIONS		
	Brass	275	135
	Cadmium	275	135
	Chrome	275	135
	Copper	275	135
	Gold	275	135

Source: www.dupont.com. Rudolf Gutbrod GmbH has been a DuPont licensee in Germany since 1967

Representative Compatibility Data

The test results shown in **Table 2** represent the tensile strength, elongation and weight changes after exposures at indicated temperatures.

The test results confirm the chemical resistant properties of ETFE.

Table 2

Actual laboratory tests on chemical compatibility – taking DuPont Teflon® ETFE as an example - with representative chemicals

The data is based on long-term experience and the results from the development department and is not binding.

Chemical	Boiling Point °F	Boiling Point °C	Test Temperature °F	Test Temperature °C	Days	Retained Properties—% Tensile Strength	Retained Properties—% Elong.	Retained Properties—% Weight Gain
Acid/Anhydrides								
Acetic Acid (Glacial)	244	118	244	118	7	82	80	3.4
Acetic Anhydride	282	139	282	139	7	100	100	0
Trichloroacetic Acid	384	196	212	100	7	90	70	0
Aliphatic Hydrocarbons								
Mineral Oil	—	—	356	180	7	90	60	0
Naphtha	—	—	212	100	7	100	100	0.5
Aromatic Hydrocarbons								
Benzene	176	80	176	80	7	100	100	0
Toluene	230	110	230	110	7	—	—	—
Functional Aromatics								
O-Cresol	376	191	356	180	7	100	100	0
Amines								
Aniline	365	185	248	120	7	81	99	2.7
Aniline	365	185	248	120	30	93	82	—
Aniline	365	185	356	180	7	95	90	—
N,N-Dimethylaniline	374	190	248	120	7	82	97	—
N-Methylaniline	383	195	248	120	7	85	95	—
N-Methylaniline	383	195	248	120	30	100	100	—
n-Butylamine	172	78	172	78	7	71	73	4.4
Di-n-Butylamine	318	159	248	120	7	81	96	—
Di-n-Butylamine	318	159	248	120	30	100	100	—
Di-n-Butylamine	318	159	320	160	7	55	75	—
Tri-n-Butylamine	421	216	248	120	7	81	80	—
Tri-n-Butylamine	421	216	248	120	30	100	100	—
Pyridine	240	116	240	116	7	100	100	1.5
Chlorinated Solvents								
Carbon Tetrachloride	172	78	172	78	7	90	80	4.5
Chloroform	144	62	142	61	7	85	100	4.0
Dichloroethylene	170	77	90	32	7	95	100	2.8
FREON® 113	115	46	115	46	7	100	100	0.8
Methylene Chloride	104	40	104	40	7	85	85	0
Ethers								
Tetrahydrofuran	151	66	151	66	7	86	93	3.5
Aldehyde/Ketones								
Acetone	132	56	132	56	7	80	83	4.1
Acetophenone	394	201	356	180	7	80	80	1.5
Cyclohexanone	312	156	312	156	7	90	85	0
Methyl Ethyl Ketone	176	80	176	80	7	100	100	0

Source: www.dupont.com. Rudolf Gutbrod GmbH has been a DuPont licensee in Germany since 1967

Table 2 (continued)

Actual laboratory tests on chemical compatibility – taking DuPont Teflon® ETFE as an example - with representative chemicals

The data is based on long-term experience and the results from the development department and is not binding.

Chemical	Boiling Point °F	Boiling Point °C	Test Temperature °F	Test Temperature °C	Days	Retained Properties—% Tensile Strength	Retained Properties—% Elong.	Retained Properties—% Weight Gain
Esters								
n-Butyl Acetate	260	127	260	127	7	80	60	0
Ethyl Acetate	170	77	170	77	7	85	60	0
Polymer Solvents								
Dimethylformamide	309	154	194	90	7	100	100	1.5
Dimethylformamide	309	154	248	120	7	76	92	5.5
Dimethylsulfoxide	373	189	194	90	7	95	90	1.5
Other Organics								
Benzoyl Chloride	387	197	248	120	7	94	95	—
Benzoyl Chloride	387	197	248	120	30	100	100	—
Benzyl Alcohol	401	205	248	120	7	97	90	—
Decalin	374	190	248	120	7	89	95	—
Phthaloyl Chloride	529	276	248	120	30	100	100	—
Acids								
Aqua Regia	—	—	194	90	*	93	89	0.2
Chromic	257	125	257	125	7	66	25	—
Hydrobromic (Conc)	257	125	257	125	7	100	100	—
Hydrochloric (Conc)	223	106	73	23	7	100	90	0
Hydrochloric (Conc)	223	106	223	106	7	96	100	0.1
Hydrofluoric (Conc)	—	—	73	23	7	97	95	0.1
Nitric—25%	212	100	212	100	14	100	100	—
Nitric—50%	221	105	221	105	14	87	81	—
Nitric—70% (Conc)	248	120	73	23	105	100	100	0.5
Nitric—70% (Conc)	248	120	140	60	53	100	100	—
Nitric—70% (Conc)	248	120	248	120	2	72	91	—
Nitric—70% (Conc)	248	120	248	120	3	58	5	—
Nitric—70% (Conc)	248	120	248	120	7	0	0	—
Phosphoric (Conc)	—	—	212	100	7	—	—	—
Phosphoric (Conc)	—	—	248	120	7	94	93	0
Sulfuric (Conc)	—	—	212	100	7	100	100	0
Sulfuric (Conc)	—	—	248	120	7	98	95	0
Sulfuric (Conc)	—	—	302	150	*	98	90	0
Halogens								
Bromine (Anhy)	138	59	73	23	7	90	90	1.2
Bromine (Anhy)	138	59	135	57	7	99	100	—
Bromine (Anhy)	138	59	135	57	30	94	93	3.4
Chlorine (Anhy)	—	—	248	120	7	85	84	7
Bases								
Ammonium Hydroxide	—	—	150	66	7	97	97	0
Potassium Hydroxide (20%)	—	—	212	100	7	100	100	0
Sodium Hydroxide (50%)	—	—	248	120	7	94	80	0.2
Peroxides								
Hydrogen Peroxide (30%)	—	—	73	23	7	99	98	0

(continued)

*Exposed for 6 hours.

NOTES: Change in properties -15% is considered insignificant. Samples were 10–15 mil microtensile bars. TS/E and wt. gain determined within 24 hours after removal from exposure media.

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Table 2 (continued)

Actual laboratory tests on chemical compatibility – taking DuPont Teflon® ETFE as an example - with representative chemicals

The data is based on long-term experience and the results from the development department and is not binding.

Chemical	Boiling Point °F	Boiling Point °C	Test Temperature °F	Test Temperature °C	Days	Retained Properties—% Tensile Strength	Retained Properties—% Elong.	Retained Properties—% Weight Gain
Salt-Metal Etchants								
Ferric Chloride (25%)	220	104	212	100	7	95	95	0
Zinc Chloride (25%)	220	104	212	100	7	100	100	0
Other Inorganics								
Phosphoric Oxychloride	220	104	220	104	7	100	100	—
Phosphoric Trichloride	167	75	167	75	7	100	98	—
Silicon Tetrachloride	140	60	140	60	7	100	100	—
Sulfuryl Chloride	115	68	155	68	7	86	100	8
Water	212	100	212	100	7	100	100	0
Miscellaneous								
A-20 Stripper Solution	—	—	284	140	7	90	90	—
Aerosafe	—	—	300	149	7	92	93	3.9
Skydrol	—	—	300	149	7	100	95	3.0

*Exposed for 6 hours.

NOTES: Change in properties -15% is considered insignificant. Samples were 10–15 mil microtensile bars. TS/E and wt. gain determined within 24 hours after removal from exposure media.

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Benchmark for Surface Protection

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