HALAR® ECTFE

FLUOROPOLYMER

HALAR®
ECTFE

Chemical
Resistance
Data

Chemical Resistance Data

AUSIMONT
MONTEDISON GROUP

Introduction

What is HALAR® Fluoropolymer ?

HALAR ECTFE is essentially a 1:1 alternating copolymer of ethylene and chlorotrifluoro-ethylene. It contains about 80% by weight of chlorotrifluoro-ethylene, one of the most chemically resistant building blocks that can be used to make a polymer. CTFE homopolymers are difficult to fabricate into complex shapes. By copolymerization with ethylene, HALAR ECTFE was developed with the chemical resistance of CTFE based materials with easy processability.

Why is HALAR Fluoropolymer Used for Chemical Applications?

HALAR ECTFE, as the following data indicate, is one of the most chemically resistant polymers available today. This chemical resistance is due to the chemically resistant monomers used, the highly ordered 1:1 structure, and the high crystallinity of the resulting product.

In addition to its high degree of chemical resistance, HALAR possesses the following factors that make it suitable for demanding applications.

- Mechanically tough with excellent cut through and abrasion resistance
- Low cold flow
- High tensiles and elongation
- Excellent impact at room temperature and down into the cryogenic
- Dimensionally stable
- Continuous use to 300°F in many applications
- Excellent release properties
- Resistant to Cobalt-60 radiation
- High purity and does not contaminate high purity fluids
- Easily fabricated into complex shapes by normal melt processable techniques
- Extremely smooth surface

Known Factors Affecting Chemical Resistance

Chemical attack and chemical resistance are very complex phenomena. The known factors affecting chemical suitability of HALAR or any other plastic for a chemical application, not listed in order of priority , are as follows:

- Specific chemical or mixture composition
- Temperature and temperature variation
- Concentration of the attacking chemical which may be a complex completely different than the individual components
- Exotherm or heat of reaction or mixing
- Pressure, due primarily to the effect of pressure on concentration of a reactive gas
- Time of exposure
- Stress levels
- Velocity
- Suspended solids
- Thickness
- EMF potential of the supporting metal compared to the ground potential

Other factors probably exist but the above are the existing known factors.

Recommended Procedure to Determine Suitability

The recommended procedure to determine suitability of HALAR is as follows:

- Determine as accurately as possible the chemicals in the stream in question.
- Determine the maximum temperature and the normal operating temperature
- Review the maximum recommended temperature from the list provided.

The effect of synergism or reaction or complex formation with mixtures cannot be predicted by the table. In any case, appropriate chemical resistance tests using a representative sample of the stream should be performed.

HALAR® 300 Chemical Compatibility Data Based on Actual Laboratory Tests
All specimens tested for 30 days chemical immersion at specified temperatures

Chemical Name	Test Temp. °C	Retained Properties			Color Change
		Tensile Strength	Elongation	Weight Gain, %	
Acetic Acid	140	I	I	3.4	1
Acetone	100	A	I	3.5	1
Acetone cyanohydrin	50	I	I	0.0	1
Acetonitrile	140	A	I	2.2	1
Acetophenone	75	I	I	3.9	1
Acrylic Acid	100	I	I	0.4	1
Aluminum Chloride 50%	100	I	I	0.0	2
Anisole *	50	I	I	3.9	1
Ammonium Hydroxide 30%	140	I	I	1.2	2
Amyl Acetate, 99% *	50	I	I	4.7	1
Aniline	100	I	I	2.5	3
Benzaldehyde	100	A	I	5.4	2
Benzene	66	A	I	4.2	1
Benzyl Chloride, 97% *	50	I	I	2.3	1
Benzyl Alcohol	121	I	I	1.6	1
Butanol n,	121	I	I	1.9	1
Butyl Acrylate *	50	I	I	4.4	1

LEGEND

RETAINED PROPERTIES: **I** –Insignificant **A** –Reduced 25-50% **B** –Reduced 50-75% **C** –Reduced >75%

COLOR CHANGE: **1** – no change **2**- any shade of tan **3**- brown or black

* -tested for 28 days; all others tested at 30 days. Values are comparable.

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Chemical Name	Test Temp. °C	Retained Properties: Tensile Strength	Retained Properties: Elongation	Retained Properties: Weight Gain, %	Color Change
Butyl Acetate	50	A	I	3.8	1
Butylaldehyde*	50	I	I	2.8	1
Butyl Amine *	50	A	I	8.7	4
Butyl Lactate *	50	I	I	0.5	1
Butyl Phthalate	100	I	I	2.4	1
Calcium Chloride 20%	160	I	A	0.0	1
Calcium Hydroxide, 0.5%	140	I	I	0.3	2
Cellosolv Acetate	100	I	I	4.6	1
Chlorine water, sat.	121	I	I	3.5	2
Chloroacetic acid, 50%	100	I	I	0.3	3
Chlorobenzene	50	I	I	4.8	1
Chlorosulfonic acid	50	I	I	4.3	3
Chlorotoluene a,	50	I	I	2.9	2
Chromic Acid, 30%	100	I	I	0.0	2
Chromic Acid, 30%	140	A	I	0.0	3
Cresol o,	100	I	I	3.3	1
Cyclohexane	100	A	I	5.0	1

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Chemical Name	Test Temp. °C	Retained Properties: Tensile Strength	Retained Properties: Elongation	Retained Properties: Weight Gain, %	Color Change
Cyclohexanone	75	I	I	5.7	1
Cyclohexylamine *	50	I	I	2.3	3
Dexron II (Auto Trans Fluid)	150	I	I	1.1	1
Dibutyl Sebacate	100	I	I	2.4	1
Dibutyl Phthalate *	50	I	I	0.1	1
Diethyl Phthalate *	50	I	I	0.08	1
Dichlorobenzene o,	50	I	I	5.6	1
Dichloroethane	20	I	I	4.7	1
Dichloroethylene	50	A	I	4.9	1
Dichloroethylene 1,2	20	I	I	1.8	1
Dichloropropane	100	I	I	6.4	1
Dichlorotoluene a,a	121	I	I	10.5	1
Diethylamine *	50	I	I	4.3	3
N, N Diethylethanolamine *	50	I	I	0.2	1
Diethyl Hydroxy Amine, 85%	30	I	I	0.0	1
Diethylene glycol butyl ether acetate *	50	I	I	0.5	1
Diethylene glycol meno butyl ether *	50	I	I	0.2	1

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Chemical Name	Test Temp. °C	Retained Properties (%) Tensile Strength	Retained Properties (%) Elongation	Weight Gain, %	Color Change
Diethylene Triamine	50	I	I	0.2	2
Diisobutyl Ketone *	50	I	I	1.1	1
Diisopropyl Acetate *	20	I	I	0.2	1
Diisopropyl Ketone	100	I	I	6.5	1
Dimethyl Acetamide N,N	100	I	I	5.9	2
Dimethyl Formamide N,N	100	I	I	4.8	2
Dimethyl Phthalate	100	I	I	2.5	2
Dimethyl Sulfoxide	100	I	I	1.9	1
Dimethylamine	20	I	I	1.9	1
Dioctyl Phthalate	50	I	I	0.2	1
Dioxane 1,4-	50	I	I	4.7	1
Dioxane 2,4	100	A	I	5.7	1
Dipropylene glycol methyl ether *	50	I	I	0.2	1
Ethanol	140	I	I	1.6	1
Ether *	50	I	I	3.5	1
2 Ethoxy-ethanol, 99% *	50	I	I	0.4	1
Ethyl Acetate	50	I	I	3.4	1

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HALAR® 300 Chemical Compatibility Data Based on Actual Laboratory Tests
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Chemical Name	Test Temp. °C	Retained Properties (%)			Color Change
		Tensile Strength	Elongation	Weight Gain, %	
Ethyl Acrylate	100	I	I	6.4	1
Ethyl Formate	100	I	I	3.8	1
Ethylacetate	75	A	I	3.4	1
Ethylacrylate	75	A	I	3.6	1
Ethylene Glycol	100	I	I	0.4	1
Ethylenediamine	20	I	I	0.3	2
Ferric Chloride 55%	100	I	I	-0.1	1
Fluoroboric Acid, 10%	100	I	I	0.1	1
Formaldehyde, 37%	80	I	I	0.6	1
Fuming Sulfuric Acid	50	I	I	1.4	3
Furfural	100	I	I	4.0	3
Hexane	149	A	I	2.7	2
Hydrochloric acid, 37%	100	I	I	0.7	3
Hydrofluoric acid, 37%	121	I	I	0.9	2
Hydrofluoric acid, 49%	100	I	I	0.2	2
Hydrofluoric acid, 70% HF	50	I	A	0.1	2
Hydrogen Peroxide (60%)	30	I	I	0.3	1

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		Retained Properties (%)			
Chemical Name	Test Temp. °C	Tensile Strength	Elongation	Weight Gain, %	Color Change
4-Hydroxybenzene sulfonic acid *	70	I	I	0.1	2
Isopentyl Alcohol	100	A	I	1.5	2
Isophorone *	50	I	I	0.5	1
Lithium Hydroxide	100	I	I	0.0	1
Methane Sulfuric Acid, 50%	66	I	I	0.0	1
Methanol	50	I	I	0.4	1
Methanol	140	B	B	1.6	2
5-Methyl-2-hexanone *	50	I	I	4.1	1
Methyl Acetate *	50	I	I	5.8	1
Methyl Acrylate *	50	I	I	5.5	1
Methyl Cellosolv	140	I	I	2.4	1
Methyl Ethyl Ketone	100	I	I	6.1	1
Methyl Formate	100	A	I	5.5	1
Methyl Isobutyl Ketone	100	I	I	5.7	1
Methyl Methacrylate	50	I	I	3.7	1
N-Methylpyrrolidinone	20	I	I	1.5	1
1-methyl-2-pyrrolidinone	20	I	I	0.3	1
Methylene Chloride	50	I	I	4.1	1

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Mesityloxide *	50	I	I	4.5	2
N,N-Dimethyldodecylamine	75	I	I	0.5	1
Napthalene	121	I	I	8.8	1
Nitric Acid, 10%	121	I	I	0.4	1
Nitric Acid, 50%	50	I	I	0.1	1
Nitric Acid, 90%	71	I	I	2.3	2
Nonyl Phenol *	50	I	I	0.1	1
2-Octanol	50	I	I	0.2	1
Oleum 30% in Sulfuric Acid	20	I	I	0.4	1
Oleum 30% in Sulfuric Acid	50	A	B	3.4	3
Pentanedione 2,4	100	I	I	6.3	1
Pentyl Acetate	50	I	I	3.9	1
Phenol	50	I	I	0.1	1
Phosphoric Acid, 30%	100	I	I	0.1	1
Phosphoric Acid, 85%	140	I	I	-0.1	2
Phosphorous Oxychloride	50	I	I	12.8	1
Potassium Carbonate, 53.2%	140	I	I	-0.1	2
Potassium Carbonate, 53.2% sat.	100	I	I	-0.1	1

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		Tensile Strength	Elongation	Weight Change	
Potassium Hydroxide, 50%	121	I	I	-0.1	2
Potassium Hydroxide, 50%	140	C	C	-0.2	3
Propanol *	50	I	I	0.16	1
Propyl Acetate	50	I	I	3.6	1
Sodium Carbonate, 33.7% sat.	100	I	I	0.0	1
Sodium Chlorite, 45.9% sat.	100	I	I	0.1	1
Sodium Hydrosulfide, 50%	140	I	I	0.0	2
Sodium Hydroxide, 50%	132	I	I	-0.2	2
Sodium Hypochlorite, 12.5-15.5%	45	I	I	0.1	1
Sodium Hypochlorite, 5%	121	I	I	0.1	1
Stearoyl Chloride	125	A	A	2.0	3
Sulfuric Acid, 98%	121	I	I	0.7	3
Sulfuric Acid, 98%	150	A	B	1.7	3
Tetrachloroethylene	50	I	I	7.9	1
Tetrahydrofuran	50	A	I	4.3	1
Tetramethyl Ammonium Hydroxide	100	I	I	0.6	2
Thionyl Choride *	50	A	I	12.9	2

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Chemical Name	Test Temp. °C	Retained Properties (%) Tensile Strength	Elongation	Weight Change	Color Change
p-Toluenesulfonic acid (sol. sat.) *	70	I	I	0.0	1
Toluene	20	I	I	0.7	1
Toluene	50	A	I	3.8	1
Tributyl Phosphate *	50	I	I	0.12	1
Trichlorobenzene	50	I	I	4.0	1
Trichloroethylene 1,1,1	20	I	I	0.3	1
Trichloroethylene and nitric acid *	50	I	I	4.6	2
Trichloroethylene in methanol *	50	I	I	0.5	1
Triethylamine *	50	I	I	0.93	2
Tricresyl Phosphate	100	I	I	0.3	1
Triethyl Phosphate	100	I	I	4.5	1
Triethylene Tetramine	50	I	I	0.0	2
Vinyl Acetate	50	I	I	3.1	1
Water	140	I	I	0.6	2
Xylene	50	I	I	3.4	1

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For further information on HALAR® Fluoropolymer or any other Ausimont product, please contact one of the offices below. A list of worldwide offices is available.

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