INCHEMREZ Phenoxy PKFE® Resin For Molding and Extrusion

INCHEMREZ® Phenoxy PKFE resin has the highest molecular weight and lowest residual volatiles of any commercially available Phenoxy resins. In addition, it offers the following advantages:

- Phenoxy PKFE has good compatibility with many polymers. With a solubility parameter of 10.676, it is most compatible with polar materials and surfaces and is generally incompatible with acrylics and vinyls.
- An amorphous polymer that will not crystallize or build up stress concentrations.
- No additives and a low order of residual solvents, monomers, and low molecular weight extractables.
- Good thermal stability, allowing high-temperature and high-speed processing.
- Does not require chemical conversion that might cause shrinkage, induce stress, or produce undesirable by-products.

INCHEM CORPORATION · 800 CEL-RIVER · ROCK HILL, SC 29730

Resin Properties

Tables 1 to 6 give data of Phenoxy PKFE in solution, mechanical, thermal, electrical and miscellaneous properties.

Table 1 · Typical Properties of INCHEMREZ Phenoxy PKFE®

	Range	
Properties		
Specific Gravity	1.17	1.19
Melt Index(1),g/10min	2.0	3.0
Viscosity at 25°C, cP		
In MEK(2)	7500	10,000
In Cyclohexanone(3)	600	895
Color(3) (Pt-Co), max.	-	200
Solution Haze(3),%, max.	-	15
Nonvolatiles(4),%	99.0	99.8

(1) 220°C at 44 psi
(2) 40% solution
(3) 20% solution
(4) 80°C/3 hr + 220°C/1 hr

Table 2 · Fabrication-Related Properties of INCHEMREZ Phenoxy PKFE®

Properties		**ASTM Test Method**
Bulk Factor	1.71	D1182
in^3/lb	23.4	
g/in^3	19.4	
Molding Shrinkage, in/in	0.003-0.004	D955

Table 3 · Mechanical Properties[1] of INCHEMREZ Phenoxy PKFE®

Properties		ASTM Test Method
Izod Impact Strength[2], ft-lb notch	2.5	D256
Charpy Impact Strength, ft-lb/in width		D256
73°F	No Break	
-40°F	No Break	
Tensile Strength[3], psi		D638
Ultimate	9500	
Yield	9000	
Elongation, %		D638
Ultimate	90	
Yield	3.5	
Modulus of Elasticity, psi		
in Tension	380,000	D638
in Flexure	410,000	D790
Flexural Strength[4], psi	14,000	D790
Compressive Yield Stress[5], psi		D695
1% Deflection	2700	
Maximum Yield	12,000	
Modulus	325,000	
Strain at Yield, %	9	
Poisson's Ratio	0.38	

(1) All values at 73°F unless otherwise noted
(2) Milled notch, $^1/_8$-in x $^1/_2$-in x $2^1/_2$-in bar
(3) $^1/_8$-in bar
(4) $^1/_4$-in x $^1/_2$-in x 5-in bar
5) 1-in x 1-in x 1-in bar

Table 4 · Thermal Properties of INCHEMREZ Phenoxy PKFE®

Properties		ASTM Test Method
Heat Distortion Temperature[1], °F		D648
at 264 psi	188.4	
at 66 psi	196.1	
Coefficient of Linear Thermal Expansion, in/in/°F		
-22°F to 86°F	3.2×10^{-5}	
86°F to 140°F	3.8×10^{-5}	

(1) $^1/_4$-in x $^1/_2$-in x 5-in bar

Table 5 · Electrical Properties[(1)] of INCHEMREZ Phenoxy PKFE®

Properties		ASTM Test Method
Dielectric Strength[(2)], volts/mil		D149
Short-time	520	
Step-by-step	490	
Volume Resistivity, ohm-cm	>5 x 10^{13}	D257
Dielectric Constant		D150
60 cycles	4.1	
10^3 cycles	4.1	
10^6 cycles	3.8	
Dissipation (Power) Factor		D150
60 cycles	0.0012	
10^3 cycles	0.002	
10^6 cycles	0.03	

(1) All values at 73°F unless otherwise noted
(2) $^1/_8$-in sheet

Table 6 · Miscellaneous Properties[(1)] of INCHEMREZ Phenoxy PKFE®

Properties		ASTM Test Method
Rockwell Hardness, R Scale	123	D785
Water Absorption, Wt Gain, %		D570
24-hr Immersion	0.13	
Equilibrium	1.5	
Dimensional change in Water, in/in		
3 mo at R.T.	0.0025	
Color	Transparent to Light Amber	
Index of Refraction[(2)], nD	1.5978 ± 0.0005	

(1) All values at 73°F unless otherwise noted
(2) 77°F

Gas Permeability and Vapor Transmission

The overall gas barrier properties of Phenoxy PKFE are superior to those of any other commercially available injection-moldable plastic. In oxygen barrier tests, Phenoxy PKFE exhibits 15-20 times lower permeability than high-density polyethylene or polypropylene. Its moisture barrier properties are about equivalent to rigid, unplasticized polyvinyl chloride. Low gas permeability and low moisture vapor transmission make Phenoxy PKFE an excellent candidate for critical co-extrusion packaging applications.

Table 7 compares the permeability properties of Phenoxy PKFE with other packaging resins.

Table 7 · Permeability Properties[(1)]

Properties	Phenoxy PKFE	High-Density Poly-ethylene	Cellulose Acetate Butyrate	Crystal Poly-styrene
Moisture Vapor Transmission, g/mil/ 100 in^2/24 hr	3.5	<1.0	80-110	6-8
O_2 Permeability, cc/mil/100 in^2/24 hr	5.8	100-150	>1000	200-300
CO_2 Permeability, cc/mil/100 in^2/24 hr	15-30	500-700	>1000	1100-1800

(1) 1-mil free films, 25°C

Chemical Resistance

Phenoxy PKFE has excellent resistance to mineral acids, alkalis, aliphatic hydrocarbons, water, and mineral salt solutions. Its resistance to most aromatic and polar solvents and esters is generally poor. Table 8 presents chemical resistance data obtained in accelerated tests and can be used as a guide. However, where extremely high stresses are encountered, molded parts should be tested under specific use conditions.

Table 8 · Chemical Resistance of INCHEMREZ Phenoxy PKFE® Films[(1)]

Resistant to	Attacked or Softened by
Sodium Hydroxide, 20% & 40%	Most Esters
Ammonium Hydroxide, 24%	Ketones
Sulfuric Acid, 5% & 50%	Aromatic Hydrocarbons
Sodium Chloride, 10%	Chlorinated Hydrocarbons
Gylcerine	Concentrated Acetic Acid
Corn Oil	
Motor Oil	
"Tide" Solution, 8%	
Crude Oil	
Water	

(1) Immersion for 7 days, zero strain

Molding and Extrusion

The unique combination of properties and compatibility with polyesters of Phenoxy PKFE is especially desirable in injection molding and film extrusion applications. Useful blends for molding and film extrusion can be made with polyesters (PET, PBT) and for molding with talc-filled polypropylene.

Injection Molding

Phenoxy PKFE is particularly well-suited for molded parts that have critical requirements in terms of molding tolerances, dimensional stability, creep resistance, chemical resistance, and gas permeability.

Phenoxy PKFE and its blends provide the following advantages for injection molders:

- Improved mechanical performance because of better pigment and filler wetting.
- Improved printability, dyeability, and adhesion.
- Control of crystallinity kinetics during fabrication.
- Control of heat distortion temperature.
- Improved thermal stability.

Extrusion

For multilayer film extrusion, the use of Phenoxy PKFE and its blends provides a number of product performance advantages:

- Good mechanical properties, e.g., strength and ductility.
- Improved heat resistance for flexible packaging.
- Heat sealability.
- Good adhesion to polar polymers and paper.
- Good barrier properties, especially low oxygen permeability.
- Outstanding resistance to oils.
- Low order of extractables, odor, and taste.

Suggested Processing Conditions

Drying Recommendations

Phenoxy PKFE is delivered as dry pellets in protective bags and is suitable for molding as received. Exposure to high atmospheric humidity for several hours, however, may result in moldings having a splashed surface or in extrusion having fish eyes surface defects. Therefore, when parts show evidence of water, melt temperatures should be reduced to below 260°C (500°F) and mold temperatures raised. If this does not eliminate splash, the resin should be dried in a hopper dryer set at 70°C (160°F). Oven drying for two hours at 70°C (160°F) will also give satisfactory results.

Injection Molding

Phenoxy PKFE is easily injection molded at material temperatures from 220 (425°F) to 260°C (500°F) with cylinder pressures of 10,000 to 15,000 psi.

Extrusion

For extrusion, melt temperatures of 200°C (390°F) to 230°C (450°F) are recommended, depending on the gauge and shape being formed and on the take-off rate. A general purpose polystyrene screw profile is satisfactory for Phenoxy PKFE resin.

Shipping and Storage

INCHEMREZ Phenoxy PKFE is shipped in 5-ply multi-wall bags containing 25 kg net weight. It may be stored indefinitely under normal conditions without appreciable change in properties. Storage in a cool place in properly sealed containers is recommended.

Product Safety

When considering the use of Phenoxy PKFE in a particular application, you should review our latest Material Safety Data Sheet and ensure that the use you intend can be accomplished safely. For Material Safety Data Sheets and other product safety information, contact InChem office at 800 Cel-River Road, Rock Hill, SC 29730.

Further Information

For information on prices, delivery, and service, phone **1-803-328-3825** or our distributors near your location.

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