

# FLUOROPOLYMER SPEC CHART

## Property Comparison of Various Fluoropolymers

Property	ASTM test method/test condition	PTFE	PFA	FEP	ETFE	CTFE
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### Physical Properties

Specific gravity	D792 D570/24 hrs 1/2"t	2.13~2.22	2.12~2.17	2.12~2.17	1.70~1.76	2.10~2.18
Water absorption (%)		<0.00	<0.03	<0.01	<0.1	<0.00
Mold shrinkage (cm/cm)		0.02 ~0.05	0.04	0.03~0.06	0.03~0.04	0.015~0.020
Contact angle (degree)	Angle to level	110	115	115	96	84

### Thermal Properties

Thermal conductivity (cal/sec/cm)	C177	$6 \times 10^{-4}$	—	$6 \times 10^{-4}$	$5.7 \times 10^{-4}$	$4.7 \sim 5.3 \times 10^{-4}$
Coefficient of linear thermal expansion (1/°C)	D696/23~60°C	$10 \times 10^{-5}$	$12 \times 10^{-5}$	$8.3 \sim 10.5 \times 10^{-5}$	$5 \sim 9 \times 10^{-5}$	$4.5 \sim 7.0 \times 10^{-5}$
Melting point (°C)		327	302~310	270	260	210~212
Melt viscosity (coise)		$10^{-11} \sim 10^{-13}$ (340-380°C)	$10^{-4} \sim 10^{-5}$ (380°C)	$4 \times 10^{-4} \sim 10^{-5}$ (380°C)	$10^{-4} \sim 10^{-5}$ (300-330°C)	$10^{-7}$ (23°C)
Maximum temp. for continuous use (°C/°F)		260/500	260/500	200/392	150/302	120/248

### Mechanical Properties

Tensile strength (kgf/cm <sup>2</sup> )	D638/23°C	140~350	280~315	190~220	410~470	320~420
Elongation (%)	D638/23°C	200~400	280~300	250~330	420~440	80~250
Compression strength (kgf/cm <sup>2</sup> )	D695/1% deformation, 25°C	50~60	50~60	50~60	109	90~120
Tensile modulus (kgf/cm <sup>2</sup> )	D638/23°C	4,000	—	3,500	5,000~8,000	10,500~21,000
Hexural Modulus (kgf/cm <sup>2</sup> )	D790/23°C	5,000~6,000	6,600~7,000	5,500~6,500	9,000~14,000	13,000~18,000

Impact strength (ft-lb/in)	D256/23°C Izod	3.0	—	No breakdown	No breakdown	2.5~2.7
Hardness (Shore)	Durometer	D50~D65	D60	D55	D75	D90
Deformation under load (%)	D621/100°C 70 kgf/cm <sup>2</sup> , 24 hrs D621/25°C 140 kgf/cm <sup>2</sup> , 24 hrs	5.0	2.4	5.0	5.4	2.6
		7.0	2.7	3.0	2.3	0.2
Static friction coefficient	Coated steel surface	0.20	0.50	0.50	0.60	0.80

## Electrical Properties

Dielectric constant	D150/10 <sup>3</sup> Hz	2.1	2.1	2.1	2.6	2.3~2.7
	D150/10 <sup>8</sup> Hz	2.1	2.1	2.1	2.6	2.3~2.5
Dielectric dissipation factor	D150/10 <sup>3</sup> Hz	<1 X 10 <sup>-5</sup>	1 X 10 <sup>-5</sup>	6 X 10 <sup>-5</sup>	8 X 10 <sup>-4</sup>	(2.3~2.7) X 10 <sup>-2</sup>
	D150/10 <sup>8</sup> Hz	2 X 10 <sup>-5</sup>	3 X 10 <sup>-5</sup>	5 X 10 <sup>-5</sup>	5 X 10 <sup>-3</sup>	1 X 10 <sup>-2</sup>
Dielectric breakdown strength (V/ml)	D149/Short time, 1/8 in	480	500	500~600	400	500
Volume resistivity (ohm-cm)	D257	>10 <sup>-18</sup>	>10 <sup>-18</sup>	>10 <sup>-18</sup>	>10 <sup>-18</sup>	>10 <sup>-18</sup>
Chemical resistance		Excellent	Excellent	Excellent	Excellent	Excellent
Weatherability		Excellent	Excellent	Excellent	Excellent	Excellent
Combustibility (%)	D2863/Oxygen concentration index	>95	>95	>95	>31	>95

## Typical Filler Properties

Filler	Physical Form	Amount (% Weight)	Effect of Filler
Glass Fibers	Milled Fibers	up to 40% (also in combination with graphite, MoS2 and carbon)	<ul style="list-style-type: none"> <li>increased compressive strength</li> <li>increased rigidity</li> <li>increased wear resistance</li> <li>reduced cold flow</li> <li>resistant to organic solvent</li> </ul>
Carbon	Powder	up to 25% (also in combination with graphite, bronze, and glass)	<ul style="list-style-type: none"> <li>increased comprehensive strength</li> <li>increased hardness</li> <li>increased wear resistance</li> <li>improved thermal conductivity</li> </ul>
Carbon Fibers	Milled Fibers	up to 30%	<ul style="list-style-type: none"> <li>good dry running properties</li> <li>electrically conductive at</li> </ul>

Graphite			<ul style="list-style-type: none"> <li>higher filler contents</li> <li>resistant to hydrofluoric acid</li> </ul>
	Powder	up to 25% (also in combination with glass, bronze, and carbon)	<ul style="list-style-type: none"> <li>improved sliding properties</li> <li>reduced coefficient of friction</li> <li>improved thermal conductivity</li> </ul>
Bronze			<ul style="list-style-type: none"> <li>increased comprehensive strength</li> <li>increased hardness</li> <li>increased wear resistance</li> <li>improved thermal conductivity</li> <li>reduced cold flow</li> </ul>
	Powder	up to 60% (also in combination with carbon, graphite, and MoS2))	
Molybdenum disulphide (MoS2)			<ul style="list-style-type: none"> <li>improved sliding properties</li> <li>increased wear resistance</li> </ul>
	Powder	up to 5% (also in combination with glass and bronze)	
Stainless Steel			<ul style="list-style-type: none"> <li>improved thermal conductivity</li> <li>reduced cold flow</li> <li>resistant to most chemicals</li> </ul>
	Powder	up to 60%	
Pigments			<ul style="list-style-type: none"> <li>for coloring (identification)</li> </ul>
	Powder	up to 2%	

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