Tetramer Optical Polymers

Tetramer Technologies, L.L.C.
657 S. Mechanic Street,
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PERFLUOROCYCLOBUTYL (PFCB) POLYMER & COPOLYMER

Polymer	Condition or Property	Controlled Range
Thermoplastic Polymer (solid or solution)	Number average molecular weight (M_n, GPC)	20,000 - 40,000
	Refractive Index (1550nm)	1.442 - 1.505
	Glass Transition Temperature (°C, DSC)	110 - 155
	Thermal Decomposition Temperature (°C, TGA)	> 450
	Typical solvents	Mesitylene, THF, Cyclopentanone
Polymer Solution	Solid content (wt %)	50 - 90
	Solution viscosity (Pa·s, RMS)	0.02 - 100
	Number average molecular weight (M_n, GPC)	1,200 - 30,000
	Cure temperature (°C) / time (h)	220 / 2
	Single spin coat thickness (μm)	1 - 20
	Patterning Technique	Micromolding or RIE
	Loss (dB/cm, 1550 nm)	< 0.25
	Birefringence ($\eta_{TE} - \eta_{TM}$)	< 0.003
	Refractive index (1550 nm)	1.442 - 1.505
	Thermal Decomposition Temperature (°C, TGA)	> 450 (Fully cured sample)
	Glass Transition Temperature (°C, DSC)	110 - 350
	dn/dT (1550nm)	-7×10^{-5} ~ -1.5×10^{-4}
	Typical solvents	Mesitylene, Cyclopentanone (others on request)
	Cleaning solvents	Acetone, Hexane
Solventless Prepolymer	Synthesis on request	
Electro-optic Polymer	Synthesis on request (containing polyene, CLD chromophore, etc)	

* Customer requested polymers are at negotiated price.
* Monomers are available at our distributor **Oakwood Products, Inc.** at *www.oakwoodchemical.com*

References:
1. Smith, Jr. D. W.; Chen, S.; Kumar, S. M.; Ballato, J.; Topping. C.; Foulger, S. H. *Adv. Mater*. **2002**, *14*, 1585-1589.
2. Smith, Jr., D.W.; Babb, D.; Shah, H.; Hoeglund, A.; Traiphol, R.; Perahia, D.; Boone, H.; Langhoff, C.; Radler, M. *J. Fluorine Chem*. **2000**, *104*, 109-117.
3. Smith, Jr. D. W.; Babb, D. A.; *Macromolecules* **1996**, *29*, 852-860.

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OTHER SELECTED PROPERTIES OF PFCB POLYMER

Properties	Triphenyl Ethane PFCB Thermoset	Biphenyl PFCB Thermoplastic
Dielectric Constant (10 kHz)	2.45	2.41
Dissipation Factor (10 kHz)	0.0004	0.0003
% Water Absorption (24 hr)	0.021	0.040
Tensile Strength MPa (psi)	66.0 ± 1.4 (9,600 ± 203)	50.3 ± 1.4 (7,300 ± 203)
Tensile Modulus MPa (psi)	2,270 ± 79 (329,000 ± 11,450)	1,770 ± 79 (246,000 ± 11,460)
Flexural Strength MPa (psi)	74 ± 12 (10,700 ± 1800)	92.4 ± 2.1 (13,400 ± 304)
Flexural Modulus MPa (psi)	2,320 ± 13 336,400 ± 1,900	1,779 ± 85 258,000 ± 12,385
Percent Elongation (Break)	4.1	12.5
Limiting Oxygen Index (LOI)	0.47	0.419
Critical Surface Tension (dynes/cm)	27.6	-

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References:
1. Babb, D. A.; Snelgrove, R. V.; Smith, Jr., D. W.; Mudrich, S. F.; *"Step-Growth Polymer for High Performance Materials: New Synthetic Methods"* Eds Hedrick, J. L. & Labadie, J. W., ACS Symposium Series 624, ACS, Washington DC, **1996**, p.432.