

Material Properties Guide



Advanced Composite Manufacturing for Your Critical Applications

Collaborative Engineering • Injection Molding of High Temperature Thermoplastics

Automated Thermoplastic Composite Processing

In-House Mold Design & Tool Making • Multi-Axis Machining • Bonding & Assembly

ISO 9001:2008 / AS9100 / NADCAP

www.trimack.com

Polyimide (PI)

SUPPLIER AND TRADENAME	DESIGNATION	FILLER	SPECIFIC GRAVITY ⁽¹⁸⁾	TENSILE STRENGTH ⁽¹⁶⁾ (73°F) (P.S.I.)	TENSILE STRENGTH AT HIGH TEMPERATURE ⁽¹⁶⁾ (P.S.I.)	TENSILE ELONGATION ⁽¹⁶⁾ (73°F) (%)	TENSILE MODULUS ⁽¹⁶⁾ (73°F) (P.S.I. × 10 ³)	COMPRESSIVE STRENGTH ⁽¹⁶⁾ (P.S.I.)	COMPRESSIVE MODULUS ⁽¹⁶⁾ (P.S.I. × 10 ³)	FLEXURAL STRENGTH ⁽¹⁶⁾ (73°F) (P.S.I.)	FLEXURAL MODULUS ⁽¹⁶⁾ (73°F) (P.S.I. × 10 ³)	NOTCHED IZOD IMPACT STRENGTH ⁽¹⁷⁾ (ft-lb/in)	UNNOTCHED IZOD IMPACT STRENGTH ⁽¹⁷⁾ (ft-lb/in)	HEAT DEFLECTION TEMPERATURE ⁽¹⁸⁾ @ 64 P.S.I. (°F)	COEFFICIENT OF LINEAR THERMAL EXPANSION ⁽¹⁸⁾ (10 ⁻⁶ IN./IN. × °F)	HIGHEST CONTINUOUS USE TEMPERATURE RANGE ⁽¹⁶⁾ (°F)	RELATIVE WEAR CHARACTERISTICS (1 = EXCEPTIONAL; 5 = POOR)	RESISTANCE TO OILS, FUELS AND SOLVENTS TO 300°F ⁽¹⁶⁾ (1 = EXCEPTIONAL; 5 = POOR)
DUPONT (1) VESPEL®	SP-1	NONE	1.36	10,500	5,300 (500°F)	8.0	—	19,000	.35	14,000	0.36	1.5	30.0	680	28	500-550	2	1
DUPONT (1) VESPEL®	SP-21	15% GRAPHITE POWDER	1.43	9,000	4,400 (500°F)	6.0	—	16,000	.33	13,000	0.46	.8	8.0	680	23	500-550	1	1
DUPONT (1) VESPEL®	SP-22	40% GRAPHITE POWDER	1.46	7,000	3,800 (500°F)	2.5	—	14,000	.38	10,000	0.70	—	—	—	15	500-550	1	1
mitsui (21) AURUM®	PL-450	NONE	1.33	13,442	2,418 (482°F)	90.0	—	17,446	.31	20,200	.43	1.6	—	460	—	445-480	5	1
mitsui (21) AURUM®	JCN3030	CARBON FIBER	1.43	33,319	—	2.0	—	30,173	.57	46,618	.33	1.9	—	478	—	445-480	3	1
mitsui (21) AURUM®	JRF3025	PTFE GRAPHITE	1.40	13,156	—	6.0	—	—	—	14,157	.50	1.1	—	460	—	445-480	8	1

COMMENTS
HIGHEST CONTINUOUS USE TEMPERATURE RANGE; EXCELLENT BEARING RESISTANCE
POOR STEAM RESISTANCE

RELATIVELY NEW POLYIMIDE WITH GOOD MOLDABILITY

Polybenzimidazole (PBI)

HOECHST (22) CELAZOLE®	U-60	NONE	1.3	23,000	13,000 (600°F)	3.0	.95	58,000	.90	32,000	.95	.5	11	815	13	450-500	2	1
HOECHST (22) CELAZOLE®	TU-60	NONE	1.3	16,000	—	2.8	.70	30,000	.43	24,500	.81	—	—	491	19.1	450-500	2	1
HOECHST (22) CELAZOLE®	TF-60V	GLASS FIBER	1.5	26,300	—	1.9	1.9	32,000	.53	35,100	1.85	—	—	597	9.6	450-500	—	1
HOECHST (22) CELAZOLE®	TF-60C	CARBON FIBER	1.4	29,000	—	1.7	3.1	32,000	.55	46,000	2.90	—	—	619	14.7	450-500	—	1
HOECHST (22) CELAZOLE®	TL-60	—	1.4	16,300	—	1.2	2.3	32,000	.45	26,400	2.11	—	—	600	14.7	450-500	—	1

VERY HIGH TEMPERATURE RESISTANCE

Polyamide-imide (PAI)

AMOCO (2) TORLON®	4203L	NONE	1.42	27,800	9,500 (450°F)	15.0	.70	32,100	—	34,900	0.73	2.7	20.0	532	17	430-480	3	1
AMOCO (2) TORLON®	4301	12% GRAPHITE POWDER +3% P.T.F.E.	1.46	23,700	10,600 (450°F)	7.0	.95	24,100	.77	31,200	1.00	1.2	7.6	534	14	430-480	2	1
AMOCO (2) TORLON®	4275	20% GRAPHITE POWDER +3% P.T.F.E.	1.51	22,000	8,100 (450°F)	7.0	1.13	17,800	.58	30,200	1.06	1.6	4.7	536	14	430-480	2	1
AMOCO (2) TORLON®	5030	30% GLASS FIBER +1% P.T.F.E.	1.61	29,700	16,300 (450°F)	7.0	1.56	38,300	1.15	48,300	1.70	1.5	9.5	539	9	430-480	5	1
AMOCO (2) TORLON®	7130	30% GRAPHITE FIBER +1% P.T.F.E.	1.48	29,400	15,700 (450°F)	6.0	3.22	36,900	1.14	50,700	2.88	.9	6.4	540	5	430-480	2	1

HIGHEST STRENGTH AT 500° F; GOOD MOLDABILITY; LONG POST CURING REQUIRED TO ACHIEVE OPTIMAL PROPERTIES

Polyetheretherketone (PEEK)

I.C.I. (3) VICTREX®	450 G	NONE	1.32	13,300	1,700 (480°F)	50.0	.52	17,100	—	24,700	0.53	1.6	NO BREAK	320	26	430-480	3	1
I.C.I. (3) VICTREX®	450 GL 30	30% GLASS FIBER	1.49	22,800	4,900 (480°F)	2.2	1.40	31,200	—	33,800	1.49	1.8	13.6	600	12	430-480	5	1
I.C.I. (3) VICTREX®	450 CA 30	30% CARBON FIBER	1.44	30,200	6,200 (480°F)	1.3	1.88	34,800	—	46,100	1.88	1.6	14.0	600	8	430-480	2	1
LNP (4) THERMOCOMP®	LCL 4033	15% CARBON FIBER +15% P.T.F.E.	1.41	25,600	—	4.5	—	—	—	37,100	1.80	1.5	11.0	600	—	430-480	1	1

BEST RESISTANCE TO STEAM; VERY GOOD RESISTANCE TO RADIATION; EXCELLENT MOLDABILITY; MARGINAL PROPERTIES AT 500° F

Polyphenylene Sulfide (PPS)

HOECHST (6) FORTRON®	0214-P	NONE	1.35	12,400	—	3.0	—	—	—	21,300	0.50	0.5	11.6	220	—	425-450	5	2
PHILLIPS (7) RYTON®	R-4	40% GLASS FIBER	1.67	17,500	6,000 (460°F)	0.9	2.25	26,000	—	26,000	1.70	1.3	4.5	500	16	425-450	5	2
LNP (4) THERMOCOMP®	OC-1006	30% CARBON FIBER	1.45	27,000	—	3.0	—	—	—	34,000	2.50	1.1	6.0	505	6	425-450	2	2

VERY GOOD PROPERTIES AT LOW COST

Polyphthalamide (PPA)

AMOCO (23) AMODEL®	A-1133	33% GLASS FIBER	1.43	32,000	—	2.0	—	40,000	—	45,000	1.65	2.4	—	545	13	320-370	5	2
RTP (24) PPA®	4085	30% CARBON FIBER	1.33	43,000	—	1.7	4.2	—	—	66,000	3.2	1.6	14	540	—	320-370	4	2

VERY GOOD PROPERTIES AT LOW COST

Polyetherimide (PEI)

G.E. (5) ULTEM®	1000	NONE	1.27	15,200	6,000 (350°F)	60.0	.43	20,300	.42	21,000	0.48	1.0	25.0	392	31	350-400	5	3
G.E. (5) ULTEM®	2300	30% GLASS FIBER	1.51	24,500	11,000 (350°F)	3.0	1.30	23,500	.55	33,000	1.20	2.0	8.0	410	11	350-400	5	3
LNP (4) THERMOCOMP®	EC 1006	30% CARBON FIBER	1.39	34,000	—	4.0	—	—	—	44,000	2.50	1.4	13.0	420	7	350-400	2	3

GOOD PROPERTIES AT LOW COST

Liquid Crystal Polymer (LCP)

CELANESE (8) VECTRA®	A-950	NONE	1.40	24,000	—	3.0	1.40	—	—	24,500	1.30	10.0	—	356	—	400-420	3	1
AMOCO (9) XYDAR®	RC-210	GLASS FIBER	1.60	20,000	3,200 (575°F)	1.7	2.30	9,900	.47	23,300	1.94	2.0	11.5	655	6.4	430-460	3	1
CELANESE (8) VECTRA®	B-230	CARBON FIBER	1.50	35,000	—	1.0	5.40	—	—	46,000	4.60	1.4	—	440	—	400-420	2	1

HIGHEST UNIDIRECTIONAL PHYSICAL PROPERTIES; LOW COEFFICIENTS OF FRICTION

Polytetrafluoroethylene (PTFE)

DUPONT (10) TEFLON®	T-7	NONE	2.20	3200	600 (500°F)	250.0	—	NO BREAK (TOO SOFT)	—	NO BREAK (TOO SOFT)	0.09	3.0	—	—	100	500-550	5	1
LNP (11) FLUROCAMP®	FC 403	15% GLASS POWDER	2.19	2800	—	295.0	—	1295	.09	1225	0.15	—	—	—	74	500-550	1	1
LNP (11) FLUROCAMP®	FC 423	15% GRAPHITE POWDER	2.08	2550	—	175.0	—	1487.5	.07	900	0.12	—	—	—	83	500-550	2	1
LNP (11) FLUROCAMP®	FC 482	55% BRONZE POWDER +5% MoS ₂	3.67	2075	—	110.0	—	1750	.15	2100	0.21	—	—	—	68	500-550	1	1

EXCELLENT BEARING PROPERTIES; BROADEST BALANCE OF OVERALL PROPERTIES

Metals⁽¹²⁾

ALUMINUM	2024	—	2.60	27,000	11,000 (500°F)	20.0	10.7	—	10.5	62,000	10.5	—	—	—	14	—	—	—
TITANIUM	Grade 2	—	4.50	50,000	30,000 (600°F)	20.0	14.9	—	15.5	—	—	—	—	—	7	—	—	—
BRONZE	90/10	—	8.10	44,000	—	30.0	—	12,000	—	—	—	—	—	—	10	400	—	—
STEEL	1025	—	7.83	60,000	42,000 (700°F)	30.0	30.0	—	—	—	—	—	—	—	7	—	—	—
CAST IRON	G-2500	—	7.20	25,000	—	—	—	—	—	—	—	—	—	—	7	—	—	—



tel: 401-253-2140
fax: 401-253-4654
info@trimack.com
www.trimack.com