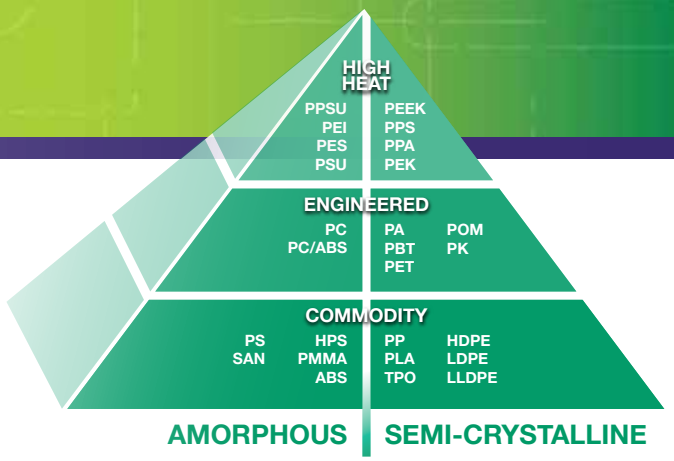
RTP Co.
Imagineering Plastics®

Structural Products

Improving Strength and Other Properties Using Thermoplastic Technologies

Structural Products



Structural Products from RTP Company provide a combination of excellent stiffness, strength, impact, heat resistance, and overall toughness – even in the most challenging application environments. Our portfolio spans the performance spectrum from cost optimized commodities to the highest performing Ultra Performance Compounds in most polymers, from Polypropylene to PEEK.

Structural integrity can be predicted and preserved to meet your specific end-use requirements by pairing the appropriate resin system with tailored fillers, reinforcements, and additive technologies.

Our Product Development Engineers have access to nearly all thermoplastic and additive technologies; when combined with the expertise to apply them successfully, the result is a custom formulation that meets your cost and performance expectations.

The properties listed below are achievable in our broad offering of Structural Products, including an extensive database of active, commercially available formulations. We welcome the opportunity to discuss your particular requirements and present a Structural Product that will work for you.

Contact us, scan our code, or visit **www.rtpcompany.com** to get your project started today!

PROPERTIES

Physical
- Chemical Resistance
- Heat Profile
- Warp Reduction
- Flow Profile
- Density

Mechanical
- Strength
- Stiffness
- Toughness - Impact Strength

Visual
- Color
- Surface Appearance
- Scratch and Mar Resistance

Protective
- UV Protection
- Regulatory Compliance
- Heat Stability
- Hydrolytic Stability

In addition, we can further enhance your application by formulating a compound featuring custom color, wear and friction resistance, flame retardant, and/or conductive properties.

RTP Company Structural Additive Technologies

This table shows a general overview of how structural additive technologies influence physical and mechanical performance.

Primary Technology	Abbr.	Page	Description	Strength	Stiffness	Impact Resistance
Unfilled Resin	Resin	-	The baseline reference for comparing physical performance	●	●	●
Impact Modified	IM	4	Improved ductility at room and low temperature	●	●	●●●●
Mineral Filled	MF	4	Increased stiffness and improved dimensional stability	●	●●	●
Short Glass Fiber	GF	5	Balanced increase of most physical performance characteristics	●●●	●●●	●●
Light and Tough	LT	5	Designed for weight savings without sacrificing short glass fiber performance	●●●	●●●	●●
eXtra Performance	XP	6	High performance short glass fiber reinforced polypropylene compounds	●●●●	●●●	●●●
Very Long Fiber	VLF	6	Very best performance available using glass reinforcement	●●●●	●●●	●●●●
Carbon Fiber	CF	7	Lightweight with extremely high load bearing capability	●●●●●	●●●●●	●
Ultra-Performance	UP	7	Lightest and best performance available in carbon fiber reinforcement	●●●●●●	●●●●●●	●

Technology	Page	Description	Desired Effects		
Sustainable Materials	8	Designed for recycled content and carbon footprint reduction	Sustain-ability	Good performance	Drop-in replacement
High Gravity	9	Filled with heavy additives to mimic beneficial characteristics of metal	Vibration and sound dampening	Perceived value	Functional weight design
Low Gravity	9	Filled with hollow glass spheres to significantly reduce specific gravity	Light-weighing	Avoid chemical foaming	Surface finish vs. foaming
Controlled Geometry Pellets (CGP)	9	Remarkably small and specially shaped pellets for compression molding	Reduced porosity	Improved properties	Compression molding
Extrusion Compounds	9	Compounds with tailored viscosity meant for use in extruded applications	Stiffness	Melt strength	Appearance

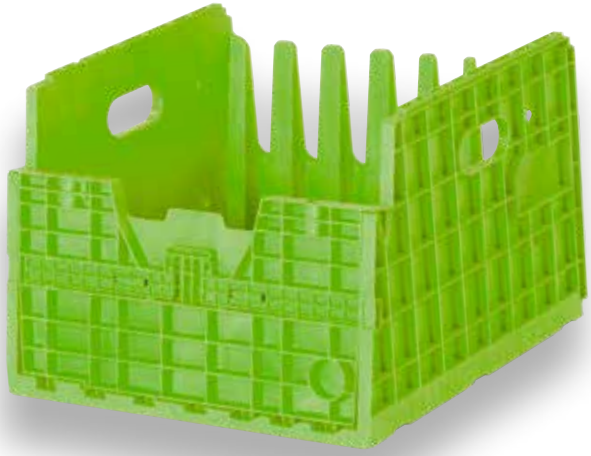
Impact Modified (IM) Compounds

Impact Modified Compounds from RTP Company provide increased impact resistance at all temperatures in comparison to unfilled compounds. This technology can also be used in tandem with other structural fillers (such as Mineral, Glass, or Carbon Fiber) to increase ductility in compounds that also need to retain their strength and stiffness.

Impact Modified Compounds are used in a large array of markets including sporting goods, industrial, outdoor recreation vehicles, automotive, consumer goods and electronics.

Strength	Stiffness	Impact Resistance
•	•	••••

Advantages:
- Improved impact resistance
- Improved ductility
- Increased low temperature performance



Strength	Stiffness	Impact Resistance
•	••	•

Advantages:
- Cost effective
- Increased stiffness
- Improved dimensional stability

Mineral Filled (MF) Compounds

Our Mineral Filled Compounds offer improvements in dimensional stability and stiffness over unmodified resin. These compounds are also the lowest cost filler option when price sensitivity is important to end application success.

Some common mineral fillers include calcium carbonate, talc, and mica, which are commonly used in Polypropylene or Nylon resin systems. Mineral Filled Compounds may be used in high volume, low cost applications such as appliances, automotive, and packaging. Conversely, they may be used to reduce costs of more expensive polymers.

Strength	Stiffness	Impact Resistance
●●●	●●●	●●

Advantages:

- Produce strong, lightweight parts
- Cost effective
- Increased tensile and flexural strength vs. Mineral Filled Compounds
- Increased strength at elevated temperature vs. Mineral Filled Compounds

Short Glass Fiber (GF) Compounds

When additional performance from a part is needed, Short Glass Fiber Compounds from RTP Company offer excellent strength and stiffness vs. Mineral Filled Compounds. Short Glass Fiber Compounds can be individually formulated to end-use specifications and offer better mechanical properties than competing materials. They are available in commodity and engineering resin systems, and are very widely used by many markets, including automotive, healthcare, consumer goods, and more.

Strength	Stiffness	Impact Resistance
●●●	●●●	●●

Advantages (vs. GF Compounds):

- Similar mechanical properties with up to 10% weight reduction
- Density reduction is not wall thickness dependent; no chemical foaming agents
- Often able to be used as a drop-in solution with existing tooling
- Aesthetic parts still achievable vs. chemical foaming

Light and Tough (LT) Compounds

Our LT Compounds introduce hollow glass spheres and weigh 5% - 10% less than typical reinforced compounds, while targeting equivalent mechanical properties and similar shrinkage values. Unlike chemical foaming agents, this technology is not dependent on wall thickness. These compounds are best used as lightweight alternatives when the goal is to minimize energy consumption or the amount of human effort required to use the part.

eXtra Performance (XP) Compounds

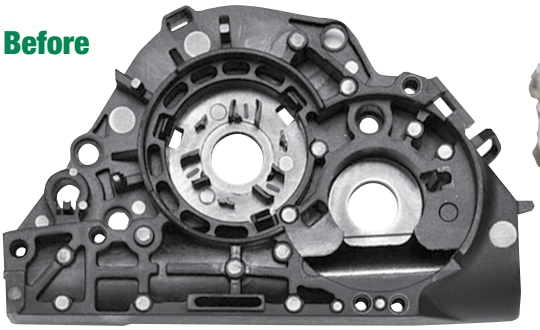
The eXtra Performance Series from RTP Company consists of Polypropylene-only compounds that serve as a bridge between standard Short Glass Fiber Compounds and Very Long Fiber Compounds. XP Compounds have up to 20% more modulus and 50% more impact performance than GF PP Compounds while remaining more cost effective than VLF Compounds. XP Compounds are excellent alternatives to Nylon and other hygroscopic resins whose properties can be affected by moisture levels. Markets that benefit from XP Compounds include automotive, industrial, and consumer goods.

Strength	Stiffness	Impact Resistance
●●●●	●●●	●●●

Advantages:

- Extra strength, modulus, and impact resistance compared to standard GF Polypropylene (PP) Compounds
- Comparable performance to moisture conditioned Nylon compounds at a lower density
- Strength and stiffness comparable to Very Long Fiber Compounds

Before



After

Parts made from VLF Compounds showing before and after resin burn off, which exposes the VLF skeleton structure as depicted on the right.

Very Long Fiber (VLF) Compounds

Our VLF Compounds are made using a proprietary pultrusion process to create long pellets (11mm) with long fibers inside – the same length as the pellet. These long fibers create an internal skeleton during the molding process which not only increases strength and stiffness, but impact resistance as well. These stiff and tough VLF Compounds are the go-to technology for metal replacement, making them a top technology for automotive and industrial applications.

Strength	Stiffness	Impact Resistance
●●●●	●●●	●●●●

Advantages:

- Improved strength, stiffness and impact resistance vs. GF Compounds
- Improved creep resistance vs. GF Compounds
- May improve dimensional accuracy and reduce warpage over GF Compounds

Strength	Stiffness	Impact Resistance
●●●●●	●●●●●	●

Advantages:

- Lighter, stiffer, and stronger than even the best Glass Fiber Compound
- Similar processing and possible decrease in tool wear
- Capable of achieving physical performance comparable to metal alloys with 60-80% weight reduction

Carbon Fiber (CF) Compounds

Carbon Fiber Compounds from RTP Company can achieve mechanical performance that Glass Fiber Compounds cannot. Carbon fiber itself has unique advantages of being stronger, stiffer, and lighter than traditional glass fiber reinforcements. CF Compounds also provide an excellent alternative to aluminum, die cast zinc, and other metals, as they can maintain similar properties with 60-80% weight reduction.

Strength	Stiffness	Impact Resistance
●●●●●●	●●●●●●	●

Advantages:

- Optimized compounds based on high temperature polymers
- Highest temperature resistance thermoplastic compounds
- Suitable alternatives to Magnesium, Aluminum, and other polymer compounds

Ultra-Performance (UP) Compounds

Drawing on our expertise in high temperature polymers and fiber reinforced materials, we have created Ultra-Performance Compounds, featuring elevated mechanical properties, heat resistance, and chemical resistance. These industry-leading compounds stand up to the most demanding requirements when compared to standard polymer compound options, and also offer a competitive alternative to aluminum, zinc, and magnesium metals and thermoset compounds.

Sustainable Material Solutions

At RTP Company, we strategically formulate sustainable thermoplastic compounds that help our customers reach their recycled content and carbon footprint reduction goals!

Our Sustainable Material Solutions portfolio includes:

- nylon and polypropylene compounds containing Post-Industrial Recycled (PIR) content
- low density compounds used for lightweighting parts
- metal-to-plastic replacement solutions
- bio-sourced materials
- materials with lower carbon options (i.e., Short Glass Fiber PA to Very Long Fiber PP)

We are also exploring the possibilities of Post-Consumer Recycled (PCR) additive technology as a way to achieve **carbon-neutral** or even **carbon-negative** materials.

RTP COMPANY SUPPORTS CARBON FOOTPRINT REDUCTION

Our Roots in Recycling

Our commitment to eco-friendly processes is an extension of our parent company, Miller Waste Mills, which was founded on the concept of recycling back in 1923. Today, the mill processes post-industrial and post-consumer fiber and textile waste into reclaimed fiber products for consumer, industrial, and automotive applications. This process diverts thousands of pounds of textiles from landfills each year.

RTP Company was established under the Miller Waste Mills umbrella in 1982. We are committed to building on the initiatives started by Miller Waste Mills nearly 100 years ago by developing sustainable material solutions for OEMs and molders around the world!

Gravity Modified Compounds

RTP Company's Gravity Modified Compounds are formulated with the ability to "dial in" any density from 0.70 g/cm^3 to 11.0 g/cm^3. These compounds are very effective replacements for traditional materials, and can also incorporate important characteristics such as radiopacity, sound dampening, vibration dampening, balance shifting (center of gravity), and perceived quality, durability, or value.

Low Gravity Compounds

Low Gravity Compounds are also Gravity modified compounds, but are designed to reduce the weight of parts of any geometry with achievable densities as low as 0.70 g/cm^3 without the use of chemical foaming agents.

- Achieve up to 30% weight reduction
- Improved surface appearance vs. chemical foaming
- Density reduction not dependent on wall thickness

Desired Effects
Light-weighting
No chemical foaming
Good surface appearance vs. foam

High Gravity Compounds

With density up to 11.0 g/cm^3, our High Density Compounds provide a weightier feel to components and applications that require it.

- Customization of density by application needs
- Lead replacement potential

Desired Effects
Vibration and sound dampening
"Expensive feel"
Center of gravity adjustment

Controlled Geometry Pellet (CGP) Compounds

RTP Company's patented Controlled Geometry Pellets are small, shape-defined pellets used to improve your compression molding process, productivity, and performance.

- Improved mechanical properties vs. traditional powder blends
- Best packing of standard compression molding materials

Desired Effects
Reduced porosity
Improved properties
Compression molding

Extruded Compounds

Our extrusion grade compounds incorporate many of the same filler, reinforcement, and additive technologies available in our injection molded compounds but are formulated for use specifically into extrusion processing. These compounds can be tailored with the precise property profiles and melt behavior to meet the desired physical, aesthetic, and processing requirements.

Desired Effects
Stiffness
Melt Strength
Appearance

Structural Compounds from RTP Company

The materials listed here are a small selection of our standard grades. To combine technologies or get a custom Structural Product for your project, contact your local RTP Company sales rep or visit.

Nomenclature	Polymer	Primary Additive	Tensile Strength ASTM D638		Flexural Modulus ASTM D790		Notched IZOD Impact ISO 180/1eA (kJ/m^2)	Notched IZOD Impact ASTM D256		Specific Gravity
			(psi)	(MPa)	($x10^6$ psi)	(MPa)		(ft-lb/in)	(J/m)	
Impact Modified (IM) Compounds										
RTP 200 H	PA 6/6	IM	7,500	52	0.30	2,000	75	17	907	1.08
RTP 1000 HI	PBT	IM	5,300	37	0.25	1,750	95	18	961	1.22
RTP 1399 X 142203	PPS	IM	7,000	48	0.36	2,500	55	7.3	388	1.25
RTP 4099 X 134209	PPA	IM	7,500	52	0.30	2,000	77	18	961	1.10
Mineral Filled (MF) Compounds										
RTP 199 X 139120	PP	20% Talc	5,250	36	0.38	2,600	3	0.8	42	1.05
RTP 199 X 149959	CoPP	20% Talc	3,900	27	0.26	1,800	10	1.3	68	1.05
RTP 199 X 139140	PP	40% Talc	4,900	34	0.55	3,000	3	0.8	43	1.24
Short Glass Fiber (GF) Compounds										
RTP 199 X 138829 A	PP	10% GF	7,850	54	0.43	2,950	5	1.2	64	0.97
RTP 199 X 140470 A	PP	20% GF	9,500	66	0.61	4,200	9	2.3	125	1.03
RTP 199 X 139099 A	PP	30% GF	12,800	88	0.95	6,600	13	1.6	88	1.12
RTP 199 X 139099 B	PP	40% GF	14,000	96	1.23	8,500	13	3.4	181	1.23
RTP 199 X 139099 C	PP	50% GF	15,000	104	1.62	11,000	14	3.7	195	1.33
RTP 299 X 140480 A	PA 6/6	20% GF	22,000	152	1.04	7,200	10	1.3	68	1.28
RTP 299 X 139071 A	PA 6/6	30% GF	30,500	205	1.45	10,000	11	1.8	95	1.38
RTP 299 X 139071 B	PA 6/6	33% GF	31,200	209	1.56	10,750	13	2.0	107	1.41
RTP 299 X 139072 B	PA 6/6	40% GF	31,600	218	1.81	12,500	14	2.4	130	1.46
RTP 299 X 143324 A	PA 6	20% GF	18,200	125	0.90	6,000	6	1.0	56	1.27
RTP 299 X 143325 A	PA 6	30% GF	27,500	190	1.38	9,500	16	2.2	117	1.37
RTP 299 X 143325 B	PA 6	33% GF	28,500	196	1.49	10,250	17	2.4	128	1.42
RTP 299 X 143325 C	PA 6	40% GF	30,500	211	1.74	12,000	20	2.8	150	1.47
RTP 0299 H X 147513 A	PA 6/6	14% GF, IM	10,000	69	0.50	3,400	17	4.0	215	1.12
RTP 206 A HI	PA 6	35% GF, IM	22,500	155	1.23	8,500	19	4.0	215	1.37
RTP 1002 HF	PBT	15% GF	15,000	103	0.85	5,900	5	1.0	53	1.42
RTP 1005 HF	PBT	30% GF	20,000	138	1.30	9,300	8	1.6	85	1.53
RTP 1305 P-1	PPS	30% GF	23,000	159	1.80	12,600	10	1.5	80	1.58
RTP 1307 P-1	PPS	40% GF	24,000	164	2.20	15,200	11	1.5	80	1.68
RTP 1309 P-1	PPS	50% GF	24,500	169	2.80	19,300	10	1.5	80	1.77
RTP 1399 X 102898 B	PPS	65% GF, Mineral	19,000	131	2.90	20,000	6	1.0	53	1.98
RTP 1399 X 142237 B	PPS	40% GF, IM	23,500	163	1.80	12,400	15	2.7	142	1.59
RTP 1403	PES	20% GF	19,000	131	1.00	6,600	7	1.0	53	1.51
RTP 1405	PES	30% GF	20,500	141	1.30	8,800	8	1.2	64	1.59
RTP 1407	PES	40% GF	23,000	159	1.70	11,700	12	1.5	80	1.68

Nomenclature	Polymer	Primary Additive	Tensile Strength ASTM D638		Flexural Modulus ASTM D790		Notched IZOD Impact ISO 180/1eA (kJ/m^2)	Notched IZOD Impact ASTM D256		Specific Gravity
			(psi)	(MPa)	($x10^6$ psi)	(MPa)		(ft-lb/in)	(J/m)	
Short Glass Fiber (GF) Compounds cont.										
RTP 2103	PEI	20% GF	23,000	159	1.00	6,900	6	1.3	69	1.41
RTP 2105	PEI	30% GF	25,100	173	1.45	10,000	7	1.6	85	1.50
RTP 2107	PEI	40% GF	27,000	183	1.90	13,100	8	1.8	96	1.59
RTP 2203 HF	PEEK	20% GF	22,000	152	1.20	8,300	5	1.4	75	1.44
RTP 2205 HF	PEEK	30% GF	27,000	186	1.60	11,000	8	2.0	107	1.52
RTP 2207 HF	PEEK	40% GF	30,500	210	2.10	14,500	11	2.4	128	1.61
RTP 4005	PPA	30% GF	28,000	193	1.50	10,300	7	1.5	80	1.44
RTP 4007	PPA	40% GF	34,200	236	2.00	13,500	9	2.0	107	1.55
RTP 4009	PPA	50% GF	36,000	248	2.50	17,200	11	2.2	117	1.64
Light and Tough (LT) Compounds										
RTP 199 X 149322 B	PP	30% GF LT	12,000	82	0.83	5,750	8	2.1	112	1.04
RTP 299 A X 149343 A	PA 6	30% GF LT	24,000	167	1.45	10,000	10	2.6	139	1.22
RTP 299 X 149328 A	PA 6/6	30% GF LT	26,000	180	1.60	11,000	12	2.9	155	1.23
eXtra Performance (XP) Compounds										
RTP 101 XP	PP	10% XP GF	9,000	63	0.45	3,200	7	1.6	84	0.97
RTP 103 XP	PP	20% XP GF	12,000	83	0.63	4,500	12	2.1	112	1.03
RTP 105 XP	PP	30% XP GF	15,000	105	0.98	6,750	13	2.4	128	1.12
RTP 107 XP	PP	40% XP GF	16,000	110	1.33	9,200	14	2.6	139	1.24
RTP 109 XP	PP	50% XP GF	17,000	119	1.65	11,500	14	2.6	139	1.32
Very Long Fiber (VLF) Compounds										
RTP 199 X 108595	PP	20% VLF	12,950	89	0.68	4,700	11	3.0	160	1.05
RTP 199 X 70815	PP	30% VLF	16,500	115	0.90	6,300	18	3.7	198	1.12
RTP 199 X 70836 A	PP	40% VLF	18,000	124	1.09	7,500	29	5.1	272	1.21
RTP 199 X 70836 B	PP	50% VLF	19,500	134	1.60	11,000	31	4.5	240	1.34
RTP 199 X 118048 BLACK	PP	60% VLF	Concentrate for dilution							
RTP 199 X 110825 NATURAL	PP	60% VLF	Concentrate for dilution							
VLF 80207 EM HS	PA 6/6	40% VLF	33,000	228	1.75	12,000	27	6.5	347	1.46
VLF 80209 EM HS	PA 6/6	50% VLF	37,500	259	2.20	15,200	40	9.0	480	1.57
VLF 80211 EM HS	PA 6/6	60% VLF	40,000	276	2.90	20,000	50	10.0	534	1.71
RTP 1399 X 68907 A	PPS	40% VLF	24,500	169	2.10	14,500	23	3.3	176	1.65
RTP 1399 X 68907 B	PPS	50% VLF	25,000	172	2.60	17,900	25	5.0	267	1.73
RTP 2199 X 113442 A	PEI	40% VLF	28,000	193	2.10	14,500	14	3.5	187	1.59
RTP 2299 X 108578 A	PEEK	30% VLF	26,500	183	1.60	11,000	17	3.5	187	1.52
RTP 2299 X 108578 B	PEEK	40% VLF	30,000	207	2.20	15,000	18	4.0	214	1.61
VLF 84007	PPA	40% VLF	33,000	228	2.10	14,500	22	5.5	294	1.57
VLF 84009	PPA	50% VLF	39,000	269	2.70	18,600	25	6.5	347	1.65

Nomenclature	Polymer	Primary Additive	Tensile Strength ASTM D638		Flexural Modulus ASTM D790		Notched IZOD Impact ISO 180/1eA (kJ/m^2)	Notched IZOD Impact ASTM D256		Specific Gravity
			(psi)	(MPa)	($x10^6$ psi)	(MPa)		(ft-lb/in)	(J/m)	
Carbon Fiber (CF) Compounds										
RTP 283 A	PA 6	20% CF	27,500	190	1.80	12,500	7	1.6	85	1.22
RTP 285 A	PA 6	30% CF	32,500	224	2.80	19,000	10	2.2	117	1.27
RTP 287 A	PA 6	40% CF	34,000	234	3.40	24,000	12	2.3	120	1.32
RTP 283	PA 6/6	20% CF	32,000	221	2.00	13,800	7	1.5	80	1.22
RTP 285	PA 6/6	30% CF	36,000	248	2.70	19,000	8	2.0	107	1.27
RTP 287	PA 6/6	40% CF	40,000	276	3.70	25,500	10	2.1	110	1.32
RTP 1385 P-1	PPS	30% CF	30,000	207	3.30	22,800	6	1.0	53	1.45
RTP 1387 P-1	PPS	40% CF	31,000	214	4.50	31,000	6	1.0	53	1.48
RTP 1485	PES	30% CF	27,500	190	3.00	20,700	7	1.2	64	1.45
RTP 2185	PEI	30% CF	34,000	234	3.00	20,700	6	1.2	64	1.39
RTP 2281 HF	PEEK	10% CF	28,000	192	1.60	11,000	3	0.9	48	1.33
RTP 2283 HF	PEEK	20% CF	36,500	252	2.70	18,600	5	1.3	69	1.36
RTP 2285 HF	PEEK	30% CF	39,000	269	3.70	25,500	6	1.4	75	1.41
RTP 2287 HF	PEEK	40% CF	40,000	276	4.50	31,000	7	1.5	80	1.45
RTP 4085	PPA	30% CF	41,000	283	3.20	22,000	6	1.4	75	1.33
RTP 4087	PPA	40% CF	43,000	296	4.00	27,500	7	1.7	92	1.38
Ultra Performance (UP) Compounds										
RTP 1387 UP	PPS	40% CF UP	34,500	238	5.00	34,500	8	1.3	69	1.48
RTP 2287 HF UP	PEEK	40% CF UP	44,000	303	4.90	34,000	7	1.5	80	1.45
RTP 4087 UP	PPA	40% CF UP	52,000	359	5.00	34,500	10	1.8	95	1.38
Sustainable/PIR Compounds										
RTP 199 X 161540 A PIR BLACK	PIR PP	20% Talc	4,700	32	0.35	2,400	4	0.7	37	1.05
RTP 199 X 161540 B PIR BLACK	PIR PP	40%Talc	4,000	28	0.55	3,800	3	0.6	32	1.25
RTP 199 X 161545 A PIR BLACK	PIR PP	20% GF	8,200	57	0.50	3,400	7	1.5	80	1.04
RTP 199 X 161545 B PIR BLACK	PIR PP	30% GF	11,000	76	0.85	5,900	10	2.0	107	1.12
RTP 199 X 161545 C PIR BLACK	PIR PP	40% GF	12,500	86	1.25	8,600	13	2.5	133	1.22
RTP 299 A X 148995 A PIR BLACK	PIR PA6	20% GF	17,500	120	0.87	6,000	7	1.5	80	1.27
RTP 299 A X 148995 B PIR BLACK	PIR PA6	30% GF	21,500	150	1.20	8,500	7	1.5	80	1.37
RTP 299 A X 148995 C PIR BLACK	PIR PA6	40% GF	25,000	175	1.60	10,800	16	3.2	170	1.47
RTP 299 A X 148995 D PIR BLACK	PIR PA6	50% GF	28,000	195	2.20	15,000	13	2.5	133	1.57
RTP 299 X 148990 A PIR BLACK	PIR PA66	20% GF	20,000	140	1.10	7,600	4	0.8	42	1.28
RTP 299 X 148990 B PIR BLACK	PIR PA66	30% GF	24,500	170	1.30	9,000	7	1.5	80	1.37
RTP 299 X 148990 C PIR BLACK	PIR PA66	40% GF	29,000	200	1.60	11,000	10	2.0	107	1.46
RTP 299 H X 149000 A PIR BLACK	PIR PA66	IM	6,000	42	0.23	1,600	85	17.0	908	1.07

Morphology and Temperature Considerations

Amorphous

Semi-Crystalline

Polymer	Amorphous	Semi-Crystalline
Polymer Morphology	Randomly ordered molecular chains	Polymer chains form highly ordered crystalline regions
Dimensional Stability	Low and uniform shrinkage in all directions	Higher shrinkage that is directionally dependent
Viscosity, flow during normal processing	Gradual softening point with no melting point; flow is dependent upon processing temperature	Sharp melting point. Generally higher flow than amorphous polymers. Better for thin wall sections
Chemical Resistance	Polymer dependent – generally **less** than semi-crystalline polymers	Polymer dependent – generally **more** than amorphous polymers
Effects of adding Reinforcements*	Slight increase in mechanical and temperature performance	Dramatic increase in mechanical and temperature performance

**See chart below for details*

Some polymers have inherent resistance to high temperatures without using any additive technologies. Improving structural integrity beyond these limits may be increased dramatically with the addition of 30% short glass fiber reinforcements, particularly when compounded into semi-crystalline polymers:

Polymer	Polymer Morphology	Continuous Use Temperature, CTU	Heat Deflection Temperature, HDT @ 264 psi (1.82 MPa)	
			Polymer only	Polymer + 30GF
PEEK	Semi-Crystalline	400-450 °F (200-230 °C)	320 °F (160 °C)	>570 °F (>300 °C)
PPS	Semi-Crystalline	400-450 °F (200-230 °C)	275 °F (135 °C)	510 °F (265 °C)
PES	Amorphous	350-375 °F (175-190 °C)	395 °F (200 °C)	420 °F (215 °C)
PEI	Amorphous	350-375 °F (175-190 °C)	390 °F (195 °C)	410 °F (210 °C)
PPA	Semi-Crystalline	300-350 °F (150-175 °C)	230 °F (110 °C)	520 °F (270 °C)
PA 6/6	Semi-Crystalline	250-300 °F (120-150 °C)	195 °F (90 °C)	480 °F (250 °C)
PA 6	Semi-Crystalline	250-300°F (120-150 °C)	150 °F (65 °C)	400 °F (200 °C)
PBT	Semi-Crystalline	250-300 °F (120-150 °C)	130 °F (55 °C)	400 °F (200 °C)
ASA	Amorphous	175-200 °F (80-90 °C)	165 °F (75 °C)	–
PP	Semi-Crystalline	200-250 °F (90-120 °C)	130 °F (55 °C)	300 °F (150 °C)

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