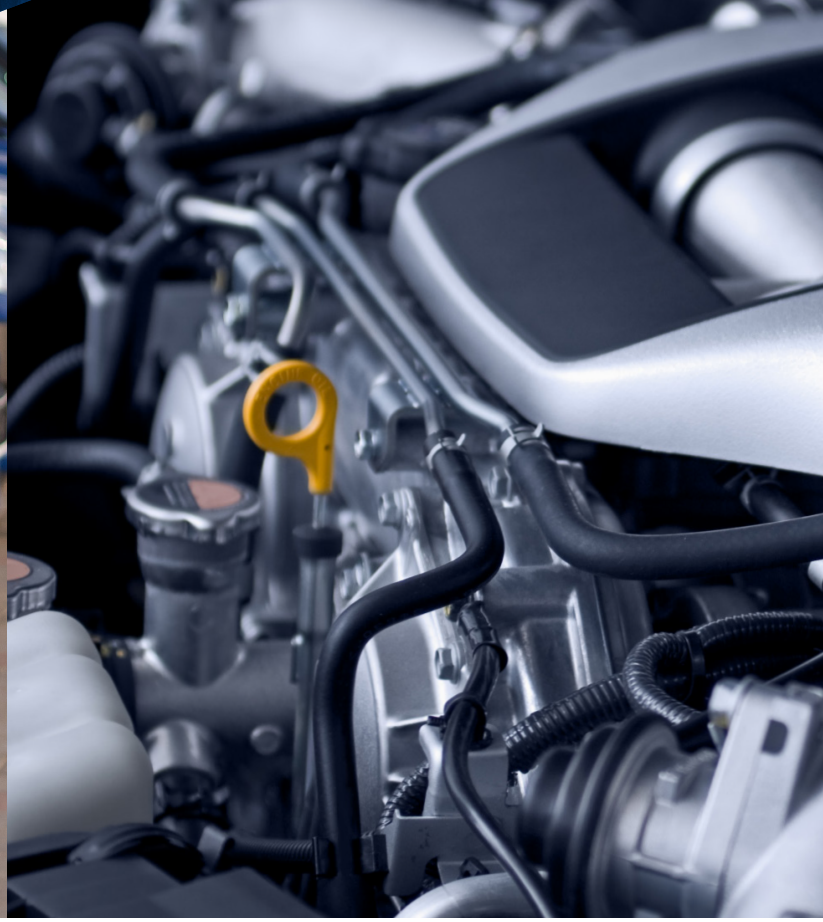
Minnesota Rubber & Plastics
Quadion LLC

Elastomer + Thermoplastic Components and Assemblies for the Automotive Market



Automotive

Specialists in high performance elastomer + thermoplastic custom components

Committed to Innovation While Providing Solutions

Minnesota Rubber and Plastics is one of the most experienced manufacturers of elastomer and thermoplastic components and assemblies, supplying the critical-to-function components for the automotive industry since 1945. For static and dynamic applications, our expertise in engineering design, materials R&D, manufacturing and assembly has made us the preferred supplier for tier-one manufacturers and original equipment manufacturers (OEM) around the globe. The automotive industry demands extensive experience and a deep understanding of end-market applications from suppliers. Component design and materials knowledge for critical-to-function products are crucial to this industry.

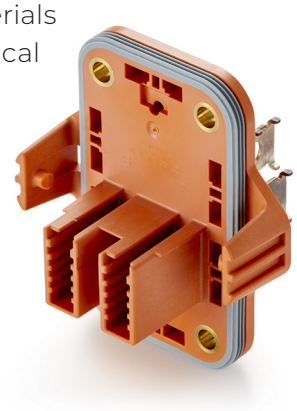
Specialized Applications

Today, increased regulations, standards, and more demanding operating environments challenge materials and designs with aggressive fluids, fuels and longer warranty periods.

- We deliver high-performance seals, thrust washers, and other components that meet the needs of these low-friction, high-temperature environments.

Technology Based

Our broad range of high-performance elastomers, fluoroelastomers and thermoplastics, such as PEEK, Aurum®, Torlon® or Ultem® are engineered to meet demanding sealing applications by providing long-term protection against wear, high temperatures and corrosive operating environments.
The technical design and materials groups can help you solve critical issues, ensuring cost effective production of high-quality products.



Local Presence, Global Reach

Today, most companies utilize global sourcing as a key component of their procurement strategy to expand or develop new markets as they look to control costs.

We leverage our local expertise and resources across both our North America and Asia manufacturing facilities to design, develop, manufacture and deliver precision components and assemblies. What's more, our six manufacturing facilities are complemented by our global warehousing and logistics operations.

Commitment To Quality

All Minnesota Rubber and Plastics design, development and production facilities operate under corporate wide quality systems including **IATF 16949 and ISO 9000.**

Our facilities also operate under a corporate wide environmental management system registered to the International Standards Organization series **ISO 14001.**

Expanding Markets – Decreasing Costs

Minnesota Rubber and Plastics is uniquely positioned to offer both rubber and plastic combination parts.

This allows us to provide greater development and production efficiencies, thereby reducing development time and costs. From prototyping to final production, our state-of-the-art design engineering services provide timely answers to difficult design questions. Our CAD/CAM and FEA systems allow us to offer design alternatives quickly, while our tool development and secondary press operations are second to none.

Finally, prior to beginning production, our prototyping services provide production-quality sample parts for final testing.

From advanced material development and innovative solutions specific to our customers' needs, to an integrated design, prototyping and best-in-class manufacturing process, we make our leading materials-science expertise accessible. Our customers can be assured that their end products provide measurable economic value.

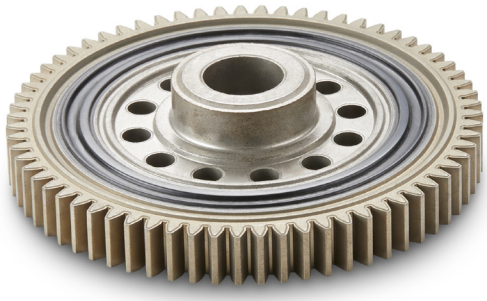
Materials R&D

Research and development are an integral part of our business, and an area where we place significant focus. With technical expertise and resources, we can design, formulate, develop, and test materials and parts using proprietary technologies for chemical and mechanical bonding.

Any material can be developed, molded, and tested in our materials R&D facility to allow you to sample multiple chemistries for your applications. R&D batches are closely monitored & measured, and we ensure through our advanced mixing capability that any R&D material is readily scalable to a production setting. With our fully equipped materials lab, we'll keep your projects on time and on budget, with the result being a durable finished part with minimized production costs.

Technology area examples:

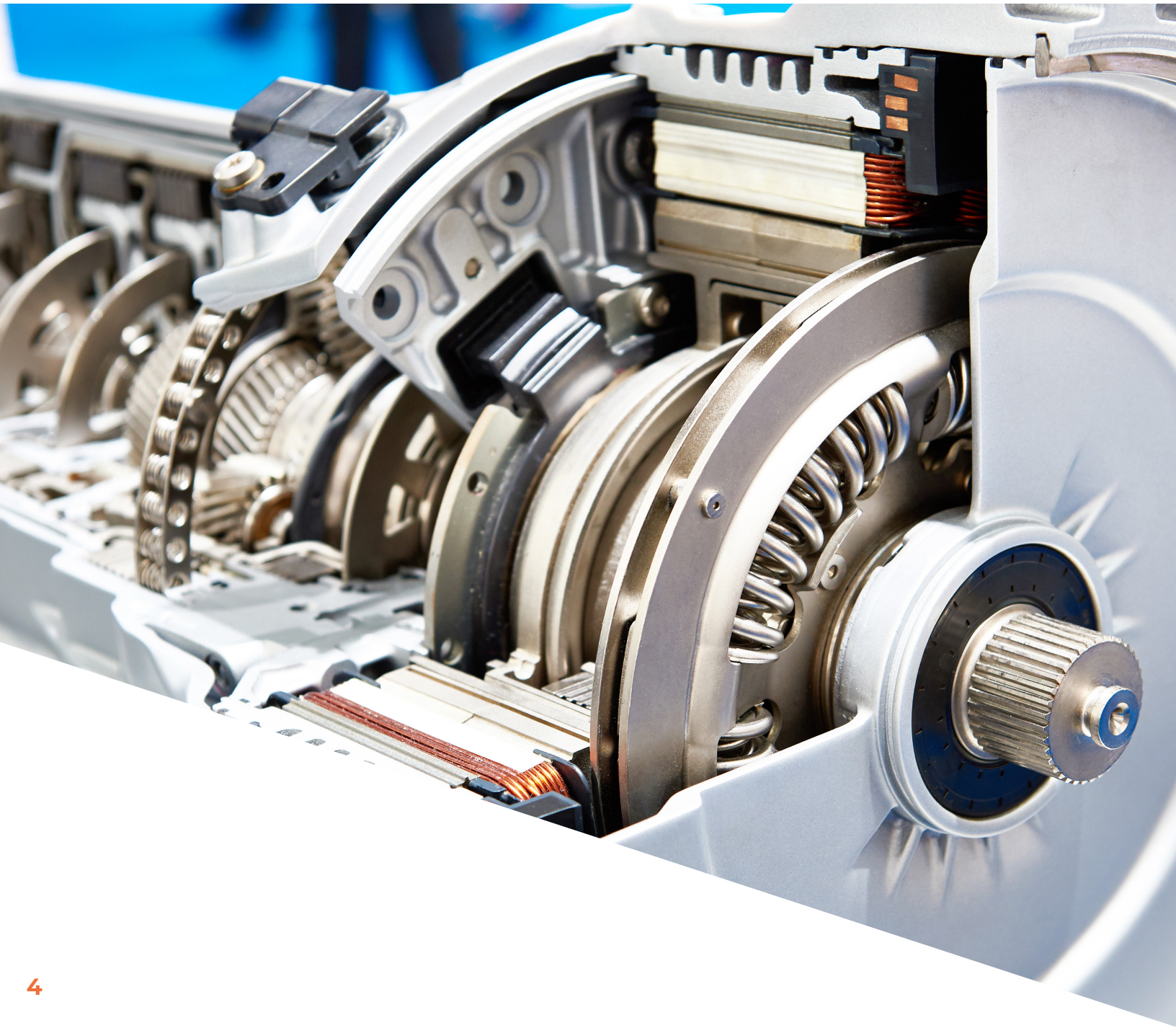
- Bonding and over molding on metal substrates or high-performance plastics
- Seal ring performance validation: Leak rate, torque loss and wear
- Seal ring test profiles: Temperature, pressure and RPM



Components + Assemblies for Demanding Applications

For years, major automotive OEMs have relied on Minnesota Rubber and Plastics for custom molded components and assemblies that improve the reliability and warranty performance of their products.

Our experienced design engineers, materials chemists and production groups solve the most difficult sealing and assembly problems with a broad range of thermoset and thermosetplastic compounds and molding processes.



ENGINE + TRANSMISSION

- Seal Rings
- Thrust Washers
- Intake Manifold Gaskets
- Oil Pump Gasket
- Transmission O-Rings
- Gaskets

BRAKE SYSTEMS

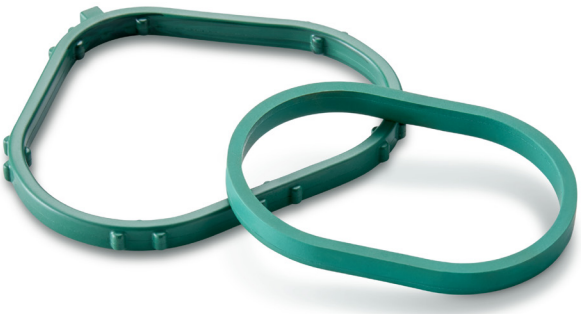
ELECTRONICS

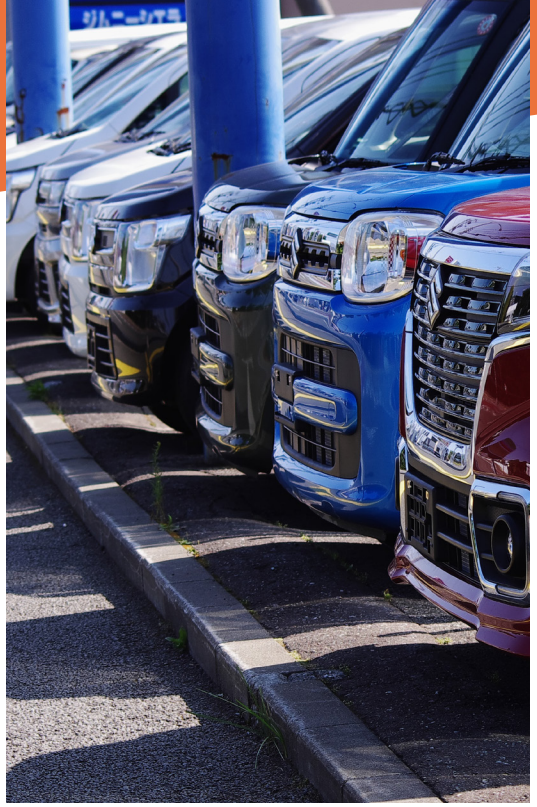
FUEL + EMISSION SYSTEMS

STEERING SYSTEM

SUSPENSION SYSTEM

THERMAL MANAGEMENT





Providing Industry Solutions

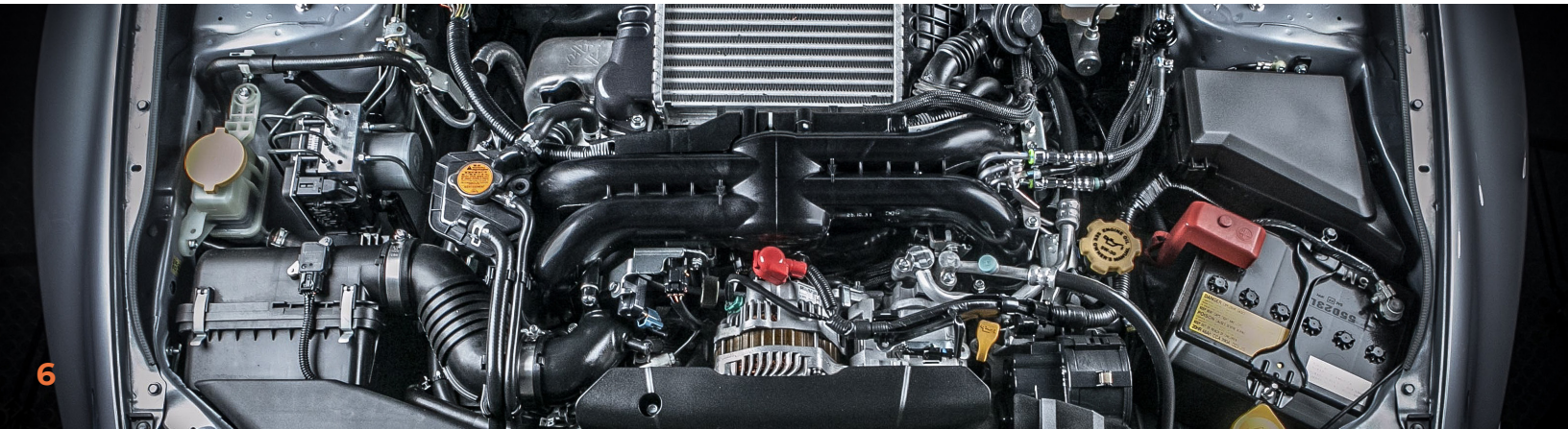
At Minnesota Rubber and Plastics our goal is to provide OEMs, tier-one and tier-two customers with the problem-solving solutions critical for their applications.

For over 75 years our commitment and dedication to the automotive industries has provided the needed components and assemblies, while meeting pricing and delivery requirements.

Whatever your elastomer and thermoplastic design challenge, we're here to make your application a reality. By working directly with you and exploring new design and material technologies, you can be certain our recommendations and commitment to your product requirements will meet your expectations.

High-Temperature Resistant Thermoplastics

Acronym	Polymer	Continuous Temp (°F)	Glass Transition Temp (F°)	Specific Gravity	HDT @ 264 psi	HDT @ 66 psi
PPS	Polyphenylene Sulfide	400-450	198	1.65/1.47	300-550°F	400-500°F
PEEK PK	Polyetheretherketone	400-450	290	1.61/1.46	350-610°F	500-640°F
Amodel® PPA	Polyphthalamide	400-450	274	1.53/1.39	530-545°F	560-574°F
PSO-PSU	Polysulfone	300-340	374	1.56/1.41	340-360°F	350-370°F
PES	Polyethersulfone	350-400	435	1.68/1.52	400-460°F	420-460°F
Ultem® PEI	Polyetherimide	350-400	415	1.59/1.44	390-420°F	400-440°F
Aurum® PI	Polyimide	550	482	1.44	475°F	–
Torlon® PAI	Polyamide Imide	482	527	1.42/1.68	534°F	–
PBI	Polybenzimidazole	500 - 535 F	340 F	1.44	590 F	-
PEKEKK	PolyEtherKetone-EtherKetoneKetone		324 F	1.41	383 F	-



Solving Design Problems with Materials Expertise + High Performance Plastics

Custom Molded Components + Assemblies

Minnesota Rubber and Plastics is a specialist in working with the design, development and production of components made from high-performance plastics, with a focus on parts produced from PEEK, PEI, PI and PAI.

Superior Performance

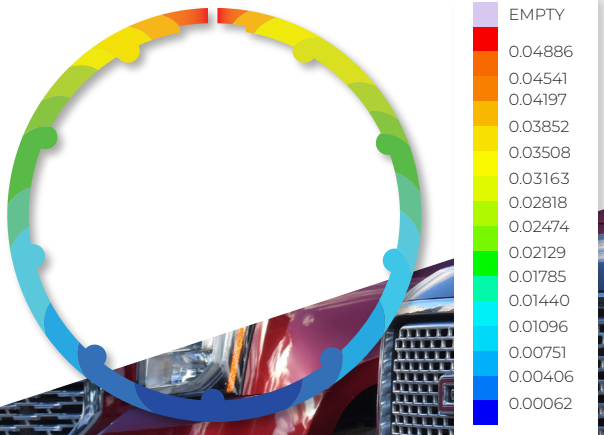
If your applications are unique or have demanding requirements, a high performance polymer could provide you with a material and design solution for:

- Chemical resistance
- Conformability
- Dimensional stability
- Flexibility
- Injection moldable
- Lightweight
- Machine-ability
- Metal replacement
- Noise reducing
- Self lubricating
- Temperature extremes

From mechanical to thermal properties, high-performance polymers provide design engineers, and their applications, with valuable design and end use options

End Use Applications :

- Bearings
- Bushings
- Retainers
- Thrust Plates
- Gears
- Poppets
- Thrust Washers
- Rotary Seal Rings



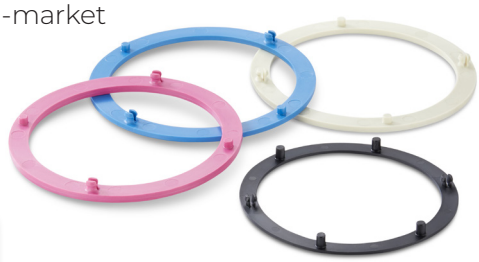
Application Environments:

- Valves
- Pumps
- Compressors
- Fuel Systems
- Transmissions
- Steering Systems
- Suspension Systems
- Torque Converters

Superior Capabilities:

Get added value via our design and material capabilities along with provided services that include specialty compounding (PTFE, carbon fiber, glass, aramide, graphite), product testing, assembly and packaging. In addition to our elastomer expertise, we specialize in finding solutions for tough applications which require the molding and assembly of close tolerance components. Capabilities available for you:

- Complete and unified project management
- Combined capital and project management
- Unified technology to assist with design recommendations
- Unified project management to accelerate time-to-market



The performance range of both amorphous + semi-crystalline polymers varies in relationship to their cost.

COST / PERFORMANCE

AMORPHOUS		SEMI-CRYSTALLINE
PI, PAI, PBI, TPI, PPSU, PEI, PES, PSF, PAR	HIGH PERFORMANCE POLYMERS	PEEK, PEKEKK, PVDF, LCP, PPS, PPA, PA-4.6
PPC		PET
PC, PPO	MID-RANGE POLYMERS	PBT, PA-6/6.6, POM, PE-UHMW
SMA, ABS, PMMA		PP
PS, SAN, PVC	COMMON POLYMERS	HDPE, LDPE

ACRONYM	POLYMER
ABS	acrylonitrile butadiene styrene
FP	fluoropolymers
HDPE	high density polyethylene
LCP	liquid crystal polymers
LDPE	low density polyethylene
PA-4,6	polyamide-4,6
PA-6/6,6	polyamide-6/6,6
PAI	polyamide imide (Torlon®)
PBI	polybenzimidazole
PAR	polyarylate
PBT	polybutylene terephthalate
PC	polycarbonate
PE-UHMW	ultrahigh molecular weight polyethylene
PEEK	polyetheretherketone
PEKEKK	PolyEtherKetone-EtherKetoneKetone
PEI	polyether imide (Ultem®)
PES	polyethersulfone
PET	polyethylene terephthalate
PI	polyimide (Aurum®)
PMMA	polymethyl methacrylate
POM	polyoxymethylene (also polyacetal)
PP	polypropylene
PPA	polyphthalamide (Amodel®)
PPC	polyphthalate carbonate
PPO	polyphenylene oxide
PPS	polyphenylene sulfide
PPSU	polyphenylsulfone
PS	polystyrene
PSF	polysulfone
PVC	polyvinyl chloride
PVDF	polyvinylidene fluoride
SAN	styrene acrylonitrile
SMA	styrene maleic anhydride
TPI	thermoplastic polyimide

Contact us today to learn more

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