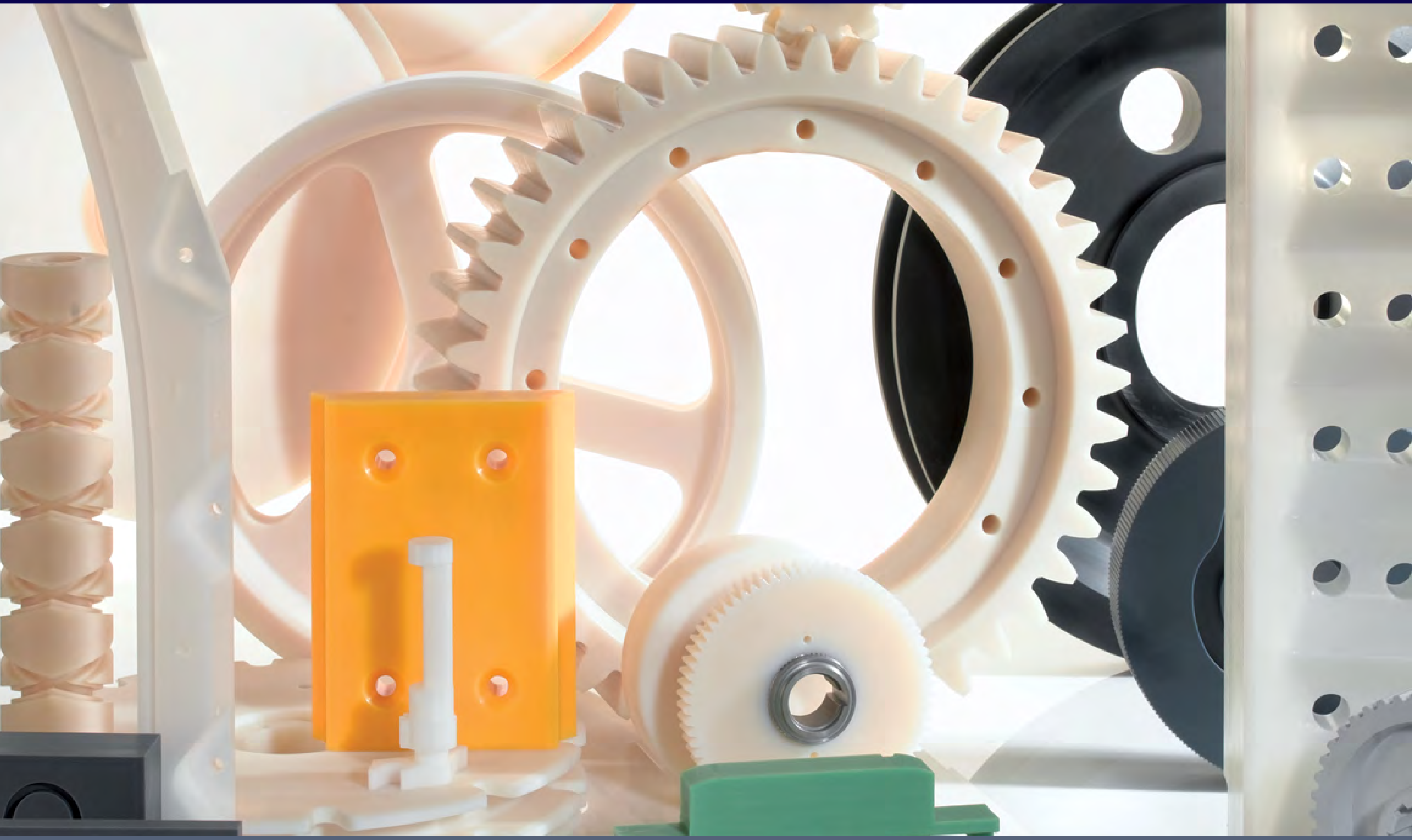
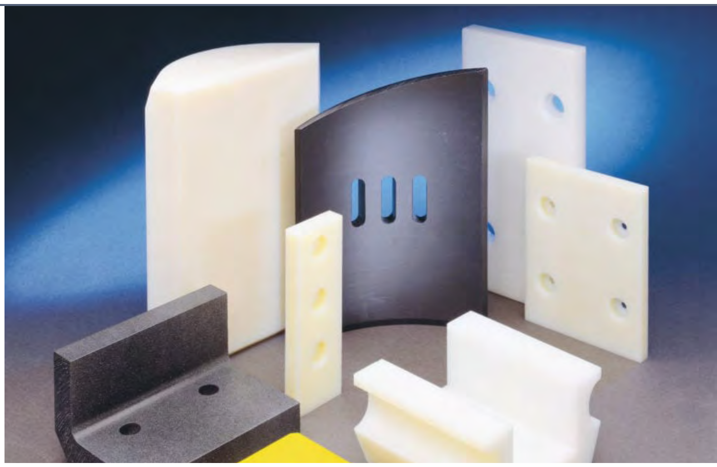
Advantages of
Using Engineering Thermoplastics



WS HAMPSHIRE
CUSTOM COMPOSITE SOLUTIONS

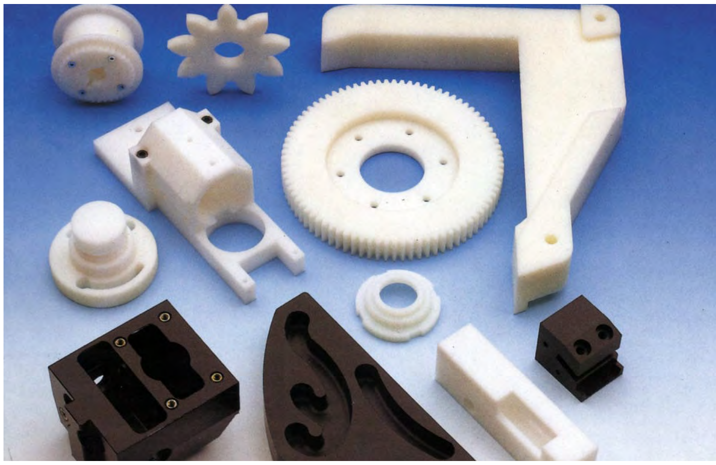
Advantages of Using Engineering Thermoplastics



Engineered plastics are beneficial in industrial settings because they possess high mechanical strength, versatility, and the ability to meet application-specific demands. These unique properties allow engineering plastics to withstand the high stress environments required by both OEM's and end users.

Commonly used in applications with high mechanical demands, when external lubrication is lacking, or when weight reduction is required, these durable thermoplastics replace metal in a wide variety of industrial applications and provide proven and cost-effective solutions.

When choosing the right material to meet specific demands of an application, it is important to select materials that provide the best combination of properties to produce the desired performance. Engineered thermoplastic materials offer advantages such as corrosion resistance, weight reduction, self-lubrication, and reduced wear on mating components. When combined, these capabilities often far outweigh those of traditionally used materials like steel, bronze, or other composites.



This eBook will provide a detailed look at the plastics available from WS Hampshire and discuss the advantages of using engineered plastics versus traditional materials. We will help you identify the varying properties and benefits of these high-performance plastics that will help you in determining which specific materials are best suited for your industrial application.

Where Plastics are Found in Industrial Settings

Plastics can be found in common industrial components, such as bushings, bearings, and other wear applications as well as structural and insulating components. Residential, industrial, and commercial settings frequently utilize these highly versatile materials, with almost every industry requiring manufactured plastics in some respect. Examples of advanced plastics include:

Ryertex®	Nylon	Acetal
Polyethylene (UHMW, HDPE)	PEEK	PET

Each material provides a different chemical makeup with specific properties to meet the demands of varying applications. It is essential to comprehend factors such as raw material supply, production method, additives, and crystallinity when selecting plastics for industrial applications that require the advantages of high-tech plastics. Advanced plastics are commonly used in the following industries:

Aerospace	Agricultural Equipment	Automotive	Biomedical
Building	Chemical	Construction	Cranes/Lifting Equipment
Cryogenics/Thermal Control	Electronics	Energy	Fire Trucks
Fluid Handling	Food Processing	Lumber Mills	Marine
Material Handling/ Conveying	MRO	Medical Equipment	Mining Equipment
Oil & Gas	Paper Mills	Pharmaceutical	Processing Equipment
Semiconductors	Steel/Aluminum Mills	Transportation	Waste Water

Advantages & Capabilities of Engineering Plastics

1 Temperature Resistance / Heat Transfer / Flame Rating

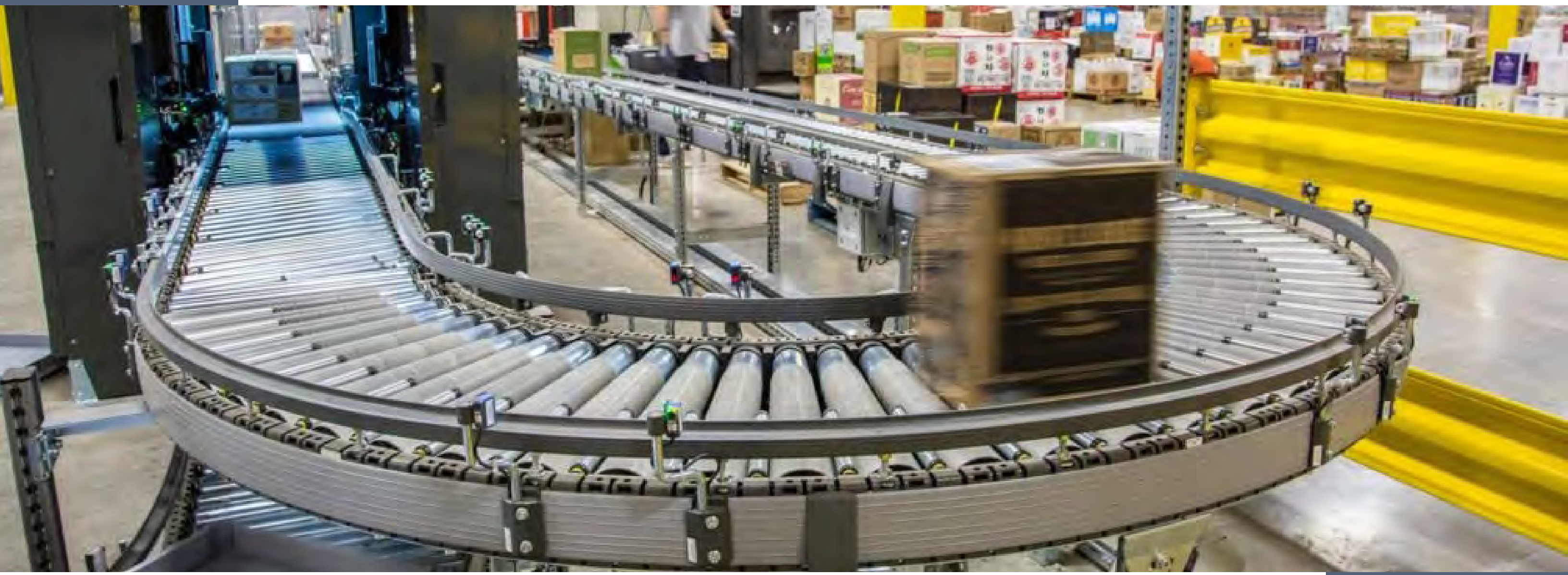
Engineering plastics are inherent heat insulators but can be modified to actually conduct heat. Specific advanced engineering plastics can withstand both high heat and cryogenic temperatures, and many materials are flame retardant.

2 Longevity/Sustainability

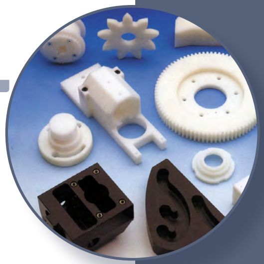
Advanced plastics are energy efficient in processing and manufacturing. Engineering plastics can have a life expectancy that far exceeds traditionally used materials. This is especially true because thermoplastics can be melted and recycled into usable material. It is important to note that there is a vast difference between plastics used in industrial settings and single-use consumer plastics that are vilified by environmental advocates. Many examples exist where plastics are used to reduce the demand on critical resources or eliminate the use of biological components.

3 Wear on Mating Parts

Plastics are an attractive alternative to metal when a low coefficient of friction is required to reduce the wear on mating components, including some that specifically reduce wear on soft metals such as stainless steel and aluminum. Plastics are often utilized as the sacrificial piece that extends the life of another part that might be more expensive or labor-intensive to change out.



4 Self-Lubrication Properties

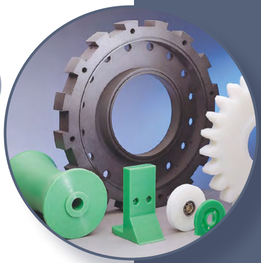


Many materials are produced with additives that provide self-lubricating properties that enhance the performance of parts. This feature helps in reducing failures and provides a longer lifespan for the entire system, leading to cost savings and reduced labor demand. Routine maintenance for parts lubrication is reduced or altogether eliminated when self-lubricating plastic components are used instead of metal. The ability to use these self-lubricating parts is extremely valuable to those with maintenance and reliability responsibilities.

5 Chemical Resistant

Advanced plastics are resistant to damage caused by chemical exposure, making them a suitable material for many applications. Some materials are specifically designed to withstand extreme chemical environments such as those required in food processing equipment cleaning.

6 UV Resistant



UV resistant additives can be included in advanced plastics, offering performance in outdoor applications. The best UV-resistant plastic materials that do not degrade when exposed to UV radiation include acrylic, PTFE, HDPE, Polyetherimide, Polyphenylene Sulfide, Polyvinylidene Fluoride, PEEK, and Poly Amide-imide.

7 Weight Reductions

Most thermoplastics are one-seventh (14.28%) the weight of steel, allowing for easier handling and improved lifting capacity, especially when using an aerial pulley system. Not only do plastics reduce the weight of assembled equipment, but also increase workplace safety. One of the many benefits of plastic compared to steel is that the lightweight material is easier to maintain and is effective in reducing vibration and noise levels.

8 Electrical and Thermal Insulation

Advanced plastics work well as electrical insulators that offer fire resistance, thermal insulation, and high dielectric strength up to UL94 V-O.

9 Cost Savings Over Time

Engineered plastics offer substantial cost savings since they are easier to process and lengthen the part life of the entire system, offering invaluable benefits to end-users and manufacturers.

10 Safety / Economy

Engineering plastic parts, being much lighter than traditional materials, are less expensive to ship, usually cost less than many more traditional materials, and are much easier and safer to install, usually without requiring any additional lifting devices.

Types of Plastics

Depending on the application, there are several types of plastics to consider when selecting a material to meet the requirements of a specific project. It is always advisable to consider the “best combination of properties” that best suits your specific application.

WS Hampshire offers a wide variety of advanced plastic materials to fit almost any application.

Bearing and Wear

1

Ryertex®:

Often used as electrical insulation or as a replacement for metal in high-speed, high-temperature, load-bearing wear applications, “Ryertex®” is a family of industrial composite laminates composed of fiber reinforcement and resin system. Ryertex® is unique to plastics as it is a thermoset rather than thermoplastic, meaning that once cured, the material cannot be melted and reformed. This feature creates a plastic composite that is highly dimensionally stable and can withstand the dirtiest and harshest environments, including extreme temperatures, load, and impact. This type of plastic is commonly used in steel mills, aerospace, military, mining, oil and gas, and rail and locomotive applications.

2

Polyamide (PA, or Nylon):

The properties of nylon include a low coefficient of friction, toughness, and effective abrasion resistance. These characteristics of nylon make it a viable replacement for traditional materials such as rubber or metal.

3

Polyoxymethylene (POM, or Acetal):

With mechanical properties that meet a broad range of structural and wear applications, acetal has good chemical resistance, excellent machinability, and dimensional stability.

4

Polyethylenetepthalate (PET):

Offers a low coefficient of friction with low water absorption and good wear resistance. The FDA-compliant material is a preferred alternative to Acetal when very high dimensional stability is required after machining.

5

PET-GL:

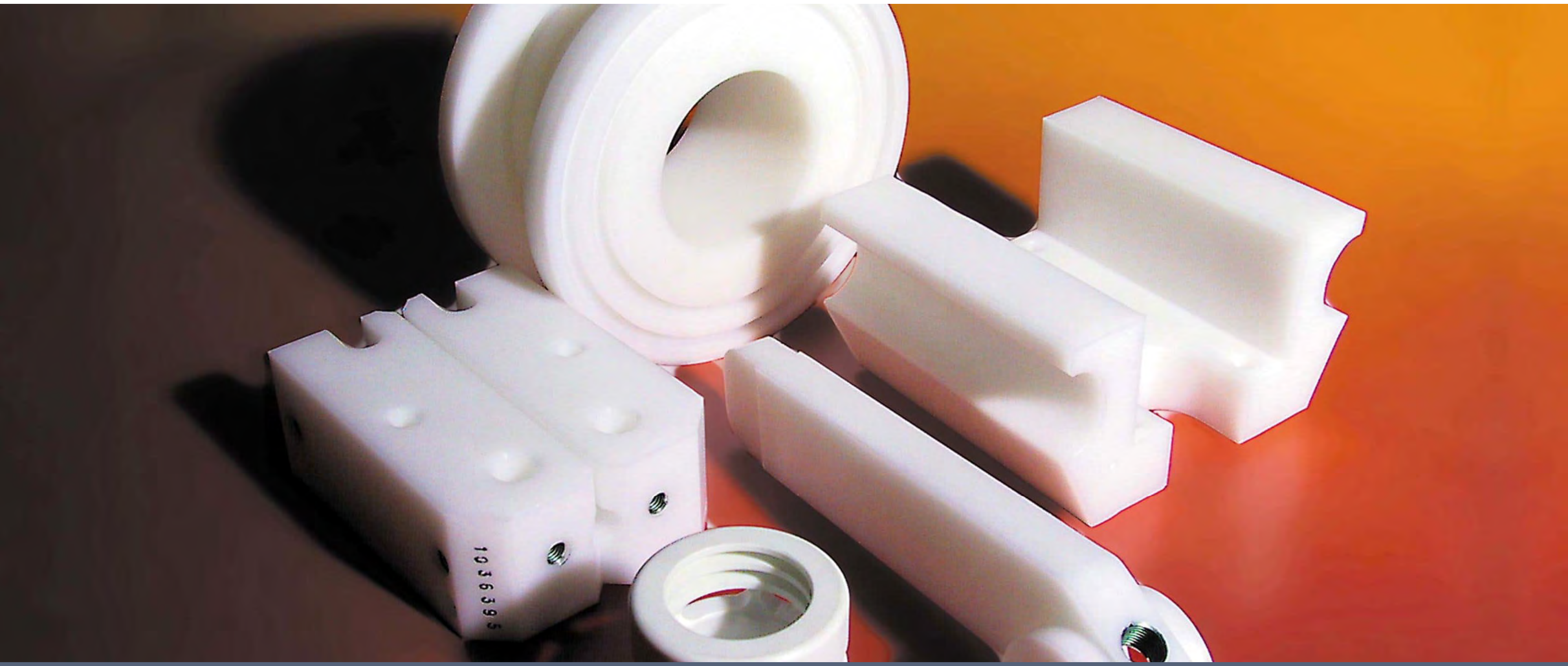
The thermoplastic version of polyester is internally lubricated to provide a premium combination of dimensional stability, reduced coefficient of friction (including the elimination of "stick-slip"), and improved wear resistance properties.

6

Ultra-High Molecular Weight Polyethylene (UHMW):

This advanced plastic is a good option for bearing and wear applications due to being chemically inert, food contact compliant, and its inherently slick properties. Its unequaled impact resistance makes the material an optimal choice for heavy equipment, food processing, and material handling applications which do not require high loads or elevated temperatures.

Types of Plastics Continued...



High-Performance Plastics

1

Polyetheretherketone (PEEK):

PEEK combines high heat and chemical resistance with excellent toughness and food agency compliance.

2

Polyetherimide (PEI):

This high-performance amorphous material offers structural strength and outstanding electrical properties. It is amber in color and semi-transparent.

3

Polyphenylenesulfide (PPS):

This material offers excellent chemical resistance and is usually produced with 40% glass filler for enhanced high-temperature performance.

4

Polytetrafluoroethylene (PTFE):

This material offers superior chemical resistance, zero moisture absorption, and an extremely low coefficient of friction. PTFE is FDA compliant and no-load stable to 500°F.

5

Polyamide-imide (PAI):

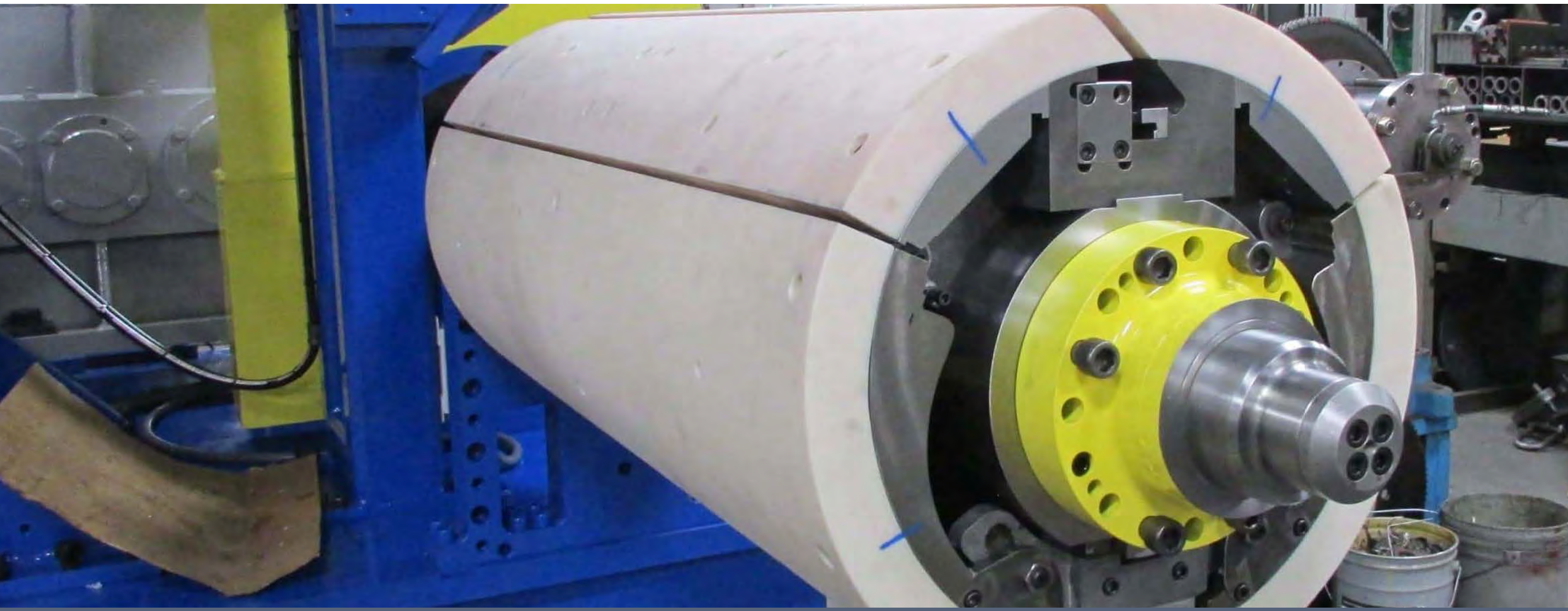
One of the most high-performance materials available, this imidized high-performing engineering plastic is uniquely melt-processible. It can be compression molded and extruded into a broad scope of shapes and sizes and has the best dimensional stability at temperature. Electrical and bearing grades are available.

6

Polyimide (PI):

The highest-performing thermoplastic in general use, this specialty family of materials offers the highest heat deflection temperature and heat insulation at temperature. Electrical and bearing grades are available.

Types of Plastics Continued...



Structural

1

Acrylonitrile-Butadiene-Styrene (ABS):
A rigid, tough advanced plastic that is an annealed and extruded product.

2

Polyvinylchloride (PVC):
Rigid PVC is a stiff and cost-effective FDA grade plastic with high resistance to impact, water, weather, and chemically corrosive environments, it is primarily used for applications like piping systems and handles. It is also available in flexible and chlorinated versions.

3

Acrylic:

Offers dimensional stability, outdoor weather sustainability, outstanding chemical resistance, and crystal-clear transparency.

4

Polycarbonate (PC):

Polycarbonate is a high-performance, tough, transparent thermoplastic polymer and is popular because of its high impact strength, good dimensional stability, and good electrical properties. Available in clear (glazing) and mechanical (electrical/structural) grades.

5

Polypropylene (PP):

Polypropylene exhibits high resistance to cracking, acids, organic solvents, and electrolytes, and has a high melting point and good dielectric properties. While stiffer than HDPE, polypropylene is also known as the “living hinge” due to its outstanding flex fatigue resistance. Readily weldable, it is the lowest cost of the chemical corrosion resistance plastics and is used primarily for tanks and valves in the metal plating, food processing, and lab equipment markets.

6

High-Density Polyethylene (HDPE):

The material is more rigid and offers a higher density than LDPE. It maintains good impact and abrasion resistance when exposed to continual heat up to 180° F and is weather resistant.

Modifications

All of these materials are available in modified versions to enhance specific properties, such as improved UV/weather resistance, wear resistance, lower coefficient of friction, increased rigidity, and high-temperature resistance through the addition of reinforcements or fillers.

TRADE NAME CROSS REFERENCE	
Ryertex®	Micarta, Bakelite, Garolite, Lamitex, Gatke, Spauldite, Tufnol, Lamitex, Textolite, Phenolex
UHMW	TIVAR, Polystone, Polyslick, Duravar, Redco, Poly-Tech, Lennite
Nylon	Nylatron, Sustamid, Ertalon, Tecamid, Nycast, Lamigamid, Oilon, Nylube, Zellamid, Mechetec, Zytel®
Acetal	Delrin, Celcon, Acetron, Sustarin, Tecaform, Mechetec, Zellamid, Pomalux
PET	Ertalyte, Tecapet, Tecadur, Sustadur, Zellamid, Murylat, Vesconite
PEI	Ultem, Duratron, Absylux, SustaPEI, Mechetec, Techepei
PPS	Fortron, Techtron, Tecatron, Sustatron, Arolux
PEEK	Victrex, Vestakeep, Ketaspire, Ketron, Duratron, Arolux, Tecapeek, Sustapeek, Arlon, Semitron
PTFE	Teflon®, Fluorosint, Fibracon, Tecaflon, Tecasint, Fluoro, Avalon, Dalcon, Glyon, Fluteck, IPM-TEK, Semitron, Aflon
PAI	Torlon, Semitron, Tecator, Tecapai, Isoflon, Misumi
PI	Vespel®, Meldin, Duratron, Sintamid, Ensinger-XP, Kapton, Isomide

Working with WS Hampshire

Originally formed in the 1890's as The Western Slate Company, WS Hampshire, Inc. occupies a 135,000 square foot facility in Hampshire, Illinois and is a custom fabricator of non-metallic materials with capabilities including CNC machining, punching, stamping, rotary die, vacuum forming, and assembly. We produce high quality, innovative, OEM quality fabricated components as well as small volume, make-to-order parts within a job shop environment, supported by customized supply chain programs. Our fabricated components are supplied to the Capital Equipment OEM, Electrical, Heavy Equipment/Vehicle, Primary Metals, Pulp & Paper, and MRO marketplaces.

WS Hampshire has the technical expertise to provide our customers with thermoplastic and composite solutions that and are better suited for their environment and lead to lower operating expenses and downtime reduction. Our company has a global reach on raw materials with the capability to manufacture the sizes, shapes, and quantities our customers require.

Contact us today to request more information and discuss the solutions WS Hampshire can offer to meet the demands of your business applications.

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Contact Us

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