RTP Co.
Imagineering Plastics®

Wear and Friction Resistant Thermoplastics

Solutions for Wear, Friction, Abrasion, and Surface Protection Issues

www.rtpcompany.com

Wear and Friction Resistant Technologies

RTP Company is a leading global provider of custom engineered thermoplastics. Our engineers are experts at solving design challenges with specialty thermoplastic technologies. Solving wear and friction issues with thermoplastic compounds is one of the hallmarks at RTP Company. Our Wear and Friction Resistant compounds provide solutions for a number of common issues, including:

1) External Lubrication

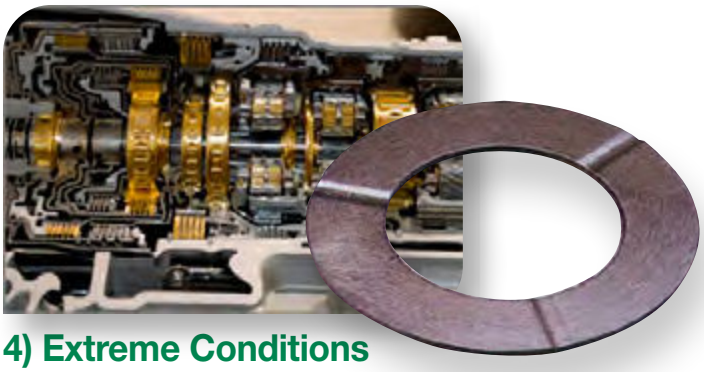
Replace oils and grease applied in messy secondary operations with internally lubricated plastics

2) Abrasion

Manage catastrophic third-party abraders with our proprietary ABR technology for injection molding and extrusion

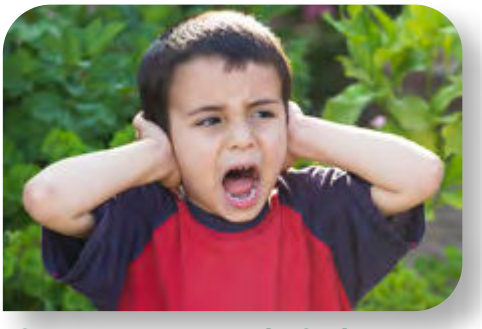
3) Stiction

Reduce stick-slip phenomenon by selecting materials based on **Glide Factor**℠ data



4) Extreme Conditions

Withstand high temperatures, pressure, velocity, chemicals, and demanding tolerances



5) Buzz-Squeak-Rattle (BSR)

Eliminate noise caused by part movement and vibration with economical compound technology

6) Scratch and Mar

Enhance product quality and increase end-use customer satisfaction using Surface Protection (SPR) compounds

RTP Company provides Wear and Friction Resistant solutions for optimal performance of mating and moving parts that might otherwise experience issues such as messy secondary operations, stiction, noise, scratching, marring, abrasion, and/or degradation due to extreme conditions.

Issue #1: External Lubrication

External lubrication is used to enhance the longevity of a product's use, but it is problematic and costly. Often, it requires a secondary brush, spray, or dip operation to apply the lubricant. The process is complicated by poor control over the amount applied, OSHA hazards, and contamination, as well as the need for additional SKUs and suppliers. When external lubricant is applied to a part, it can cause any number of problems, including:

- Inconsistent dispensing
- Contamination of other parts and assemblies in the area
- OSHA hazards (for example, causing employees to slip and fall)
- Additional costs, such as material waste and disposal issues
- Additional labor or robotics required for application of lubricant

Solutions...

What if you could eliminate the need for external lubrication by designing your parts with material that is lubricated *from the inside*?

RTP Company offers a number of **internally lubricated compounds** that provide lubricated part-on-part functionality without the need for costly and problematic external lubrication operations. Our broad portfolio includes these and other internally lubricated solutions:

- All-Polymeric Wear Additive (APWA)
- Perfluoropolyether oil (PFPE)
- Polytetrafluoroethylene (PTFE)
- Silicone (Si)
- Molybdenum disulfide (Moly)
- Graphite

These compounds are formulated to provide optimal performance of mating and moving parts, without the issues of external lubrication.

Below are some common external lubricants, but they come with a wide range of associated issues:

- Silicone (oil, grease)
- PFPE (oil)
- PTFE (grease)
- Lithium grease
- Solid lubricants

A better solution is to use internally lubricated thermoplastic compounds to create mating parts.

Issue #2: Abrasion

Substances that cause abrasion are not easily predicted or managed. In fact, third party abraders can:

- Generate debris
- Cause system contamination
- Create adverse effects on operations and quality

Typically, abrasion is catastrophic to a system, so minimizing the effects of abrasion is crucial.

Solutions...

How can you protect your product from issues with third party abraders?

Many manufacturers turn to UHMWPE (Ultra-High Molecular Weight Polyethylene); however, this material is only available in machined stock shapes, leaving very little design flexibility. At RTP Company, we formulate unique **Abrasion Resistant Alloys** that minimize abrasion as well as UHMWPE can, but are designed specifically for injection molding, offering a whole new way to solve abrasion issues!

Abrasion Resistant Alloys are available in multiple resin and additive combinations for extreme design flexibility, including complex shapes and detailed parts. Additional functionality such as wear and friction resistance, flame retardant properties, and conductivity can also be included, making these materials invaluable for solving a wide range of issues… all in one thermoplastic compound!

How is abrasion tested at RTP Company?

We test our Abrasion Resistant Alloys using two methods: ASTM G65 Dry Sand Testing, and ASTM G105 Sand Slurry Testing. In both cases, specimens are tested against a 60 Shore-D neoprene rubber wheel for 1,000 cycles. The specimen is then exposed to dry sand or sand slurry (depending on the test), and average Mass Loss is measured. *Figures 1 and 2* show the results of these test methods.

Figure 1

ASTM G65 (Dry Sand) Abrasion Results

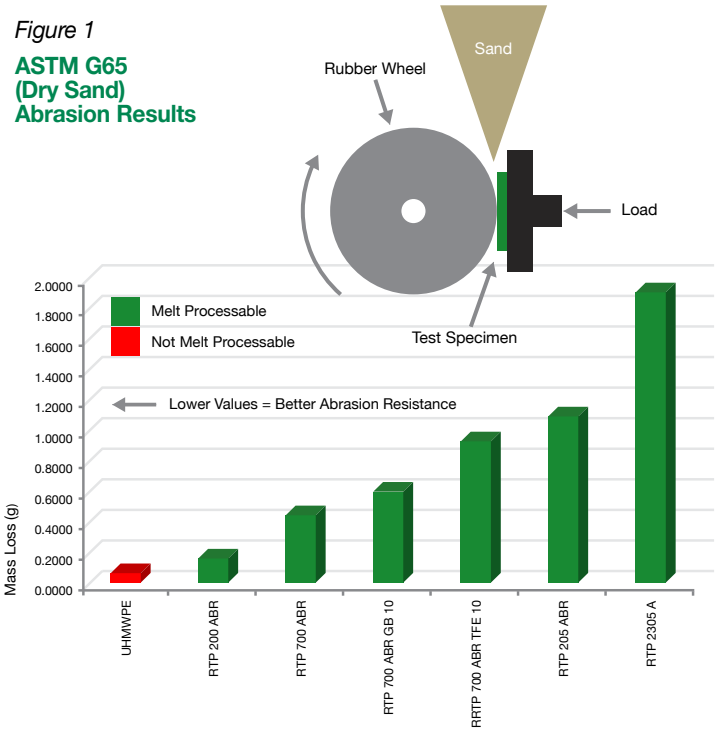
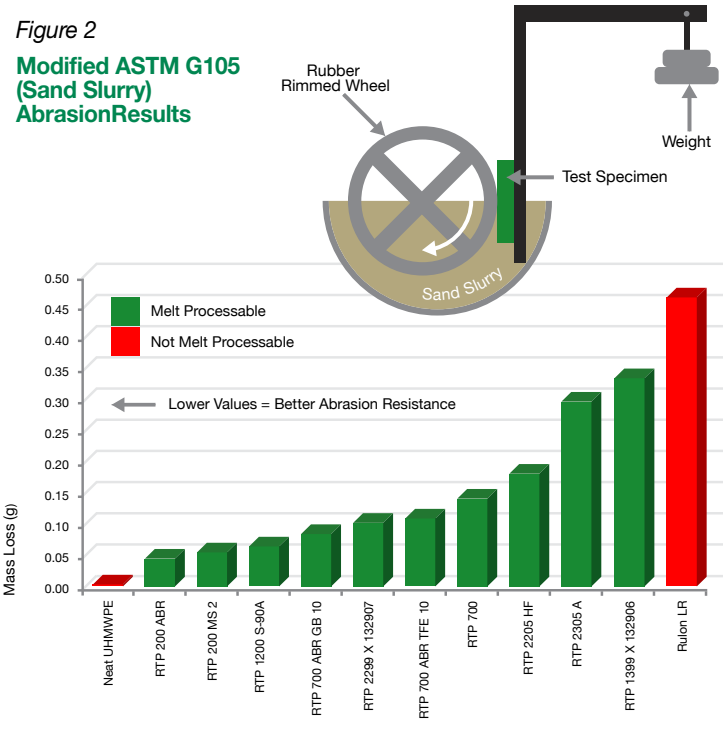


Figure 2

Modified ASTM G105 (Sand Slurry) AbrasionResults



Issue #3: Stiction

Stiction (or “stick-slip phenomenon”) is a term to describe a part that requires a high break-away force to START moving, then repeatedly slips and STOPS moving. Think of a syringe that starts and stops frequently, despite using the same amount of pressure on the plunger. Stiction can be worsened by:

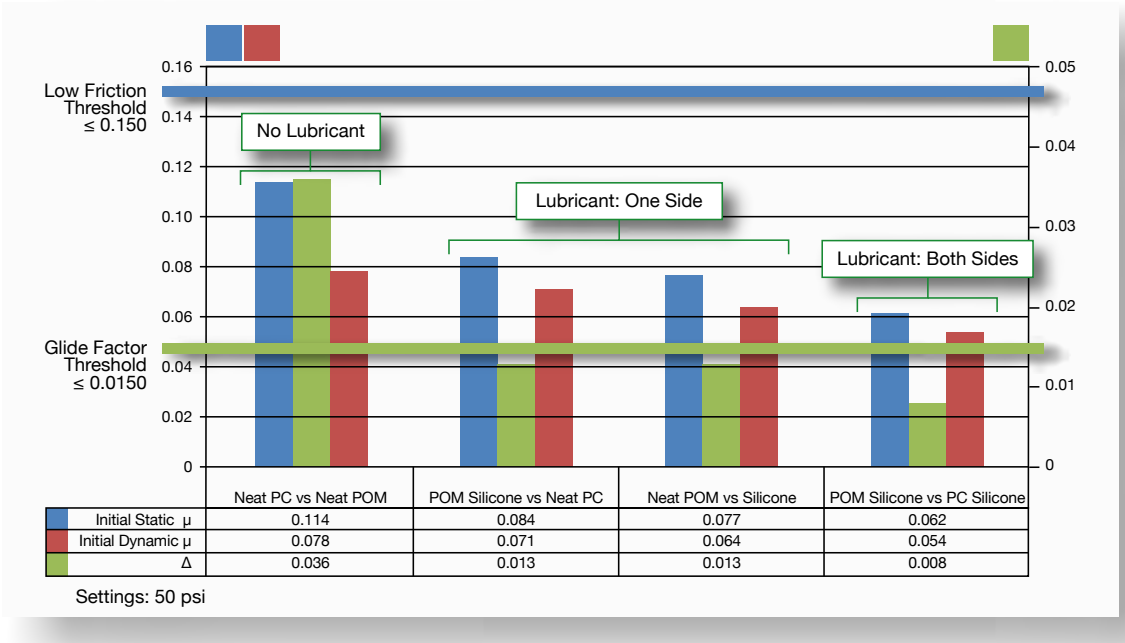
- Long periods of inactivity
- Shipping
- Cold storage conditions

When stiction occurs, it results in poor performance and impaired functionality. This is problematic for healthcare applications like single-use drug delivery devices, or even industrial applications that require consistent energy draw.

Solutions...

RTP Company has developed a unique testing method to determine what is known as **Glide Factor**[SM], the threshold at which plastic material pairings will work together with the least amount of friction. When two plastic mating surfaces have a low static coefficient of friction and a low **Glide Factor**[SM], stiction can be significantly reduced, resulting in better product performance.

PC against POM Test Results



	Neat PC vs Neat POM	POM Silicone vs Neat PC	Neat POM vs Silicone	POM Silicone vs PC Silicone
Initial Static μ	0.114	0.084	0.077	0.062
Initial Dynamic μ	0.078	0.071	0.064	0.054
Δ	0.036	0.013	0.013	0.008

Settings: 50 psi

Figure 3

How is Glide Factor[SM] determined?

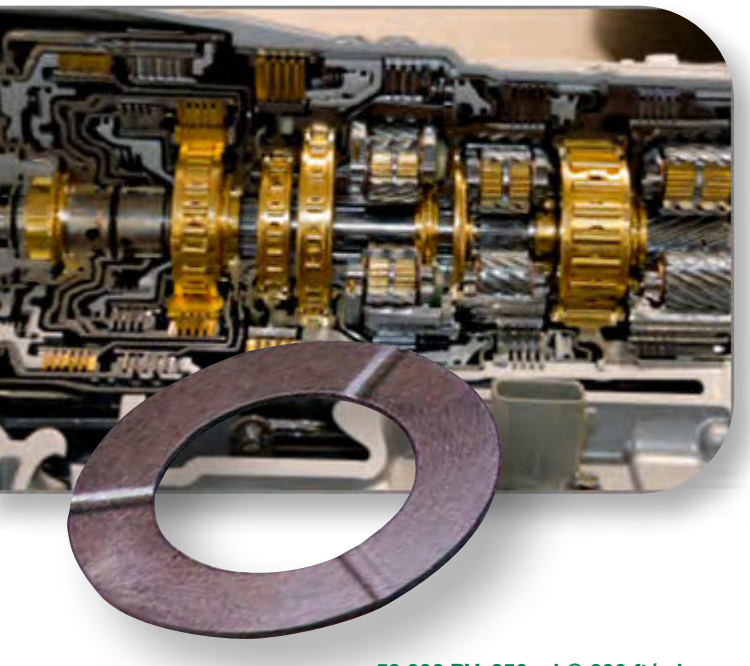
Glide Factor[SM] is determined by measuring the difference between the static and dynamic coefficient of friction between two plastic mating pairs. RTP Company has pioneered this research, using a modified thrust washer test to determine **Glide Factor**[SM] in a wide variety of plastic material pairings, as shown in *Figure 3*. This tribology data is extremely helpful for material selection when stiction is a concern.

Issue #4: Extreme Conditions

In some cases, plastic parts are required to perform under a combination of extreme conditions, such as:

- High Pressures and Velocities (PVs)
- Lubricated or dry conditions
- High temperatures
- Harsh chemicals
- Long term creep and fatigue
- Demanding dimensional tolerances

If the correct part material is not selected, part failure can occur, resulting in costly repairs and downtime.



Solutions...

Fortunately, we offer extreme solutions to minimize the effects of extreme conditions! Our **Ultra Wear and Friction Resistant Compounds** are based on resins with inherent heat and chemical resistant properties, which are then formulated with additives and fillers to create compounds to solve multiple issues using one material.

Some resins are inherently resistant to heat and chemicals, including:

- PEEK
- PPS
- PPA

However, neat resin is not always enough to withstand extreme conditions: when compounded with specific additives and fillers, the resulting material can solve multiple issues.

Figure 4

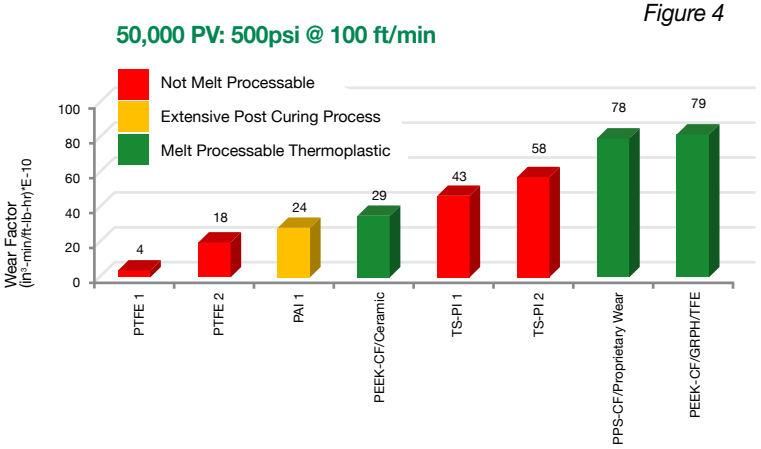
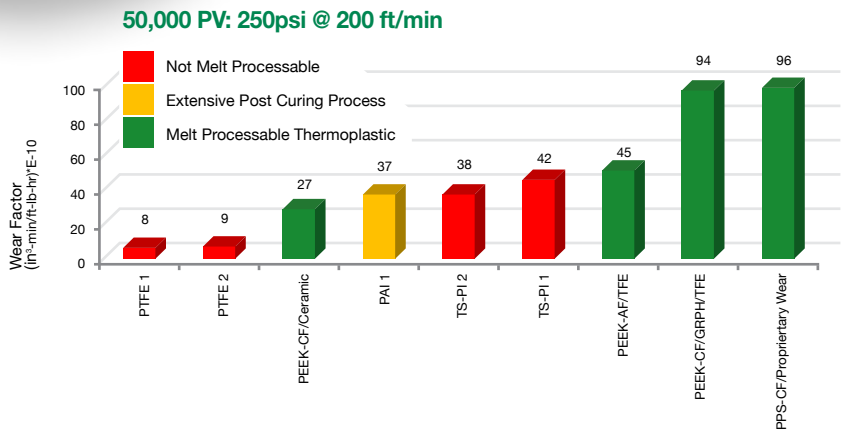


Figure 5



Figures 4 and 5 compare the wear factor of RTP Company compounds and industry standard products.

Issue #5: Noise (Buzz, Squeak, and Rattle)

In environments that are intended to be quiet like an automobile or office, there is nothing more annoying than the sound of a buzz, squeak, or rattle. Noise can be an unintended and undesired result of tightly clustered plastic components combined with movement and vibration.

Noise can be caused by:

- Unintended plastic vs. plastic contact
- Unintended plastic vs. metal contact
- Increased vibration
- More demanding dimensional tolerances
- Excessive movement, rubbing, or sliding

Solutions...

Our engineers have developed a selection of **Noise Reducing Compounds**, specially formulated to minimize noise issues. Drawing on our years of thermoplastic experience, we can assist you in material selection for optimal performance and minimal noise.

Issue #6: Scratch and Mar

Consumer expectations are high, and scratching and marring on the surface of a plastic product can unintentionally damage its perceived high value. Scratch and mar can happen before or during shipping, or they can be caused by:

- Impact
- Rubbing
- Scraping
- Abrasion
- Erosion on parts that have a high level of contact

Solutions...

Our **Surface Protection Compounds** have a lower coefficient of friction, which allows us to optimize surface protection. The advantages of these unique compounds include:

- Improved wear, scratch and mar resistance
- Improved surface feel
- Consistent slip/not affected by temperature change
- Does not interfere with printable and paintable applications
- Easy ejection for glossy or difficult-to-eject parts during injection molding cycle
- Reduced surface roughness or die lines in extruded or blow molded surfaces

Additional Wear and Fricton Resistant Solutions

At RTP Company, we are singularly focused on finding the precise solution to fit the needs of your thermoplastic part or component. Our compounds are formulated to balance the correct base polymer selection with the appropriate Wear and Friction Resistant technology to meet your end-use requirements. In addition, structural reinforcement, static protection, flame retardance, and color properties can be combined into a single material. For more information, contact your local RTP Company representative, or visit **www.rtpcompany.com/products/wear-resistant**.

RTP Co.
Imagineering Plastics®

Your Global Compounder of Custom Engineered Thermoplastics

RTP COMPANY THERMOPLASTIC TECHNOLOGIES

COLOR
We offer precolored resins, UniColor®, Masterbatches (including Color Conduit), and cube blends for plastic parts ranging from automotive to rocket components and medical devices to toothbrush handles. Our Hueforia color experts provide color selection advice and precise custom color matching services.

CONDUCTIVE
We offer compounds for electrostatic discharge (ESD) protection, thermal management, EMI shielding, or PermaStat® permanent anti-static protection. Available in particulate and all polymeric-based materials, these compounds can be colored as well.

FLAME RETARDANT
Whether you are developing a new product or need to reformulate due to ever-changing regulations, we can custom engineer a flame retardant material with the exact properties you require.

HIGH TEMPERATURE
We formulate our high temperature compounds precisely to retain their performance properties, provide better dimensional stability, and offer excellent electrical characteristics in continuous-use high temperatures.

LONG GLASS FIBER
As pioneers in developing a proprietary pultrusion process, we've perfected the manufacturing of our Long Glass Fiber (LGF) Compounds. These pellets encapsulate long fibers for superior strength, stiffness and impact resistance, making them ideal for metal replacement.

STRUCTURAL
Our reinforced Structural Compounds are formulated to increase strength and stiffness, and provide resistance to impact, creep, and/or fatigue. These materials can be customized to meet cost and performance targets.

TPE
Our thermoplastic elastomers provide rubber-like performance with the processing benefits of thermoplastic resin. Our portfolio ranges from standard, in-stock resins to custom compounds designed to meet your specifications.

TPO
For stiff, lightweight, and impact resistant material, our Thermoplastic Polyolefins are your solution, providing excellent low temperature ductility, as well as UV- and scratch/mar-resistance.

WEAR RESISTANT
Our wear resistant thermoplastic compounds can incorporate internal lubricants to reduce wear and friction, thereby lengthening the service life of your application and reducing your processing costs.

ENGINEERED SHEET
We're your one-stop-shop for thermoplastic sheet. We can offer you a unique material, designed with these technologies and extruded to meet your exact sizing requirements.

FILM – WIMAN
Through our sister company, Wiman Corporation, we can provide you with polymer film in a variety of resins, and customized with additives to provide specific properties.

Please contact your local RTP Company Sales Engineer by calling 1-507-454-6900 or 1-800-433-4787 (U.S. only), by email at rtp@rtpcompany.com, or visit www.rtpcompany.com

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