Innovative Polymers is recognized as a leader in the development of polyurethanes and has held that role since its founding more than two decades ago.

Thermoset polyurethanes have long been preferred by design engineers and manufacturers for molding appearance models, multiple prototypes, and short-run production parts.

In recent years, advanced polyurethanes have been developed that feature unique combinations of performance characteristics such as high impact strength with excellent heat resistance and good flexural properties.

Next-generation polyurethanes can also be formulated with outstanding tear strength and elongation, excellent chemical, oil and abrasion/wear resistance, good UV stability, and high impact strength.

Some systems are also flame retardant and can be used at elevated temperatures.

These new, higher performing materials are vastly expanding the use of polyurethanes for short run production applications by replacing more expensive hard-tooling injection molding solutions.

The mercury-free, RoHS compliant polyurethanes manufactured by Innovative Polymers meet and exceed industry expectations for consistency, quality and on-spec performance.

Our broad product line includes a full range of materials to meet the requirements of the most challenging applications.

Our chemists have the expertise to develop custom materials for new product designs; we are second-to-none in custom coloring of polyurethane resin systems.

Innovative Polymers also maintains a flexible production schedule that allows for shipping most orders within 48 hours.
OVERVIEW OF POLYURETHANES

High-performance thermoset polyurethanes are produced from a variety of raw materials combinations. The basic chemistry combines an isocyanate and a blended polyol that are then mixed with various catalysts and additives to create systems that can perform in a broad range of specific applications.

Among the key properties that can be determined by formulation ingredients are: gel times, processing parameters, hardness values and mechanical characteristics such as strength and flexibility.
PRODUCT SELECTION

With the proliferation of polyurethanes on the market today, selection of the best material for a project can prove as challenging as the parts for which they’re being used. In general, the handling characteristics of the polyurethane as well as its cured performance properties must be evaluated. If the part is a prototype or initial part that will ultimately be replaced by injection molded thermoplastic, the polyurethane should also feature appearance and functionality similar to the end material.

**Hardness** is a measure of a polyurethane’s resistance to permanent indentation. Typically, the hardness of thermoset plastics is determined using a Shore® durometer test. Shore A for softer, rubber-like compounds and Shore D for harder systems that can simulate engineering thermoplastics such as ABS.

**Tensile Strength** indicates a material’s ability to withstand stress without fracturing. For a load bearing part, a polyurethane with a tensile strength of around 10,000 psi should be selected.

**Impact Strength** measures a system’s shock-and-fracture-resistance. Innovative Polymers polyurethanes with 1.5 ft-lb/in impact strength are ideal for molding ABS-like parts; products with 6.0 ft-lb/in impact strength are tough enough for casting TPO-like automotive parts.

**Elongation** is the degree a polymer will stretch before breaking. An elongation of 700% indicates that a polyurethane is rubber-like while a low 5-15% elongation material will produce stiffer parts.

**Heat Deflection/Distortion Temperature** is the temperature at which a plastic deforms under a specified load. It is an indication of the suitability of a polyurethane for specific applications. However, the actual service temperature of a compound may be higher depending on the application stresses it may experience at elevated temperatures.

**Flexural Modulus** quantifies the stiffness of the product and is a key factor in product selection. A flex modulus of around 100,000 psi feels similar to polyethylene, 200,000 psi is like polypropylene, 300,000 is ABS-like, and 400,000 psi simulates polycarbonate.

Based on part size and process being used, a polyurethane must be chosen with a workable viscosity and gel time long enough to accommodate complete mold filling before the product begins to cure.
As a starting point, the manufacturer-supplied shrink characteristics of the polyurethane being used should be considered.

While the ASTM D-2566 shrink results are helpful in estimating how a particular polyurethane will perform in a real-world application, the values cannot be fully relied upon because the tests were conducted in the controlled laboratory setting with mold dimensions that are probably different than that of a customer’s parts. Therefore, it is important to determine shrinkage every time a new part design is to be molded before beginning a project.
If it is important for the cast part to retain a specific color, painting surfaces is the preferred option. However, to protect against an unfortunate paint chip, a custom colored part would be a benefit.

When a customer decides that a color-matched polyurethane is required for a project, the beginning step is to notify Innovative Polymers, providing the following information:

- The resin system being used.
- Temperatures to which the casting will be exposed, including mold temperatures.
- The mass of the wall sections of the casting.
- Appearance requirements for the cured part, i.e. opaque or translucent.
- A sample/swatch of the desired final part color and finish.

For example, if the part will have a matte finish, the color sample provided must also have a matte finish. If a swatch is not available, a Pantone number is required. We maintain a current Pantone book for use in the process. **NOTE:** This does not apply to clear tint matches.

Based on these details, Innovative Polymers laboratory technicians will determine if the match is possible. In some circumstances, for example, a fluorescent requirement is not attainable with a material that cures white in color. Or, the colored polyurethane may exhibit a translucent appearance in thin sections when the desired appearance is opaque. If it is determined that the color-matched results may not conform to the supplied project requirements, an alternate material that can be effectively colored may be recommended or the customer can choose a different color.

Innovative Polymers provides a color-matching service for customers who purchase our polyurethanes.*

*We do not offer this service for competitors’ products.

Before considering polyurethane pigmentation, there are many factors to consider.

For example, UV stability may be affected; polyurethane parts may change color after exposure to some lighting conditions or to elevated temperatures.

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FREQUENTLY ASKED QUESTIONS

We are often asked about **Color-Matched Polyurethanes.**

▶ Why is the gel time of my pre-colored polyurethane system slower now than it was when the material was originally received from **Innovative Polymers**?

This issue is commonly found with pre-colored Shore A durometer hardness systems. We recommend one of the following two solutions:

1. Incorporate a catalyst into the polyol to attain the original gel time, or...

2. Rather than having the material pre-mixed, add the color immediately before use as each individual batch is prepared.

▶ Why is the shade that I obtain when I mix polyurethane in the shop slightly different than the chip sample that I approved?

This color variation sometime occurs when a pigment that was purchased for a project is reused with a batch of polyurethane that has aged. We recommend that the proper amount of fresh material and colorant are ordered to complete an entire job because variances in base raw materials can produce slightly different shades with different batches of polyurethane.

In addition, care must be taken to ensure that colorant is fully stirred in its container before use OR the mixed, colored system is shaken to attain a uniform blend. Colors “settle out” or separate from solution when stored for any length of time.

**NOTE:** Ratios must be accurately measured because the pigment is in one part of the system. Off-ratio mixtures will change the overall pigment load in the batch.

▶ What is the maximum amount of color that I can add to the system?

Color should represent no more than four percent of the total system mixture. Higher levels of pigment can reduce the physical performance properties of the cured part.

Typically, a one to two percent load is sufficient to obtain the desired shade.
When we added color to our polyurethane, the mixed system was striated and the cured parts had "sticky", wet areas. What can we do?

Check the base of the colorant. Liquid or paste colorants are created with blends of different fillers, such as carbon black, that are placed in a carrier or base. The carrier should be compatible with the polyurethane system being used. Many times when this problem arises, the user is adding epoxy or polyester color in a polyurethane-based system.

**NOTE:** If using a pigment obtained from a source other than Innovative Polymers, check with our technical department to confirm compatibility with our products.

Should color be added to the polyurethane resin or hardener?

Always add color to the polyol portion of the polyurethane.

Different suppliers may label system components as Part A and Part B, or Resin and Hardener. The recommended way to determine the correct “side” for adding color is to look at the SDS and verify which component contains only polyol ingredients.

When using Innovative Polymers systems, color should be incorporated into the hardener and thoroughly mixed before adding the resin.
PROCESSING METHODS 1

HAND + MASS CASTING

Easy-to-mix Shore A and Shore D hardness polyurethane resin systems are widely used for hand pouring and mass casting to produce thin-walled prototypes as well as parts up to four inches thick. The polyurethanes are ideal for producing 10 to 100 durable prototypes and initial parts with a smooth, blemish-free surface finish.

For hand and mass casting, system components should be weighed on a precision scale and combined in a mixing container.

NOTE: If pigments or fillers are being added, they should be premixed into the polyol component of the polyurethane. Then, other resins and a curative can be added and the mixture stirred for one to three minutes, checking time on a clock, until uniformly blended. Then the polyurethane system is degassed, poured into a prepared mold, and allowed to cure fully.

Polyurethanes feature a number of handling benefits for hand and mass casting:

- Easy to mix. Many systems have 1:1 or 2:1 resin to hardener mix ratios and low viscosities to facilitate weighing out and mixing of components.
- Ideal for pigmenting and color matching.
- Hand pourable with gel times as long as 60 minutes at room temperature.
- Fast and slower cure materials available, depending on project requirements.
- Permit casting of parts from 0.125 inches to 4 inches thick in a single pour.
- Simulate injection-molded thermoplastics including ABS, TPO, and polycarbonate.
CARTRIDGE DISPENSING

Rapid prototyping using premeasured, cartridge-dispensed polyurethanes is faster and neater than hand mixing and pouring and can be more cost-effective because material waste is minimized. The 400 ml cartridges can be filled with premeasured amounts of resin and hardener in either a 2:1 or 1:1 ratio.

Filled cartridges are then ready to be installed in a DP-400 pneumatic dispensing gun along with a static mixing nozzle that ensures thorough system blending.

When the gun handle is depressed, resin and hardener are mixed in the disposable nozzle and can be dispensed into the mold.

Polyurethanes formulated with convenient 1:1 and 2:1 mix ratios can be used with cartridges to reduce mixing time. Cartridges also accommodate the use of faster gelling, higher reactivity formulations that can improve cured physical characteristics.

AUTOMATED METER + MIX DISPENSING

RapidCast® fast curing polyurethanes that gel in less than 60 seconds at room temperature are formulated for automated meter mix dispensing. The equipment quickly combines resin and hardener for immediate injection into the mold. Rapid cast thermoplastic-like parts that simulate injection molded ABS and polypropylene can be demolded in 15 to 30 minutes for rapid prototyping of automotive parts, appliances, medical devices, toys, packaging and more.

Water clear, translucent, amber, and white systems that are colorable as well as black materials

Flame retardant capabilities, including UL 94 V-0 systems (InnoFR™ RC-79D, RC-542 and TP-4016.)

High impact strength, high heat deflection temperature and high flexural modulus systems that can simulate thermoplastics including ABS, polypropylene, polycarbonate and TPO.

RapidCast® Fast Curing Polyurethanes exhibit a diverse variety of characteristics:
PRESSURE CASTING

To ensure complete mold filling for thin-walled and other difficult to inject parts, filled molds can be placed in a pressure pot to remove trapped air. After the lid is secured tightly, the vessel is pressurized to 60-80 psi and held until the polyurethane is fully cured.

**NOTE:** Any remaining air bubbles will be compressed to a microscopic size that is visually undetectable.

**Polyurethanes suited for pressure casting properties:**

- Easy handling with many systems that feature 1:1 or 2:1 resin to hardener mix ratios.
- Gel times as long as 25 minutes at room temperature to accommodate the degassing, injection and installation of the mold in the pressure pot before the system begins to gel.
- Formulations that accommodate pressure casting of thick walled as well as thin-walled components.

VACUUM CASTING

Polyurethanes are often vacuum cast to ensure void-free parts. The process calls for a mold to be placed in a vacuum chamber and the mixed resin system injected under a full vacuum until the mold is completely filled. The vacuum is then released and the part is allowed to cure. Vacuum-cast polyurethanes are ideal for prototyping medical equipment and models, clear lenses, furniture and automotive components.

**Polyurethanes for use in vacuum casting properties:**

- Low viscosity.
- Shore A hardness with good elongation and tear strength (for flexible gaskets, seals and fixtures and for overmolding rigid plastics).
- Shore D hardness white, clear, translucent and tan systems that are colorable and feature such physical performance characteristics as flame retardancy, heat resistance, high flexural modulus and high impact strength.
Rotational molding (or rotomolding) is an economical method for producing hollow parts. When increased strength is required, the molded pieces can be backfilled with urethane foam. Thermoset polyurethanes that are rotomolded produce rigid “shells” used for seating, fluid containers and theme park display fascia. During the molding process, the mixed polyurethane is poured into a mold and the mold is then rotated until the inside surfaces are completely coated to the desired thickness. The casting then cures and is demolded.

**Polyurethanes formulated for rotational molding exhibit characteristics including:**

- Low viscosity and a variety of gel times to accommodate complete, even coating of mold surfaces.
- Short cure time that provides for fast mold turn-around.
- Range of flexural moduli to simulate engineering thermoplastics such as ABS, polypropylene and polyethylene.

**SILICONE RUBBER MOLDS**

To cast accurate, high quality prototypes and low-volume parts from polyurethanes, room temperature vulcanizing (RTV) silicone molds are typically used. RTV silicone rubbers are easy to handle and exhibit low to no shrinkage. The materials also offer excellent durability and provide for outstanding detail reproduction.

**Innovative Polymers supplies two different types of RTV silicone rubbers:**

- **P-Series Silicone Rubbers** are addition-cure, platinum-catalyzed systems that produce high-quality molds with virtually no shrinkage at room temperature, replicate intricate detail, and offer high elongation and tear strength. The silicones are easy to mix and degas and cure at room temperature. (Cure can also be accelerated with heat.)

- **GI-Series Silicone Rubbers** are tin-catalyzed materials that cure via condensation at room temperature over virtually any pattern surface. The systems are easy to mix and degas. Cure time can be reduced using special activators. The completed molds exhibit good mechanical properties and are ideal for many prototyping applications.
Workshop Temperature

Shop temperature should be monitored. The gel times and cure cycles of most materials is determined at temperatures between 70°F and 77°F. Colder or warmer shop temperatures will affect handling of the polymer.

Inaccurate resin to hardener ratios often result in parts with soft, uncured areas. It is important to verify correct component mix ratios on product containers before measuring out and weighing resin, hardener and any fillers or pigments being used. The scale used for weighing must also be accurate to the nearest 0.1 gram. Periodic calibration is essential! Using postal scales and “eyeballing” or measuring by volume is not recommended and usually results in poor casting parts.

Containers

Mixing containers should have flat bottoms and straight sidewalls. Ridges and indentations in the mixing cup or pail can prevent thorough blending of system components. The container size should allow ample room for polyurethane system components to be stirred without spilling. Mixing sticks should have square, rather than rounded bottoms; use of dowels or stirring rods should be avoided.

Mixing

Stir resin and hardener before combining to redistribute fillers that may have settled during storage. Then, mix system components for one to three minutes, checking the time on a clock. Scrape container bottom and sidewalls frequently to ensure all components are fully incorporated. Spilling and leakage during mixing can be prevented by “double cupping” or nesting the mixing container inside a second, larger container.

NOTE: Gentle stirring will help prevent unnecessary air entrapment in the resin system.
For optimum part quality, mixed polyurethane systems should be degassed before pouring.

A high-vacuum system that can draw at least 29 inches of mercury is recommended. Allow ample room in the chamber container to accommodate material expansion as the vacuum is drawn and the mixed polyurethane bubbles and expands up to three times its volume.

As bubbles break and the material returns to its original level, the vacuum should be held for an additional period based on the system gel time.

For example, fast-setting polyurethanes can be held for 60 seconds before the resin system is removed from the vacuum chamber.

Gel times of five to seven minutes should be held for two to three minutes after the frothing subsides.

Materials will continue to bubble long after any benefit of degassing has passed. Therefore, care must be taken to remove the material from the vacuum chamber before it begins to gel.

The degassed material is then ready for pouring into a mold.
To attain the physical performance properties outlined on product data sheets, stated cure cycles must be followed.

For many Innovative Polymers polyurethanes, a room-temperature cure schedule is provided as well as a post-cure + room-temperature cure option.

If the decision is made to use a heat cure:

- Heat the oven to the specified temperature.
- Preheat the mold.
- Remove the mold from the oven.
- Pour the part at room temperature.
- Wait until the part cures enough for demolding at room temperature.

**NOTE:** Parts may require fixturing during post-curing to maintain dimensional accuracy. Alternatively, some parts can be post-cured in the mold.

- Place the part (demolded, supported or in the mold) back in the oven to complete the elevated temperature portion of the cure cycle.

The normal cure time for a polyurethane system is seven days at 77°F.

Lower temperatures will increase the cure time; temperatures higher than 77°F will decrease cure time.

**NOTE:** Some high-temperature materials may require an elevated temperature post-cure to attain their full physical properties. Most materials will be sufficiently cured to allow for normal handling and shipping within 24 hours.

The physical properties, processing details and cured performance information on Innovative Polymers technical data sheets is critical to realizing anticipated part quality and performance. Be sure to consult the data sheet before beginning every casting project.

Contact Innovative Polymers technical support for questions.
Demold time is always mass dependent and can vary according to part geometry, environmental shop conditions, and the reactivity of the polyurethane.

Fast-setting materials typically are ready for demolding in 60 minutes or less.

Products with longer gel times may require up to 16 hours of curing before being removed from the mold.

Some high-temperature materials may require an elevated temperature post-cure to attain their full physical properties.

**Parts can be post-cured in two different ways:**

- In the mold for a recommended period of time based on the tech data bulletin.
- Gel in the mold, demold and cure for a period of time at room temperature, then place in an oven for the post-cure.

**NOTE:** Fixturing may be required to avoid deformation during the post-cure process.
Many modelmakers, prototypers and molders of polyurethane parts must paint cured plastic surfaces to attain a production-quality finish.

The following procedures can help ensure high-quality results.

Begin by evaluating the specific polyurethane to be painted because coatings do not adhere to every resin system in the same way.

Many generic paints, for example, are well suited for coating rigid materials but tend to crack when applied to softer plastics that bend.

In general, polyurethanes with a Shore hardness of less than 90A require use of special primers and paints or lacquers formulated with flex agents.

The best source for these specialized paints is an auto body equipment supplier.

The quality and durability of coated polyurethane surfaces are directly affected by proper resin/hardener mix ratio and curing, surface cleanliness, abrasion/etching, priming and painting processes.

**NOTE:** Silicone rubber molds are typically NOT released if the part will be painted, although there are special release agents designed for this use.
Accurate mix ratios, precise weighing and thorough mixing are keys to molding high-quality parts.

**NOTE:** Innovative Polymers suggests agitating resin and hardener before mixing to disperse all system components. After pouring parts, cure completely for at least 24 hours at room temperature.

**NOTE:** If cured polyurethane parts have “oily” or “slippery” rather than dry, smooth surfaces, attempts to paint will be futile. The typical cause of these problems is improper mix ratio and/or incomplete curing.

Cured surfaces must be thoroughly cleaned before painting. Begin by eliminating any residual contaminants such as release agents that may have been sprayed on mold surfaces. For this cleaning process, scrub surfaces with warm, soapy water.

**NOTE:** Many Innovative Polymers customers have found that Dawn brand liquid dish soap is particularly effective in removing release agents, grease and oils from polyurethane parts. After cleaning, thoroughly rinse parts with water to remove any remaining soap and allow to dry.

**NOTE:** Some customers also wipe surfaces with alcohol before proceeding.

Next, etch parts using a fine-grit sandpaper, sandblasting or bead blasting. This step will produce small pores in the polyurethane surfaces, promoting a strong bond between parts and paint. After etching, clean parts once again using soap and water or a grease and wax remover to remove any contamination that occurred during sanding.

Begin the coating process by applying an automotive primer to surfaces. Allow this first coating to dry thoroughly and then etch and clean surfaces once again. Priming is an important step to ensuring the successful coating of parts with paint.

For the top-coat color, customers have found that automotive lacquers are ideal. It is critical to follow manufacturer's instructions for use of the selected paint. Coat surfaces with a minimal amount of paint; use multiple thin coats rather than one thick layer. If excessive paint is applied to a polyurethane part, drying time can increase significantly and even cause parts to warp before the coatings fully cure.
Proper storage and handling of polyurethane materials is critical to maintaining shelf life and preventing crystallization and moisture reactions.

Polyurethanes are moisture-sensitive materials. Resins that are exposed to moisture may form an indissolvable skin on the resin surface. Hardeners that are exposed to moisture may have a normal appearance but will produce foamy parts.

If skin is noted on a container of polyurethane resin, remove it. Then, if no additional particles are noted in the material, mix and cast a small amount of resin and hardener. If the cured part exhibits the expected high quality, the remaining resin system is usable.

To prevent moisture contamination, opened containers of resin and hardener must be resealed carefully. To begin, clean the lip of the container with a rag or paper towel to remove any material residue. Next, spray dry nitrogen into the open container. Finally, replace the lid ensuring a tight seal.

**NOTE:** When meter/mix equipment is used or material is dispensed from steel drums, a desiccant cartridge should be utilized. The cartridge is designed to dry the air being pulled through it, eliminating the harmful effects of water molecules.

For more details, see Casting Tips article “Check The Weather Report” on the [Innovative Polymers](http://www.innovative-polymers.com) website.
STORAGE CONDITIONS

Polyurethane resins and hardeners should be stored at temperatures between 65°F and 80°F, unless the product label indicates otherwise. During cold weather, store containers on pallets and at least 24 inches from the wall to avoid lowering the temperature of the materials. Products should NOT be stored directly on the floor or against the cold outside walls of a building.

When temperatures hover around 60°F, both resin and hardener system components may begin to freeze. If resin freezes, small white shards or crystals will form or the material will take on a “milky” or cloudy appearance. Hardener subjected to cold temperatures may become more viscous and form “waxy” chunks.

NOTE: See crystallization in troubleshooting section for more information.

HEALTH + SAFETY

Before starting a project, workers should be thoroughly familiar with information on the product containers and Safety Data Sheets (SDS) supplied to each customer. Among the details contained on labels and SDSs are descriptions of product ingredients and possible hazards, personal protective gear recommendations, suggested first aid treatment in the event of unplanned exposure and waste disposal procedures. Reading and understanding this information is the responsibility of the user.

Keep work areas clean to prevent skin contact. Use disposable mixing containers and have a ready supply of rags or towels available to wipe up spills. Discard all of the empty cups, cans, sticks and rags/towels after completing a project.

Resins and hardeners should be handled in well-ventilated areas. Forced air drafts that carry away fumes are preferred.

When working with resins, workers should wear disposable coveralls, lab coats or protective sleeves that cover the forearms. Gloves and safety glasses with side-shields are also vital to preventing skin and eye irritation from splashing or spilling resin and hardener.
**Trouble Shooting**

**Excessive Exotherm**
As a thermosetting resin and hardener cure, heat is generated. Known as an exothermic reaction, the amount of heat liberated is related to the mass of material being cast. The greater the mass, the greater the exotherm. Ambient temperature also affects exotherm; as shop temperature increases, so does exotherm.

When a thick-walled part is being cast, it should be poured in sections to reduce exotherm. Or, the resin system might be changed to one with a slower cure rate that is better suited to mass casting.

Contact the Innovative Polymers technical department for recommendations.

**Voids and Porosity**
Trapped air in a mixed polyurethane resin system can produce bubbles in the surface or wall of a cast part. To prevent the formation of voids, care must be taken during the mixing process so that air is not whipped into the polyurethane. Before the material is poured into the mold, it should be vacuum degassed.

For thin-walled castings, the mold can be filled and cured under pressure.

**Incomplete Cure + Soft Spots**
The most common cause of incomplete curing is the use of inaccurate resin to hardener ratios and inadequate mixing of system components. It is important to verify correct mix ratios on product containers before measuring and weighing resin, hardener and any fillers or pigments being used. The scale used for weighing must also be accurate.

**NOTE:** Electronic scales accurate to the nearest 0.1 [as mentioned above] gram are recommended.

During mixing, resin, hardener and fillers should be stirred together for one to three minutes, checking the time on a clock.

Mixing container bottom and sidewalls should be scraped frequently to ensure that all components are fully incorporated.

Shop temperature should also be monitored. The cure cycle of most materials is determined at temperatures between 70-77°F. Colder or warmer shop temperatures will affect the cure schedule of the polymer.
Excessive Shrinkage
The physical characteristics of a resin system will affect its shrinkage. For example, materials with high exotherm can be expected to shrink more than low exotherm products. Similarly, when resin systems are cast to form thick-walled or large parts, they will generate more heat during curing and exhibit greater shrinkage than when used for thin-walled parts. Pre-heating the tool may help eliminate excessive shrink.

Contact the Innovative Polymers technical department for recommendations.

Moisture Contamination
If polyurethane components are exposed to moisture, a skin may form on top of the resin in the container. This skin is insoluble and cannot be dissolved. It must be carefully removed from the resin surface.

Remaining resin must then be examined to see if any particles remain in the material. If the polymer is particle-free, mix a small amount of resin and hardener and pour a test part to verify that the polyurethane is still usable.

If moisture permeates the hardener container, you will note the problem if your cast part bubbles or foams on the surface. The water molecule is a reactive regent and will cause materials to foam. If this has taken place, contact your Innovative Polymers representative for possible solutions.

Crystallization
Resin and hardener can be contaminated with dust or other foreign materials. These particles can act as seeds that form crystals in the products. Similarly, exposure to temperatures below 65°F can cause crystal formation.

A crystallized material usually can be returned to its original state by heating the compound to 120°F to 140°F and then stirring until a normal, liquid consistency is attained.

NOTE: If a polyurethane resin appears cloudy or has solidified, the material may have undergone a chemical reaction known as dimerization.

NOTE: MDI-containing formulations dimerize when two identical molecules form a pair. These systems cannot be reclaimed.