PRO-SET

REPORT

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Disposable Glove Tips

Glenn House, Health, Safety & Environmental Manager

Most epoxy resins can cause skin irritation or an allergic skin reaction. Epoxy curing agents are commonly regarded as severe skin irritants and sometimes can even be moderately corrosive to skin tissue. Consequently, some sort of hand protection should be worn to prevent skin contact. Disposable gloves are in many cases the most convenient and economical hand protection for use with epoxy. They are particularly good for projects where dexterity and fingertip sensitivity are necessary. However, to use disposable gloves safely, it is important to understand their limitations.

Disposable gloves may be made from many materials, not all of which are recommended for use with epoxy. Glove materials that offer the suggested protection for general epoxy use, based on tests and data provided by chemical and glove manufacturers, include nitrile, neoprene, butyl rubber, natural rubber, and latex. Other disposable glove materials, such as vinyl and polyvinyl chloride (PVC), can quickly degrade upon exposure to epoxy and allow chemical breakthrough to occur rather quickly.

Breakthrough rates often depend on the thickness of the glove. The thicker the glove, the longer it is likely to take for breakthrough to occur. Typically, disposable gloves are manufactured to be about 4-6 mils thick. This will provide adequate permeation and degradation protection for quick (1-30 minute) epoxy jobs. For longer jobs, it may be necessary to replace gloves with a new set.

Keep in mind that breakthrough and degradation may still occur with suggested glove materials, but will take a much longer period of time. To date there is no such thing as an "all purpose" disposable glove that will withstand exposure to a wide range of chemicals for an extended period of time and still provide the necessary dexterity and durability characteristics. One of the challenges of finding the right disposable glove to use with epoxies is finding a material that will stand up to the chemistry of both the resin (Part-A) and the hardener (Part-B). Resins and hardeners have components that attack glove materials differently and at different rates.

The following are some guidelines for longer lasting hand protection with disposable gloves:

1. Use a protective barrier cream underneath the disposable glove to provide secondary protection in case a glove should tear or puncture. You should not depend on the barrier cream to provide primary hand protection by itself.
2. Double layer your disposable gloves. This will insure that you always have an uncontaminated pair underneath. Periodically (every 20-30 minutes) replace the top gloves before degradation occurs or when damaged. Replacement frequency will depend on usage conditions, such as how saturated the gloves become with epoxy and the likelihood of puncture or tear. Obviously, low contact will not require as frequent glove replacement as total saturation or immersion.
3. Replace gloves carefully. The most common technique is to peel the gloves off inside out, one at a time, being careful not to contact the wrist area with a contaminated glove. Carelessly removing and re-donning gloves can cause additional and unnecessary exposure.

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Editor
Kay Harley

Design
Jennifer J. Weaver

Pro-Set Inc. / PO Box 656 / Bay City, MI 48707 USA / 888-377-6738 / www.prosetepoxy.com

Vacuum Bagging Materials

Joe Parker, Product Manager

The vacuum bagging process requires equipment and materials that facilitate removal of the air from under the bag film. This article will provide an overview of the most common materials and processes.

Vacuum Bag Film

Bag films are available in many types. Higher cost materials have higher temperature capabilities and can be used for any of the processes, while lower cost materials have more constraints and therefore less versatility. Some bags are disposable and can only be used once or twice, while others are designed for multiple use in a production environment.

The most common disposable bag films are nylon and can be used at temperatures up to about 400°F. For some applications, high quality polyethylene film (PE) can be used. If using PE film, use virgin material, not re-grind or recycled material. Disposable bag films are typically 1 to 5 mils (0.001 – 0.005″) thick and are packaged in rolls up to 120″ wide and 1000′ long. Some suppliers provide embossed films that are both the bag film and breather, with the pattern providing air flow channels to allow air to escape to the vacuum port.

Reusable bags can be made of heavy gauge polyurethane, cured silicone rubber sheet or cure-in-place silicone. In most cases, the bag seal, and resin and vacuum ports are built into the bag. Some of these bags are also embossed to provide built-in air or resin flow medium. These options allow bagging the part to be very quick with almost no labor involved during part fabrication. However, the initial construction and assembly of the bag will require a significant capital investment. Depending on the manufacturing process used and the cure temperature of the part, these bags can last as many as 100 mold cycles or more. Choose a material that is compatible with the resin system used for the part, as each bag material is compatible with certain resin types.

Peel Ply

In almost all vacuum-bagging operations, some type of peel ply or release fabric is required. Again, there are a number of products to choose from. The process and resin system should always be considered when making a peel ply choice. Testing is required to determine the most appropriate peel ply for a specific laminated part. Peel ply or release fabric is also beneficial for contact molding as well, keeping the surface clean and providing a surface that is ready or nearly ready to bond to once the fabric is removed. Common peel plys are woven nylon or polyester fabric, available untreated or treated with a mold release material. The weave of the fabric will determine the finish of the part, so consideration should be given to additional steps done to the part after the process materials are removed. Heavier fabrics are easier to remove from the laminate surface, but are not as drapable, making them more difficult to work with during the laminating process. Lighter fabrics may tear and leave streamers of fabric on the part surface when they are removed. Treated fabrics are typically used with higher temperature cures because they will more readily release from the cured epoxy. For extremely high temperature cures, treated woven fiberglass fabric is used because the fiberglass will not tear. If using a treated fabric, care must be used to ensure that no residual release materials transfer and contaminate the laminate surface, preventing proper adhesion of any additional laminate or finish system.

Release Film / Bleeder Film

These films are a very light film that is used in place of peel ply in some applications. It can also be perforated with specific hole sizes and patterns to control resin flow out of the laminate stack during the bagging process. This is especially important with a long working time or low viscosity laminating systems. The bleeder film holds a certain amount of resin in the laminate stack until gellation (keeping the breather film from acting like a blotter). The films can be used directly against the laminate stack, or more commonly, on top of the peel ply layer. The standard perforation patterns range from a 0.045″ hole on 0.250″ centers to a 0.015″ hole on 8″ centers. Bleeder film is generally not reused.

Breather Layer

The breather has to resist compression by the bag pressure and allow air and resin to flow between the laminate/peel ply/perforated film stack and the bag film. If the bag were to seal tightly against the peel ply or release film as the air is evacuated, there would not be a path for continued air flow. This air lock would prevent the bag pressing with the desired force on the laminate surface. The material is also sometimes used to absorb excess resin, so multiple layers or heavier breather fabric is necessary with heavy, wet bagged laminates.

Many roll goods can be used as a breather layer. The industry standard is a non-woven polyester or nylon felt-like material. Some of the choices have very high elongation, which will help the material get into deep contours on a detailed part. Swimming pool cover material, bubble wrap, burlap, multiple layers of dry fiberglass fabric, or strands of line are sometimes used. The key is to have enough non-compressible material under the bag that any excess resin will not fill the space. Choose the breather layer material based on the laminate material. Some materials will transfer a

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New Adhesive Combinations

PRO-SET M1011/276 Black Toughened Adhesive

There have been numerous requests for a black version of our popular PRO-SET 176/276 highly toughened epoxy adhesive. We have responded to those requests by creating M1011 Black Adhesive Resin. The product is sold in combination with the 276 Hardener in easy to use cartridge sets. The handling characteristics, working and cured properties are the same as the standard "yellow and blue make green" 176/276 combination.

276 Black Toughened Adhesive will bond to wood, concrete, composites, and metal. It is used primarily for highly loaded structures and works very well in carbon laminate/metal bonding situations.

Unlike the standard PRO-SET Adhesives, the black resin does not change color with the addition of the blue hardener, so no visual indication of both the resin and hardener is present during dispensing. Extra caution is recommended to ensure both the resin and hardener are flowing through the mixer nozzle.

At room temperature, the 100g (100 gram) pot life is 30 minutes and working time for a 1/2" bead is 90 minutes. Clamps off cure time is 10 hours.

Test		Substrate	Result
ASTM D-256	Izod Impact	n/a	1.46 ft.-lb/in.
ASTM D-1002-72	Lap Shear	A-366 Steel	2,880 psi.
ASTM D-1002-72	Lap Shear	2024 T Aluminum	2,864 psi.
ASTM D-4541	Tensile Adhesion	A-366 Steel	4,296 psi.
ASTM D-4541	Tensile Adhesion	2024 T Aluminum	3,415 psi.

Substrate Properties for M1011/276 Black Toughened Adhesive

M1010/M2013 White Adhesive

We have recently created a white version of our PRO-SET Epoxy Adhesive. The M1010/M2013 White Adhesive combination has the same shear thinning characteristics as all of the PRO-SET adhesives, with exceptional tooling characteristics for a fillet or glue line, while still maintaining excellent slump resistance. Mechanical properties are on par with the standard PRO-SET 175/275 combination.

At room temperature, the 100g pot life is 30 minutes, while working time for a 1/2" bead is 75 minutes. Time to clamp removal is 8 hours.

The M1010/M2013 White Adhesive *is a non-standard 3 to 1 system and requires a PPM-300 dispensing gun, available from Cox North America by calling 800-822-8114.* This formulation provides 3 to 4 times better resistance to yellowing than the typical 1 to 1 or 2 to 1 epoxy chemistry will allow.

Again, unlike the standard PRO-SET Adhesives, the white resin and untinted hardener do not provide any visual confirmation of proper dispensing and mixing. Extra attention to dispensing, time in the mixer, and application temperature is crucial.

Working and cure times are determined at 72° F for all of our PRO-SET Adhesives. Mass and temperature will significantly affect gel and cure times. Larger mass or higher temperatures will accelerate the cure, while cooler temperatures or thin glue lines will extend the cure times.

Minimum application temperature for both adhesive combinations is 60° F.

The adhesion of these two new epoxy combinations to FRP, wood, and concrete is generally strong enough to fail those substrates, indicating the bond strength to these materials exceeds the strength of the material. Additional mechanical properties are available by contacting the technical staff at Pro-Set Inc. Please contact Pro-Set Inc. for data sheets and current prices on these new products. ■

Gloves, cont'd

4. Remember that materials used in manufacturing latex gloves can cause allergic reactions in certain individuals.
5. Consider using thicker, reusable gloves for long projects, when gloves may be totally saturated or immersed for an extended period of time, when frequent glove change is not feasible, or when dexterity and fingertip sensitivity are not as crucial. Keep in mind, however, that a thicker and otherwise reusable glove may not always be reusable once epoxy has cured on it.
6. Use cotton liners under liquid-proof gloves to absorb sweat and add comfort.

The sources listed below also manufacture or sell industrial disposable gloves and other non-disposable chemical protection gloves. Further information and chemical test data can be found at their web sites.

Ansell Edmont
www.ansell-edmont.com 800.800.0444

Best Manufacturing Company
www.bestglove.com

Broner Glove & Safety Company
www.employeehealth.com 810.391.5000

Lab Safety Supply
www.labsafety.com 800.356.0783

Microflex
www.microflex.com 800.876.6866

West System Inc.
www.westsystem.com 866.937.8797 ■

Vacuum Bagging, cont'd

pattern into the surface of the laminate. A wood/epoxy laminate can accept a bubble wrap or pool cover breather, but that material will distort a fiberglass laminate, causing out of column fibers within the laminate.

Bag Seals

The most common bag seal is the film sealant tapes available on a roll. These mastic sealants are flexible, and will generally stick to the waxed or release treated mold surface, but can be removed cleanly from that surface. They stick to the bag film very well, and are difficult to remove from the film. It is important to choose a sealant that can stand the intended cure temperatures, and will not be degraded by the resin system used in the part. There are also cured extruded rubber seals that can be used with a reusable bag. These seals are similar to a refrigerator door seal and are generally adhered directly to the rigid frame of the reusable bag.

Miscellaneous Equipment

Hose and fittings need to be rated for vacuum applications to ensure that they will not collapse during use. 3/4" PVC pipe and fittings are routinely used for vacuum plumbing. Vacuum gauges, ports, and vacuum leak detectors are available to increase the efficiency of getting the vacuum bag in place and monitoring the process. ■

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Pro-Set Inc.
P.O. Box 656
Bay City, MI 48707

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