



TECHNICAL SERVICES

SOLUTIONS GUIDE TO COMMON RESINOUS FLOOR COATING

This document deals with many of the most common issues or problems that are associated with the installation of a floor or wall coating system. Obviously, each project is unique, and every environment presents its own challenges; therefore, not every problem, project nuance or potential difficulty can be addressed or covered in this document. Our attempt here is to simply provide a better understanding of many of the more common coating problems that may occur.

SECTION ONE

BUBBLES / CRATERS THAT APPEAR IN A CURED COATING: Bubbles (or craters from bubbles) can appear in the surface of a coating as small as the size of a pinhead or as large as 1" (2.5 cm) in diameter; that appear randomly throughout the coated floor area or in honeycomb clusters. In most cases, the bubbles are caused by one of the following forms of air entrapment.

- A. OUTGASSING:** Bubbles may appear in the coating surface after a high solids coating is applied over a porous concrete surface. This condition is created when the coating begins to exotherm during curing. As the coating increases in temperature, cooler entrapped air in the substrate expands and rises into the coating, thereby creating bubbles.
1. To avoid the “out-gassing” problem, apply the polymer coating when the substrate and ambient temperatures are similar. This will help to reduce the chance of ‘bubbles.
 2. Make sure there are no heat sources blowing warmer air onto the coated surface.
 3. Make sure the temperature is descending and not ascending.
 4. Sealing or priming porous concrete with a thin coat of material – such as **F-01** applied at between 175 to 200 sq. ft. / gal. will also help to diminish the formation of ‘bubbles.
- B. AIR FLOW ACROSS THE COATING:** Excessive air movement from open doorways, from HVAC units, fans, or similar sources can cause the top surface to dry too rapidly and form a “skin” preventing trapped air from being released from the coating. It can also be due to excessive air flow from HVAC units, fans, or similar sources within the building envelope that blow directly onto the uncured coating - injecting undesirable air into the coating that form bubbles.
1. To avoid this condition close doors and windows, turn HVAC equipment and blowers off (if possible), or at least re-direct any air flow away from the area being coated or newly applied coating.

C. ELEVATED TEMPERATURES: When air, surface, and/or material temperatures are elevated (extremely high) during the installation process (and prior to initial cure) the polymer material may cure too quickly (skimming over) and entrapping air below the surface – the air as it tries to escape can create bubbles on the surface. Avoid the following circumstances:

1. Avoid high temperature conditions, especially ambient or substrate, whenever possible or cool the material prior to application. Applying the material in ‘thin’ coats (if possible, less than 9 mils thickness) may help to relieve bubbles.
2. Do not apply a coating in direct sunlight, if the area cannot be ‘shaded’ - wait until the sun no longer shines directly on the area to be coated or apply the coating at dusk when temperatures are cooling down.
3. Do not store material in direct sunlight or in an area of ‘confined’ heat prior to mixing and/or application of the product.

D. IMPROPER MIXING: When polymer components are mixed too aggressively (such as by using a drill with a speed of over 600 RPM), unwanted air can be forced into the liquids (resin and hardener) as they are being mixed.

1. Use a variable / slow-speed drill [300-500 RPM] for mixing, with a Spiral Mixing Blade specifically made for mixing polymers products.
2. Move the mixing blade in circles around the inside edge of the pail from bottom to top generating as little to no vortex and avoid pulling above the top of the liquid.

E. MOISTURE VAPOR: ‘Bubbles’ or blisters that appear on the surface of a cured coating can also be caused by MVT [moisture vapor transmission] or “hydrostatic pressure” passing through the ‘pores’ of the substrate and into the coating. This is typically due to a lack of a proper vapor barrier beneath the slab. If bubbles / blisters do appear, check to see if liquid / moisture is present by breaking or cutting them open.

MVT and/or Hydrostatic pressure can be a serious problem that is not associated with the quality of the material and/or quality of coating application. If it is determined that an MVT problem exists, ‘moisture’ tests must be performed immediately in order to determine the degree and level of the moisture pressure present in the substrate; feel free to contact Polymer Nation for additional advice and recommendations.

F. APPLICATION TECHNIQUE: It is extremely important to utilize the proper installation techniques *and purchase the correct application tools* when applying a floor or wall coating system. Careless application practices and/or incorrect or unsuitable tools can create ‘bubbles’ or could produce unacceptable imperfections on the finished surface. To avoid bubbles and/or miniature craters in the coating:

1. Use high-quality, “lint free”- medium nap roller covers (preferably 18" wide); cheap roller covers can leave “lint / fuzz” or other debris in the finished surface.

2. Make sure to “Roll Out” the coating using smooth and ‘even’ back-and-forth strokes and avoid vigorous or erratic rolling motions.
3. Be sure to ‘back-roll’ any areas where ‘spiked shoes’ have been worn during the application, spike marks left in the surface can appear as bubbles or ‘fisheyes’.
4. Make sure to check & clean the spikes (on the ‘spike shoes’ or ‘spiked’ rollers), prior to application in order to avoid cured coating material and/or debris that has dried on the bottom of the spikes from falling off into the ‘wet’ coating.
5. When applying a coating at a coverage rate / thickness that is greater than 16 mils [100 s.f./gal.], it is advisable to back-roll with a spiked or “porcupine” roller; this will help “break-up” any bubbles that can develop in the thicker coating (make sure to clean the spikes of the roller prior to use).

REPAIR METHODS: There is no easy way to repair ‘bubbles or blemishes in a coating without, unfortunately, recoating a specific area or the entire floor. Any debris in the coating should be removed and any larger blemishes / bubbles may require individual attention - by abrading using a hand grinder so they are “flush” with the surrounding surface. Gouges, voids or repairs may require filling, if necessary, with a compatible polymer material and allowed to cure. Coatings that have been down, or have been applied for longer than 24 hours, MUST be thoroughly abraded [to remove any ‘gloss’] prior to re-coating. This can be accomplished using a large ‘orbital’ floor sanding machine [with 36 to 100 grit paper or screens] or a large surface grinder equipped with similar grit diamonds.

Moisture related issues may need to be dealt with separately and the above repairs may not be adequate to resolve the problem(s) caused by MVT pressure.

NOTE: The proper Application Tools, including “lint free” roller covers, spiked shoes, and spiked rollers (along with ‘moisture test kits), are all available through POLYMER NATION – contact us @ 847-774-5038 for pricing and availability.

SECTION TWO

COVERAGE VARIATIONS: Actual coverage or spread rates can vary from those specified or ‘recommended’ by POLYMER NATION, due to a number of factors and/or conditions that may be unique to a specific project – including ambient, surface, and material temperatures at the time of application, porosity of the substrate, and substrate texture. When coverage rates are less than those specified or expected, the cause can usually be attributed to one of the following reasons:

- A. **LOW TEMPERATURES:** All recommended coverage rates [spread rates, viscosity, etc.] by **POLYMER NATION**, are based on controlled material application at ‘Lab’ or performance temperatures between 70°-75°F. When material, ambient (air), or surface temperatures are less than those indicated – the viscosity of most polymer coatings is increased (and become thicker/ higher viscosity) making it more difficult to spread at the specified rate.

1. Always check the ambient (air), surface, and material temperatures before commencing application; whenever possible adjust or increase the temperature of one or all of these factors to help improve application and achieve spread rates similar to those desired.
2. If possible, “climatize” the product [heat up or cool down] prior to application in cold/hot conditions.
3. Prior to application, place tape (or similar marking) on the substrate to indicate the desired or specified spread rate. Monitor the coverage of the material for the first several mixes, based on those marks and size of mix; adjust the application rate etc. to correspond to those marks.

B. POROUS OR UNEVEN SUBSTRATE: Coverage rates will also be reduced drastically [therefore using more material] when the substrate is more porous or more uneven than expected. This can be due to improper or excessive mechanical surface preparation with a shot-blast machine or grinder.

1. Always make sure that the preparation equipment is working properly to prevent this from occurring.
2. Equipment should be operated by qualified / trained personnel.

C. IMPROPER OR WORN TOOLS: Application tools that are worn, faulty or inappropriate; and/or incorrect application techniques such as varying the amount of pressure applied to a squeegee or roller during application - can all adversely affect the consumption rate or spread rates desired.

1. Make sure tools are new and/or worn parts have been replaced before commencing application.
2. Prior to application, place tape (or similar marking) on the substrate to indicate the desired / specified spread rate. Monitor the coverage of the material for the first several mixes, based on those marks, and adjust ‘squeegee’ pressure’, application rate etc. to correspond to those marks.

REPAIR METHODS: Variations of coverage rates does not necessarily require repairs except when the thickness or spread rate is less than anticipated or specified. If this is the case, an additional coat (material) may need to be applied in order to meet the specified / required thickness. Conversely, if the coating is applied thicker than specified or required – the finished product may be acceptable, but obviously more material will be used, and it can result in a costly error for the installer.

Therefore, it is essential to continually check or monitor spread rates during application, use established methods of application, and always purchase quality tools and have 'back-ups' on-site for every project. *In the coating industry, "cutting corners" on tools usually means expensive mistakes rather than saving money.*

SECTION THREE

COATINGS WITH WHITE SPOTS OR 'CLOUDINESS': coatings that appear "cloudy", have 'white' spots, or may be blotchy in appearance can typically be related to the intrusion of unwanted and excessive moisture within the coating, from beneath, and/or on the surface of coating prior to final cure.

A. EXCESSIVE HUMIDITY: product application during periods of high humidity is usually more common with lower solids coatings that have a solids content of less than 100%. The following are several causes for "white spots" or cloudiness:

1. Lower solids polymer products, either water-based or solvent-based, must expel or release non-reactive chemicals (also known as "carrying agents") into the atmosphere. High or heavy relative humidity [typically 75% RH or higher] restricts this "release" forcing or holding the chemicals in the coating and subsequently, as the coating cures, the water and/or solvents become trapped in the coating and appear as 'white' spots, discoloration, or cloudiness in the cured coating. An industrial fan can be used to increase air circulation in the work area and will help 'draw-off' the excess chemicals from the coating ***[Be careful not to blow air directly onto the coating]***.
2. In certain instances, during high humidity or when air / ambient temperatures are cool, some 100% solids coatings can develop an amine "blush", or an amine "sweat", resulting in a sticky, oily or "grease-like" substance on the surface of the cured epoxy. This is simply the unreacted or uncured portion of the curing agent (hardener) that reacts with the excess carbon or hydrogen atoms that are present (or predominate) due to the cool and/or humid air. Typically, there is nothing wrong with the cured coating under the blush (or oily film), and once the residue has been removed, with a solution of hot water and a mild detergent, the coating is functional and may be recoated.

NOTE: When applying epoxies is recommended that the substrate and ambient temperatures remain at least 5 degrees above dewpoint for placement and cure of the material. ***It is important to read and understand all PRODUCT DATA***

SHEETS prior to mixing and applying any POLYMER NATION product.

B. EXCESSIVE SURFACE MOISTURE: puddles and/or surface water on the substrate must be removed prior to product application. However, several **POLYMER NATION** products can be applied over a ‘damp’ surface [depending on temperatures]. **It is important to read and understand all PRODUCT DATA SHEETS prior to mixing and applying any Polymer Nation product.**

1. Eliminate all surface or standing water by removing it with a vacuum or by allowing the surface to dry thoroughly (and evaporate) over night.

C. INSUFFICIENT MIXING: Inadequate or improper mixing of components can develop into discoloration and/or could leave a blotchy appearance on the surface. Mixing is especially important when using pigmented coatings or when blending colorants into a clear liquid.

1. Thoroughly mix the product according to application Instructions, typically for 2 to 3 minutes.
2. Factory ‘pre-pigmented’ products **MUST** be “pre-mixed” (usually the resin side) prior to blending with the hardener or 2nd component.
3. For adding “field” added colorants, it is best to mix the **RIGHT COLORANT** in with the resin side thoroughly (for 1 to 2 minutes) prior to adding the hardener.

D. APPLICATION THICKNESS:

1. Low and medium solids products, such as U-21 or U-51, can develop discoloration or cloudiness if applied too thick. When low or medium solids material is applied too thick, the non-reactive elements [such as water and/or solvents] become entrapped and are unable to be “released” prior to final cure, resulting in cloudiness and/or white spots. Always apply coatings at their prescribed / recommended coverage rate or mil thickness.

CAUTION: Applying low or medium solids products thicker than recommended / specified, may also cause them to foam or cure incorrectly and remain ‘soft’; and / or can inhibit the adhesion of a subsequent coat.

2. Clear 100% solids materials / products can also appear “creamy” and/or can exhibit whitish blotches once cured – when applied too thick. These spots, or blotches, are typically due to micro bubbles in the clear coating and cannot be removed after the final cure. Regardless of product, or solids content, always follow recommended or specified coverage rates or mil thickness when applying a floor or wall coating system. *When in doubt, it’s better to apply 2 thin coats rather than 1 thick coat.*

E. TIMING OF AN OVERCOAT (TOPCOAT):

1. Do not apply a 2nd coat or any topcoat material, prior to the initial cure of the previous coat. Be aware that relative humidity above 75% may increase the reaction of polyaspartic and MCU products and temperatures below 70°F will slow down the cure time for epoxies and most other products. Materials that are applied too soon over a product that is not properly cured, can result in white spots, discoloration, or cloudiness – always refer to specific Product Data Sheets for cure times (and adjust for product, ambient & substrate temperatures) or contact Polymer Nation prior to application for technical assistance.

NOTE: The maximum recoat “window” for most polymer products is 24 hours, or less, after the completion of the previous coat – depending on air & surface temperatures. Fast cure products may necessitate application of successive coats [re-coat] sooner than 24 hours. It is important to read and understand all PRODUCT DATA SHEETS prior to mixing and applying any POLYMER NATION product.

SECTION FOUR

SOFT OR “GOOEY” COATING: coatings that are soft (overall) or have random “goosey” spots, after the expected or anticipated cure time has elapsed, are typically due to either incorrect proportions (mix ratio) or improper mixing of components or careless measuring procedures.

A. ENTIRE SURFACE IS SOFT or HAS NOT CURED: the catalyst or hardener was not added or was severely miss-proportioned when mixed.

1. Obviously, two component materials require a catalyst or hardener in order to produce a chemical reaction and reach a final cure. Improper measuring of the product’s ‘volume’ mix ratio can result in too much of either resin or hardener at the mix station and will result in an imbalance that will not allow the 2-components to react properly, and final cure will not occur - leaving an uncured / “Goosey” mess. Always verify the product volume mix ratio before measuring any components and always use measuring containers for proper proportions.

B. TACKY OR STICKY SPOTS (in an otherwise cured coating):

1. The most common cause for tacky or sticky spots in a polymer floor / coating are typically due to insufficient or improper mixing technique of resin and hardener.
2. Another common cause can occur when adding either the resin or hardener incorrectly, making the mix “Off Ratio”; where one of the components was not measured correctly and blended in an incorrect proportion.

3. Tacky or sticky spots may also occur when a mixing pail is placed upside down onto a floor surface, allowing it too completely empty. In cases when unreacted resin (and/or hardener) is not thoroughly blended and is unintentionally allowed to collect on the inside of the pail; this unmixed material can get poured out and create a soft or tacky spot.

REPAIR METHODS:

- A. If floor entire surface is “goosey” (uncured) and determined that one of the components was not added and/or was improperly measured or mixed – all of the unreacted resin or hardener must be thoroughly and completely removed / scraped off the surface using long-handled drywall scraper knives or a “Scrape-Away” tool on a rotary scrubber to remove all of the uncured coating.
- B. Follow the removal of the “goosey” / uncured epoxy with a safe solvent to wipe and clean the surface. ***CAUTION: While the solvent is on the surface DO NOT use any tools or equipment with electric motors as many solvents are highly flammable / combustible and it is possible that a ‘spark’ from an electric charge or motor could cause the solvent to ignite.***
- C. Dispose of the uncured epoxy and solvent residue in product containers and discard in accordance with federal, state, and local regulations.
- D. If uncured coating is only tacky or sticky in spots, identify all locations and mark them. Hand grind, scrape and/or sand each individual spot and solvent clean as above; fill or patch each spot if necessary to bring to ‘level’ and apply the coating over the spots. Remember that patches will never blend in and, therefore, it may be NECESSARY to completely recoat the entire floor.

SECTION FIVE

FISH-EYES OR “PULL BACKS”: These appear as imperfections in the coating surface that resemble small circular craters (versus Bubbles) or may appear as irregular shaped flaws in the coating that have ‘Pulled Back’ to reveal the surface underneath.

- A. **SURFACE CONTAMINANTS:** ‘Fisheyes’ can and will occur when contaminants (such as petroleum or fatty acid-based oils, grease, or silicone, etc.) are not thoroughly removed from the surface of the substrate. Surface cleaning should be expected and is especially important in any facility where chemicals are used in manufacture or processing of chemicals, equipment & vehicle repairs are made, or in plants where food is packaged or processed.
 1. When the likelihood that contaminants could be present, surface preparation will require additional cleaning with an appropriate chemical, cleaner / degreaser, or stripping agent. Shot-blasting or mechanical preparation alone will not completely remove surface contaminants.
 2. To avoid this problem, it is important to understand and identify what contaminants may be present in a specific work environment. Whenever possible, request an SDS related to the identified contaminants used in the manufacturing process; ask the facility manager questions to help better understand the process as this may help uncover how the contaminants got into the substrate.
- B. **OIL/GREASE CONTAMINANTS:** Any petroleum-based lubricant/product left in the substrate will cause a coating to experience the above flaws [i.e.-fish eyes or pull backs, etc.] and can interfere with proper adhesion to the substrate.

1. Thoroughly remove all petroleum-based contaminants with a solvent degreaser, clean and scrub with a caustic and/or an alkaline cleaner. This process should be with a final cleaning with a neutral pH detergent in order to neutralize the surface.
2. After the surface has been cleaned thoroughly prime with Polymer Nation F-52 D.

C. ANIMAL FATS, VEGETABLE OILS AND/OR ALL FOOD PRODUCTS OR BY-PRODUCT SPILLAGES: can all contaminant the substrate and will cause adhesion problems, they must be removed completely.

1. Where food products and/or food by-products can come into contact with the substrate, remove the contaminants with a degreaser / cleaner, then a caustic and/or alkaline cleaner. This process should be with a final cleaning with a neutral pH detergent in order to neutralize the surface.

NOTE: Following a thorough chemical cleaning with caustic, acid and detergent, test the concrete surface for contamination from an oily substance by sprinkling with water. If the water beads up, steam clean or use a propane flame torch to bring the contaminant to the surface and chemically clean again. It may be necessary to use a hot water pressure washer for flushing before and after each separate cleaning process, this will speed up and improve the job. Surface can also be tested for adhesion using the Simple Cup Adhesion Test adhesion test method.

REPAIR METHODS: Repairs to a floor or wall system that develop “fisheyes” or pull-backs due to contaminants, will require a complete ‘re-coat’ or, if the problem is extensive, may require complete removal of the system down to a ‘clean & sound’ the substrate. Test the system to determine the extent of the damage and to determine whether the adhesion to the substrate is adequate – if substrate bond is suitable, then the coating / system can be repaired and recoated.

- A. If time allows, test a small area (over the fisheyes / pull backs) by thoroughly cleaning the contaminated areas with a solvent, abrading the surface, and applying a thin coat of material. If the imperfections do not reappear, then proceed with the same process across the entire area and re-coat.
- B. If the imperfections DO reappear, it is an indication that the contaminants have been pushed to the surface and are still present. In this case it may be necessary to “treat” the entire area with chemical cleaning to remove the contaminants – by degreasing and/or using a solvent wipe (depending on the type of contaminant). Once the surface has been cleaned, mechanically abrade the surface, tack wipe, and apply an additional coat. If the “fisheyes” or imperfections reappear, then the entire procedure may need to be repeated.

NOTE: In some cases, “surface tension” can contribute to the ‘fisheye / pull back’ problem, using a thicker (higher) viscosity material or adding a small amount of thickener powder may resolve the problem.

SECTION SIX

DELAMINATION (PEELING, FLAKING AND/OR LACK OF ADHESION):

When the coating system separates from the substrate, or from a previously applied coating / layer, in either large or small areas – it may be due to one of the following reasons.

- A. INADEQUATE CLEANING AND PREPARATION OF THE SUBSTRATE:** No coating, regardless of price or quality, will adhere to an improperly cleaned or inadequately prepared substrate or to contaminants on or in the substrate.
1. All contaminants must be removed and suitable profile for adhesion must be achieved by:
 - a. Shot blasting (the preferred method), surface grinding, or acid etching over exposed concrete (the least preferred method).
 - b. Or heavy abrasion and tack wiping over an existing coating system.
- B. WHEN AN APPROPRIATE PRIMER WAS NOT APPLIED:** The loss of adhesion or bond can occur when an appropriate (or suitable) primer is not used. Primers are formulated to help provide penetration into the substrate and will dramatically improve substrate adhesion, thereby helping to prevent delamination and/or peeling from the substrate.
1. Appropriate primers, depending on the system being applied and/or project requirements are: -F-01-100% solids epoxy primer.
- C. IMPROPER OR INADEQUATE ACID ETCHING:** Acid etching is one (least preferred) option for preparing a concrete substrate. Acid etching helps to ‘open’ the pores and will provide a minimal surface profile (i.e. - providing concrete with a uniform feel of medium to coarse sandpaper). However, acid etching **WILL NOT** be adequate for an existing coating, steel or wood substrates, or on vertical surfaces. Without the porosity created by an adequate profile, a mechanical bond or adhesion to an existing coating cannot be achieved. (refer to ICRI-Guideline No.03732 for more surface preparation details).
1. Mix an acid solution by blending 2 parts clean water to 1-part commercial grade acid. Spread the solution uniformly over the entire floor area so that no one area is etched deeper than another. The solution should be thoroughly scrubbed, flushed immediately with clean / potable water, followed by the scrubbing of the entire surface with a neutral pH detergent (such as C-23), and then a final and thorough flush with water – removing any excess water with a squeegee (if drains are present) or with a shop-vac.
- NOTE: DO NOT allow the acid solution to DRY (or evaporate) before the final “rinse OR flush” has been completed. Acid that remains on the surface, and that has not been properly neutralized, can develop into crystals in the substrate which may interfere with the adhesion or bond of the coating system.**
- D. EXCESSIVE MOISTURE IN OR ON THE SURFACE OF THE CONCRETE:** MVT [moisture vapor transmission] and hydrostatic pressure are the major causes of coating failure. When there is any uncertainty as to an adequate vapor barrier under a concrete slab or if there is

any suspicions about moisture problems; it is mandatory to test the substrate for MVT content in a concrete slab.

1. If high-levels of moisture (typically above 75 RH as measured per ASTM F2170) exist in a concrete slab and it is sealed with a low-permeable coating, warmer temperatures and lower humidity above the sealed concrete will assist in setting up the perfect condition for moisture vapor transmission. As this moisture vapor reaches the coating/concrete bond line it turns from a gas/vapor to a liquid, this liquid is almost always caustic and begins attacking the coating/concrete interface, softening the film and eventually causing it to blister and or disbond.

NOTE: 100% Solids coatings should only be applied to on-grade or below-grade concrete that have an adequate “vapor barrier” beneath the slab and/or have been tested for moisture content.

2. There are four (4) ways to test for moisture in concrete:
 - a. **ASTM D 4263:** ASTM D 4263 is often called the “plastic sheet method”. In this test a piece of polyethylene sheeting is taped to the concrete for 16-24 hours and then examined for moisture gathered under the plastic. While this method can assist in evaluating the condition of the concrete it cannot give a quantitative value and is therefore not a reliable method for predicting the moisture content of concrete. This test should not be relied upon when determining whether moisture is in an acceptable range for installation of non-permeable finishes.
 - b. **Moisture Meters:** Electrical impedance meters are placed in direct contact with the concrete substrate and are designed to measure comparative levels of moisture across a substrate up to two inches deep. These meters are not considered effective for quantitative concrete moisture testing but may be helpful in identifying areas where further testing using a quantitative test method may be conducted.
 - c. **ASTM F-1869:** ASTM F-1869, also known as the Calcium Chloride test, was developed over 40 years ago. In this test the concrete is cleaned by light grinding. After a waiting period of 24 hours, a pre-weighed tray of anhydrous calcium chloride is placed on the prepared concrete. The tray is covered with a plastic dome and sealed to the floor. Calcium chloride is hygroscopic (absorbs moisture) and absorbs moisture present under the dome thereby increasing the weight of calcium chloride in the tray. After 60-72 hours, the tray is removed and weighed a second time. Through a calculation, the weight gain is calculated, and the results are reported in pounds of moisture emitted from 1,000 sq. ft. in a 24-hour period. Material manufacturers have historically set acceptable levels between 3-5 pounds as reported using this test method as acceptable results for applying low permeable floor finishes over concrete. For calcium chloride tests to give meaningful results, the building must be acclimatized to the anticipated service conditions for 48 hours prior to testing. This means the windows and doors must be in place with the HVAC operating. If the test is done in an "open air" setting, the results may be lower than if the heating or air conditioning is operational because without the HVAC, a relative state of equilibrium exists with the concrete moisture and the environment

above the slab. When the building becomes acclimatized, cooler, drier air on top of the slab can draw moisture out of the slab and higher test readings may result. Another reason for the necessity of acclimatizing the building is that calcium chloride test results are significantly affected by ambient humidity and temperature above the slab. If the concrete temperature is higher than the anticipated service conditions, the test results will be higher and if the concrete is colder, the test results will be lower. If the relative humidity above the concrete slab is high at the time the test is run the results will be higher because unsealed concrete absorbs moisture from the testing area as well as emits it when the air is less humid. Although calcium chloride testing has been the accepted standard in the United States for years, the market is beginning to understand the limitations of this test. It was believed that ASTM F 1869 measured moisture vapor moving through the slab, but it is now widely understood that this test measures static moisture in the top 1/2"-1" of the concrete only. Because of this, an elevated reading may indicate that the moisture level at the top of the concrete is too high for low permeable finishes, but a low reading may only indicate that the uppermost section of the concrete is dry enough to receive low permeable finishes. ASTM F1869 cannot measure the moisture that resides below this uppermost region and thus may provide a false negative result. False negatives, even from properly executed calcium chloride tests, have duped many flooring contractors and material manufacturers into applying materials only to have a moisture related failure come back to haunt them.

- d. **ASTM F 2170:** In the ASTM F 2170 test, holes are drilled into the concrete at a specified depth and liners are inserted to the bottom of the hole. The holes are then capped and allowed to equilibrate for 72 hours before inserting the probes and taking the relative humidity readings. Concrete placed on grade is measured at 40% of the slab thickness. Readings taken deeper in the slab will generally show higher RH readings while readings nearer the top of the slab will show lower RH readings. Because of this, it is critical to know the slab thickness. Cutting core samples is often the only way to get an accurate measurement of the slab thickness and should be performed at numerous locations to verify the thickness in the areas where RH tests are to be taken. This step is often skipped because of cost, inconvenience and/or potential liabilities involved with intruding concrete where electrical and other utilities may exist. The inability to show proof of the concrete depth could be argued as a violation of the test method and result in a less than satisfactory defense position. Acceptable levels of relative humidity within the slab range from 75-85% depending upon the flooring installed. Because the relative humidity probe testing is done on the interior of the concrete, it is less susceptible to atmospheric conditions above the slab than the calcium chloride test (ASTM F 1869). For this reason, it is more useful in determining moisture levels in non-climatized areas (though the test still requires an acclimatized environment).

***NOTE: Contact POLYMER NATION
for further technical assistance.***

- E. INTER-COAT ADHESION:** An existing polymer that is improperly prepared can lead to inter-coat de-lamination or peeling. Always test an existing coating for compatibility and adhesion with the proposed coating system. Certain types of polymer systems will NOT adhere to one another and could be incompatible with other polymer coatings / systems.

1. Once the polymer coating systems are found to be compatible and adequate adhesion can be achieved. Mechanically abrade the entire surface in order to completely remove the “gloss” from the existing system. For larger areas this can be accomplished by using an orbital / commercial floor sanding machine equipped with 36 to 60 grit sandpaper or large grinding machines. For edges, and smaller areas, a diamond hand grinder can be utilized. The dust must be completely removed, and the surface “tack-ragged” or wiped with a solvent to help soften the existing system slightly and allow the new coating to bond. In some instances, a “brush blast” with a shot-blasting machine is an acceptable alternative to sanding and/or grinding.

REPAIR METHODS:

The repair method will depend upon the severity or extent of the delamination and peeling:

- A. If the conditions are wide-spread and throughout the floor or wall coating system, it may be necessary to completely remove the entire system down to a clean and sound substrate, and virtually start the application process over.
- B. Depending on project, it may also be possible to repair / recoat an area between “joints”, reducing the size of area to be re-done.
- C. If the affected areas are isolated it may be possible to repair only the areas affected, depending on the size of area and thickness of the coating system. The affected area can be keyed in with a sharp knife or saw cut, removal of the damaged coating from that area, the surface prepped as needed, and the area ‘patched in’ with the same system.

SECTION SEVEN

A ‘GLOSS’ FINISH – THAT CURES DULL OR LOW GLOSS: when a coating system that is intended to have a “Gloss” finish cures with a low-gloss or dull appearance, or develops dull spots; it may be due to one of the following reasons or causes:

- A. POOR VENTILATION or EXCESSIVE HUMIDITY (ABOVE 75% RH) DURING THE APPLICATION OF A LOW-SOLIDS COATING:** the lack of ventilation / circulation or when humidity is too high (typically above 75% RH) – will prevent the “carrying agent” [solvent or water] of low solids products from escaping or evaporating and will become entrapped in the coating as it cures. These “carrying agents” [solvent or water] have an adverse influence on the final cure and the overall ‘Gloss’ of the coating.

1. Dehumidify or air condition the work area or wait for less humid weather.

2. Use fans to ventilate the work area and create suitable circulation / air flow that will draw- off and help exhaust the ‘carrying agents’ from the coating. Make sure that the fans are not blowing directly on the coating.

B. COOL/COLD SURFACE, AIR, OR MATERIAL TEMPERATURES: Cool or cold temperatures can also have an adverse effect on the gloss of a finished coating system.

1. Whenever practical, condition the product to a minimum of 75⁰ F and/or adjust the work area temperatures (surface & air) to a minimum of 50⁰ F.

C. CHEMICAL EXPOSURE PRIOR TO FINAL CURE: Whenever a coating is exposed to chemicals prior to ‘full’ chemical cure, it is likely that gloss retention will be substantially reduced. Full “chemical” cure for most epoxies is seven (7) days.

1. Many projects (customers) cannot allow for seven days of cure time before opening up to business. However, it is important to notify the customer, before the installation, that the loss of gloss is imminent.

D. DEVELOPMENT OF AN AMINE “BLUSH” OR SWEAT: Although POLYMER NATION does not manufacture products that will develop this condition under normal circumstances, there are some 2-components, amine epoxy products on the market that can develop a “blush” or “sweat”. This “oily” film appears on the surface of a cured coating and is due to unreacted amines. This typically occurs during periods of high humidity and/or where there are cold air temperatures.

E. IMPROPER PRODUCT or COMPONENT MIXING: Product that is not mixed for a sufficient amount of time and/or is not mixed thoroughly - can be responsible for low gloss and softness problems as discussed in an earlier section.

1. Always follow mixing instructions for each product and mix completely for the recommended mix period of time.
2. Make sure to read product data sheets and measure (or weigh) each component accurately before mixing together.
3. When in question contact POLYMER NATION regarding product mix times and instructions.

REPAIR METHODS: Always use recommended and standard mixing and application techniques to avoid these problems. If a 're-coat' is required:

- A. Aggressively sand / abrade the surface.
- C. Tack-wipe to remove dust and debris.
- D. Following the precautions listed below, recoat the floor as needed.

Precautions:

- 1. At the beginning of each project, a good practice is to check and record the surface, air, humidity, and material temperatures prior commencing.
- 2. Always follow the manufacturer's written installation instructions / procedures.
- 3. Read and follow all product and application recommendations regarding temperatures, mil thickness, mixing instructions and component mix ratios.

SECTION EIGHT

COLOR HIDE, SEPERATION AND/OR VARIATIONS IN COLOR: lighter and darker

streaks of same color, varying shades of color, or 'spots' of dark colors that appear on the surface of a cured coating can be due to one of the following reasons:

A. IMPRECISE MIXING / BLENDING OF COLORANTS INTO THE PRODUCT: if the colorant is not mixed / blended thoroughly with the polymer components [resin & hardener], 'streaks', color separation, or color variations in the topcoat may result. To avoid this, thoroughly blend the colorant into the resin component prior to adding the hardener and be sure to completely empty the contents of the colorant package into the resin.

- 1. Mix the combined resin and colorant for 2 to 3 minutes before adding the hardener, this is usually sufficient for eliminating this problem.

[CAUTION: the typical amount of colorant is 1 each – 24 oz. BAG-PAK of Colorant to 3 mixed gals., slightly more may be necessary for lighter colors- especially when applying over a darker substrate or existing coating.]

B. SLIGHT VARIATIONS OF COLOR FROM BATCH TO BATCH: using colorants from varying batches can produce ‘streaks’ and/or color variations.

1. Check batch numbers prior to use to ensure that all colorant containers are from the same batch. If the batch numbers do vary or if using ‘older’ colorant with recently purchased colorants, the colorants can be / should be “boxed” together by pouring the contents into a large container [a 5 gal. pail] and blending the various batches together.
2. When coating a large floor area, it is a good practice to terminate each mixed unit [resin, hardener, & colorant] at an expansion or cut joint. Then proceed with another unit from that point to the next joint.

C. EXPOSURE OF A CURED COATING TO INTERIOR SUNLIGHT: exposure of certain type of lights, that produce UV waves over a long period of time may cause slight discoloration, fading, or produce a “yellow” or amber cast to certain coatings.

SECTION NINE

WRINKLES IN THE SURFACE FILM: although rare, in some cases wrinkles can appear in 100% solids coating systems. This condition is more common with low-solids solvent or water-based coating systems.

A. EXCESS THINNING: if too much solvent is added to a coating and then applied too thick, this may cause wrinkles, or at the very least, a dull finish or soft film surface as it cures.

1. Never add solvent without the manufacturer’s prior approval and follow any recommendations closely. If solvent is added, do not apply coating too thick.

B. SOLVENT-THINNED EPOXY OVER AN UNKNOWN SURFACE: Do not add solvent to a new coating whenever applied over an existing or previous coating that is unknown. Solvents can react differently to various coatings (i.e. – paint, MMA’s, etc.), and cause it to lift and/or develop wrinkles on the top surface.

1. Always check for compatibility and never use more than the recommended amount of solvent for thinning [Typically, no more than 8% to 10% by weight].
2. Never add solvent without the manufacturer’s approval and follow recommendations with regard to film thickness closely.

C. EXPOSURE TO ELEVATED TEMPERATURES PRIOR TO CURE: an uncured coating that is exposed to elevated temperatures can wrinkle.

1. Make sure to use an appropriate coating that will allow for adequate cure in the time frame allowed, and prior to exposure.
2. If applicable, protect the coating from chemicals, hot water, or direct heat.
3. Warn the customer of the potential problem if allowed back into service too quickly.

D. COLD CONCRETE SURFACE TEMPERATURES: in some cases, application of a coating over a cold substrate can cause 100% solids coating to wrinkle or “contract” (shrink) during the curing cycle.

1. Always check and record environmental temperatures – air, surface, and product prior to installation.
2. Read product data sheets carefully and follow product temperature limitations for the product.
3. Select a product suitable for temperature conditions or do not coat when surface temperature is below 40°F.
4. When any questions arise, contact POLYMER NATION regarding product application temperatures, mix times, and additional assistance.

REPAIR METHODS: There is no easy way to repair ‘wrinkles’ in a coating without removing the imperfections by grinding or sanding, and then recoating the entire floor. Before grinding or sanding, make sure that the “wrinkles” are completely cured and/or are not soft due to uncured / unreacted resin below the surface.

Coatings that have been down, or have been applied for longer than 24 hours, **MUST** be thoroughly abraded (to scratch into the surface) and to remove any ‘gloss’. This can be accomplished using a large ‘orbital’ floor sanding machine [with 36 to 60 grit paper] or a large surface grinder equipped with similar grit diamonds. Once abraded sufficiently, tack-wipe to remove any dust & debris, and recoat.

SECTION TEN

PREMATURE WEAR OR DETERIORATION OF A COATING SURFACE: unexpected

or premature “wear and tear” of a coating system [beyond the customary scratching or scuffing inherent with a 100% solids coating], or a coating that exhibits excessive abrasion may be due to one of the following reasons:

- A. IMPROPER MIXING OF RESIN AND HARDENER:** improper or insufficient mixing can result in the premature ‘wear’ of a coating system due to unreacted or uncatalyzed components.
 - 1. Always make sure that mix ratios are correct and accurate (when units are ‘broken down’ or not using premeasured units) and that the hardener and resin are thoroughly blended together.

- B. IMPROPER MAINTENANCE:** poor maintenance of a floor or wall coating system will cause premature wear. This is especially common in warehouse environments or production facilities where heavy lift truck traffic, pallets dragged across the surface, or any area where dirt and dust are allowed to collect and build-up.
 - 1. Set up a proper maintenance program, including periodic sweeping and cleaning.
 - 2. Use “non-marking” lift truck tires, and properly trained lift truck operators.

- C. INFERIOR SUBSTRATE OR SOFT CONCRETE:** the longevity and performance of a floor or wall coating system is directly related to the quality of the substrate. Whenever the quality of the substrate is in question, one of the following tests should be performed.
 - 1. Check for concrete softness with a penknife. If you are able to ‘carve’ into the surface with a penknife, the concrete is probably too soft and will develop potential adhesion problems.
 - 2. ‘Simple Cup Adhesion Test’ – this test is inexpensive, and although it will not provide a value it will help determine the quality of the substrate and whether additional testing is required.
 - 3. ACI-503 ‘Bond Test’ – when performed according to the ACI specification, will provide a value indicating substrate suitability.

SECTION ELEVEN

SMALL BUMPS (LUMPS) IN THE CURED EPOXY COATING: a rough finish to a floor or wall coating system can be due to one or a combination of any of the following causes:

- A. **LINT FROM A ROLLER SLEEVE:** always use “lint-free” or mohair roller covers, especially for the final coat.
- B. **INSUFFICIENT CLEANING OF THE SURFACE:** after surface preparation is complete, it’s extremely important to remove all dust, dirt, debris, and/or shot-blasting media before applying the coating – using a vacuum & tack wiping.
- C. **POORLY MIXED DRY ADDITIVES:** make sure to blend all dry “additives” [such as aggregates, Cab-O-Sil, etc.] thoroughly into the liquids, into a homogeneous mix that does not have any dry lumps or particles.
- D. **DIRTY EQUIPMENT:** make sure to use clean tools during mixing and application of a coating. Dried material from a mixing blade, mixing vessel, trowels, etc. can become dislodged and get blended into the coating.
- E. **FROZEN PRODUCT:** product that has been allowed to freeze can/will develop ‘crystallization’ that will appear as cloudy “lumps” or dried epoxy floating on the surface. These crystals will not dissolve simply by mixing components and, if not dissolved, will appear in the finished coating.
 - 1. Frozen product can only be “brought back into suspension” (re-dissolved) when heated to a minimum temperature of 85°F for a period of approximately 72 hours [warmer temp. will require less time].
 - 2. This process can be accomplished by placing the ‘Bag-Pak’ or pail into a larger container of hot water, or by using drum heaters if necessary.
 - 3. The crystals are essentially gone once the liquid appears ‘clear’ (with no cloudiness) and there are no visible ‘lumps’.

REPAIR METHODS:

- A. Thoroughly abrade floor with medium grit sandpaper on a rotary disc scrubber (or medium to coarse stones on a terrazzo grinder) to remove the "LUMPS" or imperfections; remove all dust and debris with a vacuum, "tack-rag" or wipe the surface with solvent or denatured alcohol to 'open the surface' and recoat at a maximum rate of 150 square feet per gallon if less than 30 days old.
- B. Large "lumps" / imperfections many require individual hand grinding before sanding - always feather edge to the surrounding area.
- C. Large areas may also require a "thin"/tight application of application of Clear AGUA-CINCO water-based epoxy primer / sealer.

CAUTIONS AND NOTES: This document could not possibly cover all problems or installation issues that may arise on a coating project. For application problems or issues not covered in this guide, or for additional technical assistance, contact POLYMER NATION 847-774-5038

IMPORTANT: Prior to product installation, don't neglect to review all product information, and familiarize yourself with information on the specific products being installed, such as:

- ✓ TDS Sheets (Technical Data Sheets)
- ✓ SDS (Safety Data Sheets)
- ✓ INSTALLATION GUIDES (if available)
- ✓ Or Call POLYMER NATION directly.

SAFETY FIRST - When cleaning or preparing a floor surface using liquid caustic soda, acids, strong industrial detergents or solvents, always wear safety goggles, rubber gloves and impervious clothing, including rubber boots. When using chemicals that create work-place respiratory exposure levels above permissible levels, wear NIOSH/MSHA approved respirators, and any specified personal protective equipment in accordance with the Material Safety Data Sheets supplied by the Chemical Manufacturer or Distributor. Dispose of chemical waste in accordance with all Federal, State and Local regulations.