BUILDING TRUST

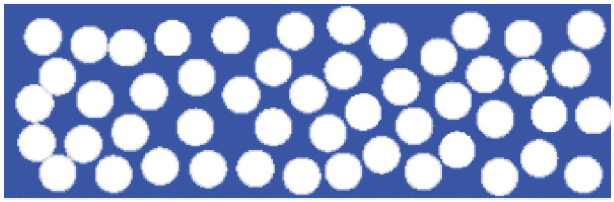
TECHNICAL BULLETIN

Wash Off of Uncured Coatings and Finishes

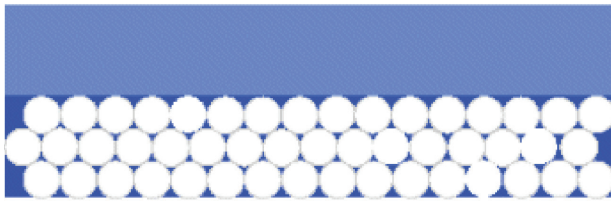
FILM FORMATION IN WATER-BASED COATINGS

This bulletin addresses concerns of wash-off of uncured coatings and finishes. It identifies potential causes for the wash off of coatings and finishes that are exposed too early to rain. In addition, it outlines general guidelines for job site protection.

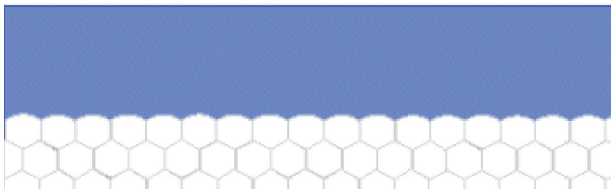
The following sequence illustrates a typical water-based coating formulation coalescing into a film.



Initial Phase: Water-based coating on the substrate



Intermediate Phase: Water evaporation yields close-packed polymer spheres with water filled voids



Final Phase: Further evaporation and polymer softening by the coalescing additive yields a continuous film

During application of the wet coating to a substrate, the latex particles suspended in the water are separated from each other. As the water starts evaporating and the coating begins to dry out, the particles come together until they touch.

As soon as the latex particles reach the densest packing point, the coalescing additive present in the formulation starts “softening” the exterior surface of the particles so that the particles fuse into a continuous polymeric film.

The film forming process applies to all water-based emulsion products including paints, coatings, adhesives and trowel-applied finishes containing sand. The sand does not react with latex particles or with the coalescence additive. Sand remains embedded in the polymeric matrix and does not interfere with film formation.

The film forming process is greatly influenced by the combined effect of relative humidity and ambient temperature.

RELATIVE HUMIDITY AND AMBIENT TEMPERATURE AFFECT FILM FORMATION

Relative humidity (RH) and ambient temperature affect the evaporation of both water and the coalescing additive, which is a solvent. However, the evaporation patterns of water and the coalescing additive are different.

The parameters for RH and ambient temperature for this bulletin are defined as:

- Low/moderate RH: from 0-30% (low) and from 30% to 65% (moderate)
- High RH: from 65% to 100%
- Low ambient temperature: less than 40 °F
- High ambient temperature: more than 40 °F

The next paragraphs discuss examination of four environmental conditions:

- Low/moderate RH + high ambient temperature
- Low/moderate RH + low ambient temperature
- High RH + high ambient temperature
- High RH + low ambient temperature

CONDITION: LOW/MODERATE RH + HIGH AMBIENT TEMPERATURE

At low/moderate relative humidity and high ambient temperature, water leaves the coating more rapidly than the typical coalescing agent does. As a result, the proportion of coalescing agent becomes significantly higher than it was when the coating was initially applied, and the point of densest packing is reached comparatively quickly. The coalescence process starts fast and is characterized by the formation of a superficial film that is dry to the touch.

When the coalescence process has started, the coalescing additive diffuses through the partially formed film according to a quite slow process and then volatilizes into the atmosphere. A good final film quality is finally obtained.

CONDITIONS:

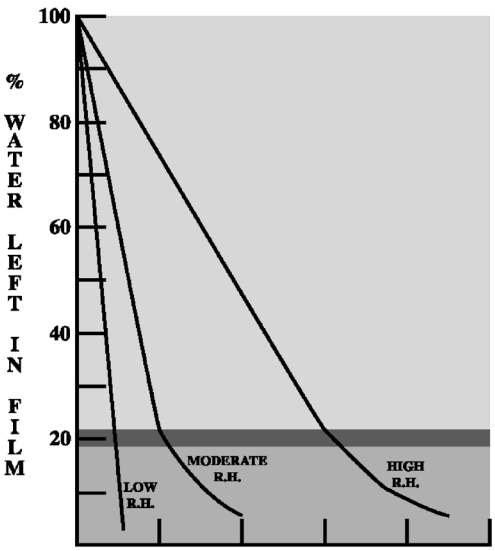
1. **Low/moderate RH + low ambient temperature, or.**
2. **High RH + high ambient temperature**

At low/moderate RH and low ambient temperature, or at high RH and high ambient temperature, water evaporates more slowly than the previous case. The coating stays wet longer and it takes more time for the latex particles to touch and to reach the densest packing point. Therefore, the opening time for initial film formation increases. (See chart on next page). The coalescence process is slowed as well, because of the reduced rate of evaporation of the coalescence additive. This delays the full film formation. However, although the firm formation is prolonged, the quality of the final film remains good.

CONDITION: HIGH RH + LOW AMBIENT TEMPERATURE

At high RH and low ambient temperature, water evaporation rate is so slow that permanent damage to the quality of the film might occur. When water evaporates at very low speed, the coalescence additive continues to evaporate at a relatively fast rate because it does not have to diffuse through a partially formed film. By the time the coating has dried reaching the densest packing of latex particles, enough coalescent may have left the coating for the particles to start fusing. Without the coalescence additive to soften the particles, these may not deform sufficiently for adequate film formation. The particles will remain compacted but separated, bringing to the so-called "cheese" look-like configuration. In most cases a superficial hard surface takes place, hiding the real "cheese" configuration of the film thickness.

Effect of Relative Humidity on the Evaporation Rate of Water from a Water-based Acrylic Coating.



The above discussion can be summarized as reported below.

Condition: Low/moderate RH + high ambient temperature:

- Quick film formation
- Good quality film

Condition: Low/moderate RH + low ambient temperature:

- Slow film formation
- Good quality film

Condition: High RH + high ambient temperature:

- Slow film formation
- Good quality film

Condition: High RH + low ambient temperature

- Very slow film formation
- Potential prevention of film formation

JOB SITE GUIDELINES

To ensure the performance of the finish, it is important to follow the manufacturer's instructions, including these recommendations related to job site activities.

PLAN AHEAD

Ensure that you have the equipment you will need to protect your work from the elements and to ensure optimal drying conditions.

After the application of the finishes, the ambient temperature must be 40 °F or higher, and the RH at 65% or lower, for a minimum of 24 hours to assure that the finish attains proper physical properties and will not be damaged by rain during its drying phase.

The curing of the finishes is dramatically slowed if the ambient temperature remains lower than 40 °F and the RH higher than 65% after the application. It can take several days to attain resistance to wash off or to extreme weather conditions. Be aware that the finishes may appear to be hard and dry on the surface but they remain uncured below it. Wind driven rain can break the hard surface of the film and wash off of the finish.

After application, make sure to protect the wall from weather and/or any other potential damage until all sealants, coatings and finishes are cured.

CHECK WEATHER CONDITIONS

As circumstances may dictate, provide appropriate sheltering such as tenting or tarping. To maintain proper curing temperature, supplemental means of heating the temporary shelter may have to be used. If supplemental heat is required, the heated area must be properly vented to allow water vapor to escape and to prevent asphyxiation.

PROTECT AND CURE

The curing process of acrylic finishes requires the attention of the applicator. There is no magic solution to prevent wash off issues.

SUMMARY

Caution, attention and expertise of those involved in the installation of acrylic finishes at the job site are the key success factors needed for attaining the best performance and aesthetics in challenging weather conditions.

If you have additional questions contact Sika Facades Technical Services Department for answers and guidance: +1 (800) 589-1336.

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