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ADHESION VERSUS SCRUBBABILITY

By Bob Cusumano

Faithful readers of PWC are aware that I often stress the importance of performing adhesion tests. Delamination, or peeling paint, is one of the leading modes of coating failure. The performance of adhesion tests can provide important insight regarding the stability of the substrate, the quality of the surface preparation performed, and the compatibility of various paint coats. However, adhesion is often confused with scrubbability as is illustrated in the following case history.

A painting contractor has the contract to paint several new apartment buildings. The drywall walls will be bedded and taped and then receive an "orange peel" texture applied by the drywall contractor. The specifications then state that the painting contractor will apply two coats of latex flat to interior drywall surfaces. The contractor applies a contractor grade latex that meets the intention of the specifications. After the first building is completed, several tenants move into the apartments. As is inevitable when moving furniture into a residence, some damage to the paint finish occurs. When the residents attempt to wash away scuff marks and blemishes from the walls, they find that the paint actually washes of the drywall.

The project manager accuses the painting contractor of using a low quality paint that has no "scrubbability". On the next building, the interior wall paint is changed to a "top of the line" latex flat. After that building is completed and attempts are made to clean the wall paint, the same result occurs; the paint comes off the wall. Although no one is sure of the cause of the problem, everyone's convinced that it's something that the painting contractor did wrong.

The paints utilized on the project have been accused of poor scrubbability, but that's not the problem, Scrubbability is an inherent property of a coating and is in effect its abrasion resistance. ASTM D 2486 Scrub Resistance of Wall Paints describes a method in which paints that have been prepared and cured are tested for abrasion resistance by passing a stiff bristle brush over the surface and counting the number of cycles to failure by erosion. However, it is important to understand that in the case being discussed, the paint is eroding, it is delaminating. Therefore, a lack of scrubbability is not the problem.

Some would describe the failure in this case as a paint adhesion problem. Indeed, had adhesion tests been performed, the results would have been considered poor with paint being removed by

the test tape. However, whenever adhesion tests are performed, it is important to not only consider the results, but also to examine the coating removed as well as the material remaining on the surface being tested. In this instance, light blue paint had been applied to the walls. Examination of the back side of the delaminated paint shows that white texture is attached to the rear of the paint as shown in photo #1. Examination of the wall area where the test was conducted revealed that part of the texture was still present on the wall. Therefore, rather than an adhesion problem, that is the paint losing its bond to the texture, we really have a cohesion problem within the drywall texture itself. In this instance the adhesion of the paint to the texture was stronger than the cohesive force that holds the texture together.

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Some would describe the failure in this case as a paint adhesion problem. Indeed, had adhesion tests been performed, the results would have been considered poor with paint being removed by the test tape. However, whenever adhesion tests are performed, it is important to not only consider the results, but also to examine the coating removed as well as the material remaining on the surface being tested. In this instance, light blue paint had been applied to the walls.

Examination of the back side of the delaminated paint shows that white texture is attached to the rear of the paint as shown in photo #1.

Photo 1

Examination of the wall area where the test was conducted revealed that part of the texture was still present on the wall. Therefore, rather than an adhesion problem, that is the paint losing its bond to the texture. We really have a cohesion problem within the drywall texture itself. In this instance the adhesion of the paint to the texture was stronger than the cohesive force that holds the texture together.

When the paint over the drywall texture is undisturbed, the cohesion of the texture is sufficient to prevent spontaneous delamination of the paint. However, when the painted drywall is stressed by the action of scrubbing, then delamination occurred. It was also theorized that the absorption of water during the scrubbing process was a factor in the failure. To confirm this condition, a cotton swab was dipped in red dye and taped to the surface of the drywall. After approximately fifteen minutes, the swab was removed and a section of the paint/drywall composite was extracted using a razor blade. Photo #2 shows a microscopic cross-sectional view. The various colored layers are the blue paint over the white drywall texture over the brown surfacing paper of the drywall. It can be seen that the red dye has penetrated through the paint and into the white drywall texture.

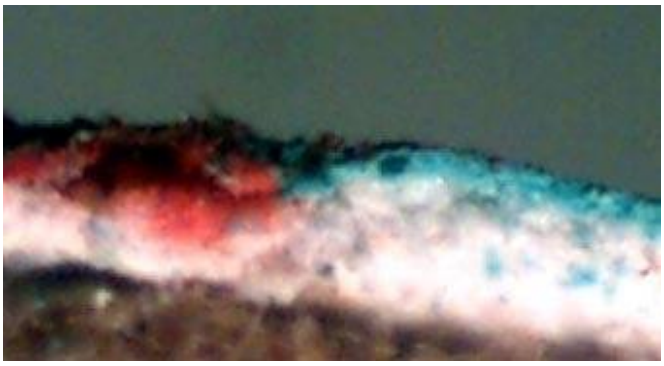

Photo 2

What's occurring on this project is that when water is applied to the painted drywall surface for the purpose of removing scuff marks, it penetrates through the paint into the drywall texture beneath. The drywall texture is re-emulsified, and the paint literally floats from the surface when it is scrubbed. The cause of the problem is the low cohesion and water sensitivity of the texture.

In this instance, not enough acrylic resin was used in formulation of the texture. Similar failures occur when wallcovering is applied. The water in the paste wets the texture and the inherent stress of the wallcovering causes delamination.

Once paint has been applied over a weak texture, there is little that can be done to improve the overall performance because the paint already applied acts as a shield against the penetration of any additional coating. It is however, possible to predict and prevent this mode of failure. Before painting any textured surface, take a piece of soft black cloth and perform a chalk test by wiping across the surface. If a heavy chalk is transferred to the cloth, then that surface is likely to be trouble. Wet a cotton ball and rub gently on the texture, if it is easily removed, then the texture is sensitive to moisture. As we've stated in previous articles, it's always wise to do a "patch test" prior to full scale production. If marginal texture is encountered, then treating the surface like a chalky exterior repaint and priming with a penetrating primer can yield good results. Check with your paint manufacturer to determine a suitable primer.

Even though the cause of the problem was not created by the painting contractor, whenever a coating failure occurs, you are going to be involved. It's far better to predict and prevent failures even if it means changing the specifications and renegotiating your contract.

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