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MAKE SURE IT STICKS
By Bob Cusumano

If you're in doubt about adhesion, do a patch test. IF YOU'RE IN DOUBT ABOUT ADHESION, DO A PATCH TEST. I'm sorry that I had to shout at you, but I did it for your own good. I see so many cases of paint delamination that could have been predicted and avoided had patch samples been applied and then adhesion tests performed. This procedure involves preparing and applying all of the specified coats to a selected area of the surface to be tested. The same preparation and application equipment you intend to use for the actual job should be used. The manufacturer's recommended drying time and coating thickness should be observed. After proper cure, the adhesion can be assessed by performing an adhesion by tape test as described in ASTM standard test method D3359. In general, cuts are made through the coating in an X or grid pattern. A pressure sensitive tape is applied over the cut and then rapidly removed. The amount of coating removed with the tape is an indication of the adhesion. Photo #1 shows a poor result on a painted stucco wall. Probing with a knife blade or other sharp instrument can also be effective in testing adhesion.

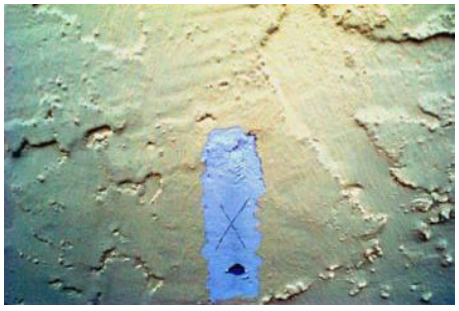

Photo 1

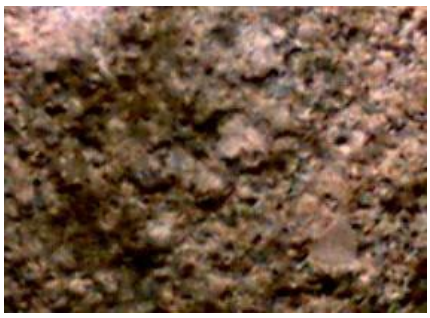

Photo 2

Let's review some of the contaminants and conditions that can result in poor coating adhesion. First, we'll discuss potential adhesion problems on new surfaces that are commonly painted.

Laitance is a thin layer on the surface of new concrete that consists of fine particles due to the upward migration of water during the placement and curing process and often occurs on concrete floors. This concrete layer is of low strength and should be removed when surface preparation is performed. Photo #2 shows a microscopic view of laitance on the rear of delaminated paint. Efflorescence is the formation of crystalline salt deposits, usually white, on a surface due to the

migration of water through a cementitious substrate. Both laitance and efflorescence are unsuitable surfaces for painting as long term coating adhesion will be compromised.

New concrete retains moisture for a very long period of time. The rule of thumb is to wait 28 days before painting. The purpose of that time frame is to allow the surface, which is initially highly alkaline, to become neutralized due to contact with carbon dioxide in the air. Be aware, however, that even though the surface may have the proper pH for painting, the concrete can still contain excessive moisture. If a "non-breathing" paint is applied, delamination can result. Unfortunately, a patch test is not always effective in predicting poor adhesion resulting from moisture due to the fact that good adhesion may be initially established but as time passes the coating may delaminate as moisture attempts escape out of the coated concrete. Moisture tests that we'll discuss in a future article should be employed for this purpose.

Painted stucco or cement plaster can similarly be affected by efflorescence and moisture. With these surfaces, however, another factor to consider is the cohesive strength of the plaster itself. It is not uncommon to have "low strength" or soft stucco as a result of an improper mix or cure. When these surfaces are subsequently painted, the paint adheres to the plaster, but delamination occurs within the plaster itself due to a cohesive failure. This is particularly likely when elastomeric coatings possessing high surface tension and weight are applied.

Painting contractors often apply finish coats to steel surfaces prepared and primed in the fabricating shop. Mill scale is an iron oxide that forms on the surface of steel as a result of fabrication and heat treatment. Initially the mill scale is tightly adhered, but as time passes, the mill scale expands at a different rate than the adjacent steel resulting in cracks. When cracks occur, moisture can penetrate allowing rust to form beneath the scale and spalling results. Rust and mill scale should be removed during surface preparation at the shop prior to priming, but if not performed properly can result in coating delamination. Photo #3 depicts rusted mill scale from the rear of delaminated paint on steel door frames.

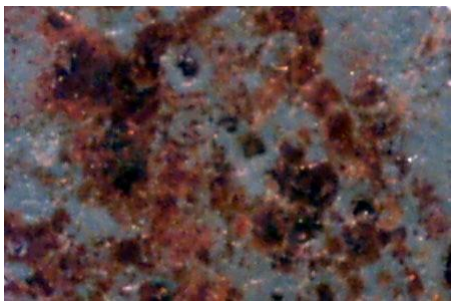

Photo 3

Photo 4

Smooth wood siding sometimes has a hard, slick surface finish known as mill glaze. It is believed that mill glaze is a result of the planning process wherein the heat produced causes wood resins to produce a varnish-like substance on the surface. Roughening the surface prior to priming, usually by sanding is advised to promote good adhesion.

Rough sawn wood, especially when weathered, has loosely attached wood fibers on the surface. If a latex paint or solid stain is spray applied to this surface, then poor adhesion often results due to the paint laying on the surface and loose fibers detaching from the wood carrying the paint with it. This condition is shown in the adhesion test result in photo #4. When that same wood was painted by brush instead of sprayed (photo #5) the adhesion was improved because the paint was "worked into" the substrate.

Photo 5

Photo 6

Probably, more gallons of paint are applied to drywall and gypsum board than any other surface and adhesion problems can even occur here. After joint compound is applied to the nail heads and joints it is often sanded to produce a smooth finish. The dust created from this operation should be removed prior to painting so that adhesion can be achieved on a sound, clean surface. Drywall texture or orange peel is sometimes applied to the surface of drywall prior to painting. If an acrylic binder is not added in sufficient quantity, then the resultant texture may have a chalky surface and low cohesive strength. Photo #6 illustrates that white texture is attached to the rear of the blue paint that delaminated during the adhesion test.

In repaint situations, chalk, dirt, mildew, wax, oil, salt, and other surface contaminants may interfere with the establishment of good coating adhesion and must be removed using appropriate measures. Hard, smooth surfaces should be sanded and wiped clean to promote good mechanical adhesion. Photo #7 shows that this is an effective procedure. But in repaint situations, not only does the surface being painted need to be evaluated but also the adhesion of the existing coatings. It is common that when additional coats are applied to a previously painted surface that has marginal paint adhesion, the additional weight and stress produced may cause delamination, especially when applying top of the line products.

Photo 7

All of the delamination failures mentioned in this article could have been anticipated had the painting contractor applied patch samples to assess the adhesion of the coatings. Taking a little time to perform this important process can save hundreds or thousands of hours redoing the job correctly and a tremendous amount of aggravation for the painting contractor.