PHORGOTTEN PHENOMENA

The Silent Inspector—Specifying Color to Assist in Inspection

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Coating inspectors may be burdened with multiple responsibilities or too many projects, and simple solutions to coating inspection problems may be overlooked. The author suggests several solutions, concentrating on measurement of dry film thickness, and recommends contrasting colors to ensure proper coverage.

Coatings inspection can be a tedious job and a lengthy process. There are, however, ways to make it simpler. But sometimes the simplest solution is overlooked, decried as too easy, too hard, or too obvious. With many competing items to be accounted for in construction inspection or maintenance responsibilities, coating inspection is often overlooked, is simply spot verified, or verified after the fact by personnel who often have little or no coatings experience. If the inspecting personnel do have coatings experience, more often than not they are burdened with multiple responsibilities, which allow them only cursory or spot inspection opportunities after the fact.

A case in point occurred as I was teaching the Federal Highway Administration (FHWA) Bridge Painting Materials & Inspection course to a major state Department of Transportation (DOT). During the course, the inspection personnel challenged me, saying, "It is fine to gather all of this information on the project, such as temperatures, relative humidity, the level of surface preparation, etc., but we have multiple bridge projects going on, and we are in charge of all construction inspection responsibilities on multiple projects that are 25 miles (40 km) apart. How do you expect us to get this information when we are not even on a particular job site for potentially several days?" I thought, "That is a really great question!" I assumed that this problem was due to underfunded state construction projects, where inspection monies were always tight, but I was wrong.

Not long after that, I received a call from a major oil company that operates many offshore platforms in Southeast Asia. They requested that I train their inspection personnel on the use of coating instruments. To my surprise, during the offshore training, I was asked the exact same question that the DOT employee had asked. With multiple projects spread out among many platforms, the distance

separating the platforms, and additional mechanical integrity responsibilities, the offshore platform inspectors had the same problems as the DOT inspectors—how to verify inspection items with limited access, time, and knowledge.

Inspection Challenges

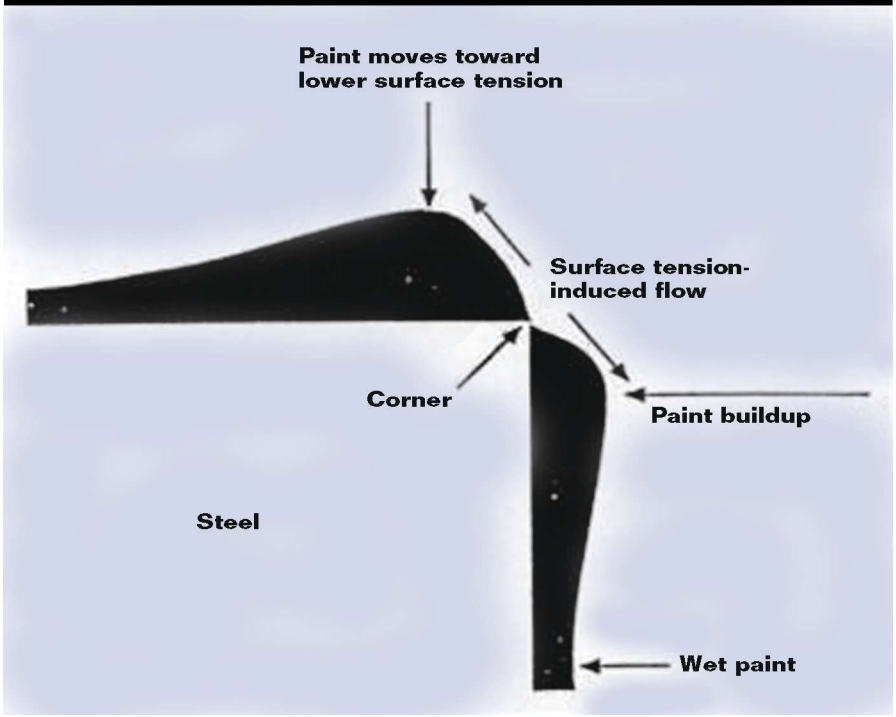
So what can specifying engineers and construction inspection personnel do to ensure a quality job and avoid "never again" scenarios? It is a difficult question with a difficult answer.

One item that can help inspection personnel verify in-the-field compliance with the specification is dry film thickness (DFT). SSPC-PA 2[1] is a standard method often specified to verify compliance with the DFT specification. As part of the standard, the requirement uses a base unit area of 100 ft^2 (9.3 m^2), selected at random, and then uses multiples of that unit area based upon the total square footage to be inspected. So what does "at random" mean? I'm not asking for the definition; I'm asking if my random area truly is random or is it really the area that is accessible at the time of inspection?

Another thing the standard mentions is that DFT readings are not to be taken within 1 in (25 mm) of edges due to geometric discontinuities affecting gauge readings, which highlights another problem. As most coatings dry and cure, they go from a liquid to a solid and shrink, pulling away from edges and discontinuities (Figures 1 and 2). If my DFT standard specifically instructs me not to take readings at areas that will have the lowest film thickness, am I missing the areas about which I should be the most concerned? I am going on the record here. The answer is yes! My personal experience on water tanks, offshore platforms, floating production storage and off-loading vessels (FPSOs), bridges, refineries, power plants, etc., has given me enough data to say that edge failure is a major problem, if not the number one mechanism that causes coatings to begin to fail. Specifiers combat this by specifying a stripe coat, which is an additional coat of material, typically applied by brush, to edges, welds, bolts, etc., that increases the film thickness.

Stripe coating is expensive, but it is one item that will absolutely maximize coating life. (The level of surface preparation is the other.) There is a disincentive from a time and material standpoint to perform this task. And the task is extremely difficult to verify after the fact, and nearly impossible without damaging the coating. If my inspection personnel are only available at varied times, how can I be sure a stripe coat was applied?

FIGURE 1



Edge effect of coating.

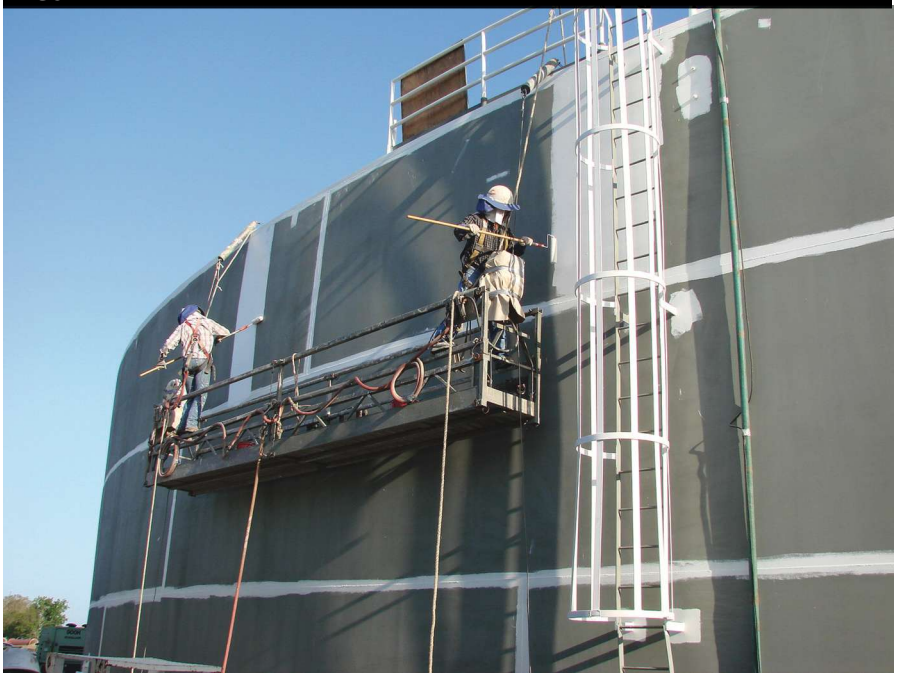
FIGURE 2

Edge effect of coating along a welded seam.

FIGURE 3

Stripe coating with contrasting colors—tank interior.

FIGURE 4



Painters applying stripe coating to a tank exterior—note the contrasting colors.

Color as an Inspection Tool

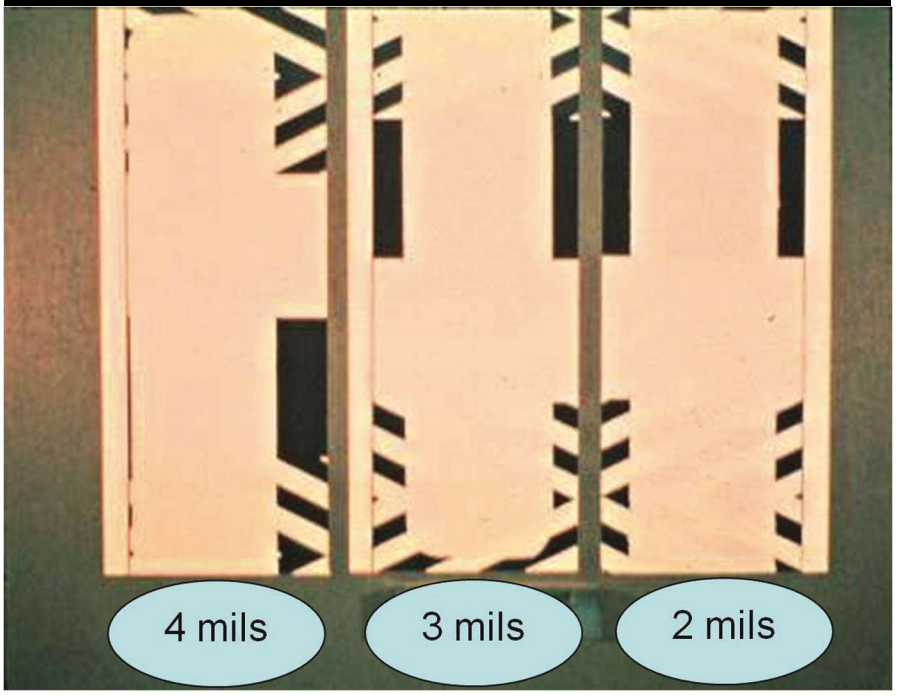
Coating materials have an interesting property, called opacity, or hiding. Defined as the ability of the coating material to obscure the surface color beneath it, opacity is different for each generic coating, for each formulation of coating, and for each color of each formulation.

By specifying color as a means to assist inspection, the specifying engineer and the facility owner can take a giant leap forward in assisting inspection personnel in verifying compliance with the specification. The contrast of the colors must be significant enough that the minimum DFT of the next coat will hide the color of the coating below it. For example, I would specify a dark gray primer with a white topcoat to ensure a minimum amount of topcoat was applied to cover the primer below. This allows inspection personnel by visual examination to locate potential areas of low film thickness because areas of poor hiding may not have enough coating material applied in the topmost coat. These would be good areas to locate the SSPC-PA 2 "random" areas for compliance check.

A contrasting color for stripe coating can offer a similar method of confirming that the stripe coat is actually being applied and ensuring compliance (Figures 3 and 4). If the coating supplier provides an intermediate coat in two colors, one color for the full coat and one color for the stripe coat, it could be more expensive. If the full intermediate coat does not cover or hide the contrasting color stripe coat (Figure 5), who is at fault? The expense of compliance could cost either the coating manufacturer or the applicator.

Caution: If using color as an inspection tool, verify with your coating manufacturer that colors specified actually do cover or hide at the minimum specified thickness. This can be done by the coating manufacturer using drawdown cards with the specified colors applied to them. Depending on product formulation, a specified color may not hide at the specified thickness. Yellow and red, in particular, are notorious for this. If the engineer specifies a gray primer with a safety yellow topcoat at 2 to 3 mils (0.05 to 0.08 mm), for example, the yellow topcoat may not hide the gray primer at 3 mils, and the engineer may be "hit up" for a change order by the contractor. By including language in the specification that requires aesthetics to be an overriding item above thickness, and mentioning it specifically in the pre-job conference, the specifying engineering can ensure proper finish aesthetics.

FIGURE 5



Example of hiding by one coat over another.

With limited personnel having multi-project tasks that limit their inspection times, or with personnel not specifically trained in coatings inspections, the simple use of color as an "inspection assistant" can be an option to help an owner get what was specified as far as project quality. It is not fool-proof, nor is it, by any means, a substitute for full-time coatings inspections, but it can assist a project in getting closer to the quality specified with regard to DFT.

Reference

1 SSPC-PA 2, "Measurement of Dry Coat Thickness in Magnetic Gages" (Pittsburgh, PA: SSPC).

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