High Performance Coating Systems

By Tom Calzone

The Shuttle Mount/dismount structure resides at the west coast salt and sun environment. NASA selected inorganic zinc and polysiloxane to maintain the structure. Polysiloxane will retain color durability even in red. Courtesy of Coatings Pro Magazine.

Another article on coatings. I have read enough of these to know if you are not snoring by now, you are an insomniac in search of relief. You may simply have a serious need for knowledge. Too bad, you are not going to get it here. Instead, this topic is painted with a wide brush and you will become familiar with the considerations used in the formulation of high performance coatings, if indeed you have not gotten that relief.

Several driving factors have lead to a plethora of coating products. The desire to have "new and improved" is accelerated by ever more stringent environmental regulations of solvent and hazardous air pollutant (HAP) emissions. The requirement to re-formulate created an opportunity for resin suppliers, and their products are the basis for our new formulations. Polyamide, polyamine, phenalkamine, amidoamine are all flavors of epoxy. There are just as many flavors of acrylic, polyurethane, zinc rich primers and more, let alone waterbased varieties of each of these. Each has its market niche and, without fail, most new formulations are superior to the ones they replace. For the user, this is a windfall if you can navigate all the options.

Coating suppliers avoid commoditization by formulating marketable features into their products. Constructability features are attractive to the shop and field painter and can have a huge impact on installed cost, particularly as it relates to material handling and schedule. Some new coating systems can save half the installed cost over traditional materials.

Designers are more attuned to coating durability than ever before. Rarely is a stadium, arena or architecturally exposed steel structure built without a zinc rich primer. What's not to love, VOC compliant, Class B friction connections, virtually permanent protection and low life-cycle cost. There is more to it.

How to Choose

Manufacturers invest millions developing coatings. Each puts his own philosophy on their product line. Some tend toward low product cost, others top performance or constructability features. The trick is to formulate products the applicator will prefer and the designer will specify. The architect must make sure he does not approve the cheap and easy at the expense of the durable.

Manufacturers routinely do performance testing to compare new formulations to old, and to competitors' products. To improve marketability, they will invest in independent laboratory testing as well. Some clients require it and some manufacturers promote it to highlight product superiority. You should request test results for candidate coating systems to tune your pre-approved list. You may also use test results to establish a system as your standard of quality and require submitted alternates to be supported with test results. Beware of big sellers with no performance testing.

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Application Properties.

Feature	Value
Easy mixing	Single package or easily dispersed multi-component products save painter labor, sometimes at the expense of toughness and durability.
Fast dry-to-topcoat, handle	This can be huge for shop applications to improve material flow, maximize efficiency of cranes and labor.
Robust products (forgiving of application variables)	Coatings should have a broad window of acceptable application thickness. A narrow target thickness can spell trouble for the painter, particularly on some configurations.
Cold cure, moisture tolerance	Some construction schedules result in painting or field finishing in the off-season. Some high performance coatings are formulated for those conditions.
User friendly	Easy to achieve the desired appearance, long pot life, tintable finishes, and other features that garner painter preference.
Dry fall feature	Avoids overspray onto unintended surfaces.

Physical Properties.

Feature	Value
Friction rated primer	Usually a zinc rich primer, this one feature can save on costly bolted connection details. Class B rated primers can provide the best value. Outstanding corrosion resistance is an additional benefit of the zinc.
Toughness	Damage resistance during construction and service. Extraordinary field touch-up can be costly.
Open recoat period	Some coatings cure hard and solvent resistant to the point sanding is required to get adhesion of topcoats after as little as one month. This costly step can be avoided with proper coating selection. Often the fabricator selects the coating system, yet a separate contractor may end up with a sanding requirement that could have been avoided.
High adhesion values	Good adhesion to the substrate and between coats aids in durability.

Performance Properties.

Feature	Value
Corrosion resistance	The severity of the service environment will effect the coating decision here. The other consideration is the cost of maintenance. If maintenance painting will be expensive, opt for the most durable system practical. Zinc primers defeat undercutting corrosion, providing a long window from the onset of corrosion to an actionable issue. Zinc constructability benefits usually offset the higher material costs.
Color and Gloss durability	A lot of progress has been made here with new finish technology. Corrosion durability has gotten so good that even urethane finishes fade and chalk before corrosion mandates painting. If such aesthetics are important, ultra-durable finishes can be used to add many years to that new look. Test results will show a disparity between "ultra-durables".
Number of coats	Direct to metal (self-priming) coatings are gaining popularity as single coat systems in mild service. High build coatings can provide outstanding protection for aggressive service with two coats opposed to the traditional three, if properly formulated.
Other performance properties	Other desirable properties may include non-skid, anti graffiti, abrasion resistance and more.

What Sells

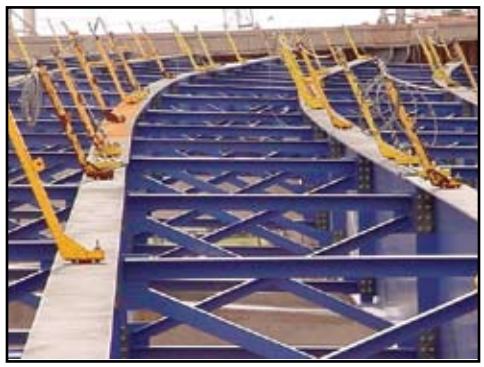
Within a given set of qualified coating systems, the contractor will select products based on a variety of features. Not to underestimate the impact of a supplier relationship, product availability, and comfort level, these product features weigh on the selection process:

One of my favorite new coatings is a relatively new finish called polysiloxane. This product provides something of interest to everyone. As an ultra-durable color coat, it can maintain original appearance for many years longer than traditional high performance finishes like polyurethane. In addition, it is an excellent barrier as a high build and can be applied directly to zinc rich primers. Here are two examples of its use.

The San Francisco-Oakland Bay Bridge (SFOBB), currently under construction, is protected with a shop applied inorganic zinc and a single field coat of polysiloxane. Products underwent laboratory performance testing to gain acceptance. The inorganic zinc offers great constructability as a shop primer when field finished. The SFOBB is a salt water crossing with a 100 year design life

The Marquette Interchange in Milwaukee is an example where performance based specifications resulted in a two coat system replacing the traditional three coat bridge spec. The epoxy zinc rich primer was shop finished with high build polysiloxane for the same cost. Better coating performance and improved constructability benefitted the entire project. The interchange has a 70 year design life.

Air quality and coating regulations vary in regions of the United States. The coatings industry anticipated and formulated compliant solutions that provide improved performance and cost saving features. Your coating supplier will help you navigate the options, and you will find better value with today's technology.▪



The Marquette Interchange in Milwaukee is an example where performance based specifications resulted in a two coat system replacing the traditional three coat bridge coatings. Courtesy of Tony Holzinger.

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