LIQUID VS. POWDER:
A COMPARATIVE REVIEW OF FLUOROPOLYMER COATINGS

What does the next generation of powder coatings mean for architectural applications in North America?

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With their superior custom-color and small-batching capabilities, liquid fluoropolymer coatings have long been the product of choice among architects for curtain walls, commercial windows, building panels and other architectural elements.

But a new generation of powder fluoropolymer coatings promises to offer the small-batch, custom-color capability of liquid coatings in combination with the waste-free, zero-VOC application benefits of powder.

Greater choice is good news for architects, specifiers and curtain wall consultants, but it also presents new product selection challenges. Let's look at the roles of three major coating types — liquid, conventional powder and next-generation powder coatings — and the protective, decorative and application properties of each, starting with how they work in green building construction.

## Metal Coatings in Green Building Construction

In the U.S., green building, led by the U.S. Green Building Council (USGBC) and its Leadership in Energy and Environmental Design (LEED) rating system, has transformed the construction industry.

Government mandates, building codes and incentives by utilities and third-party certification organizations motivate acceptance of green building practices and products in new construction as well as major renovation and renewal projects.

The environmental impact of today's metal coatings, which are integral to contemporary building design and construction, comes from their formulation and where and how they are applied.

**Coatings and Performance Standards**


Each establishes minimum performance criteria for chalk resistance, fade resistance, colorfastness, color retention, gloss retention, erosion and other factors. AAMA 2605-05, the most rigorous of these standards, is the most specified and installed standard for monumental and commercial construction applications.

In North America, specifiers face little risk when specifying high-performance PVDF-fluoropolymer liquid coatings, particularly from companies with a history of formulating coatings with durable pigments. Products with this background consistently meet the AAMA 2605-13 standard and have a proven track record of durability and performance in North America's harsh, UV-intensive climates.

Historically, powder coatings formulated in Europe do not meet these more exacting criteria, in part because they cannot meet the rigorous “South Florida” test standards for UV exposure.

Next-generation powder coatings address that problem and incorporate the proven pigmentation and resin technologies associated with FEVE- and PVDF-based fluoropolymer liquid coatings. As a result, architects and building owners who want the advantages of powder coatings can largely eliminate their liability risk by specifying powder coatings manufactured to meet AAMA 2605-13 performance criteria and from manufacturers with long-term pigment and resin exposure data.

**Corrosion Performance in Seacoast Environments**

Performance requirements for coatings in seacoast environments are even more stringent than most, due to the increased risk from exposure to humidity, salt, wind and other environmental hazards. The current AAMA 2605-13 standard addresses finish properties as they
Pretreatments are an important part of this equation. Thus far, chromium pretreatments have provided the most effective long-term protection of aluminum in seacoast environments. But because these products have environmental drawbacks, the industry is working to develop alternatives.

Until new pretreatments are developed, chromium remains the best option for optimal corrosion resistance, especially in harsh seacoast and industrial environments. Corrosion resistance contributes to the sustainability of the coating system by limiting the need to reapply coatings in the field that have failed due to inadequate pretreatment.

Film permeability is another critical difference between liquid and powder coatings. As a general rule, liquid coatings are made with thinner film builds, making them less vulnerable to seacoast corrosion because moisture is less likely to become trapped under the finish.

Next-generation powder coatings, like their liquid counterparts, can be applied as part of a multi-coat system that features a corrosion-resistant primer base coat.

Corrosion resistance is particularly important for metal curtain wall and window systems. When these components, typically fabricated from precoated extrusions, are installed, their edges may be cut, exposing the underlying aluminum and increasing susceptibility to salt-related corrosion.

Traditional single-coat powder coatings are more susceptible to failure in seacoast applications because they lack chrome-containing primers that protect the metal from corrosion. Liquid and powder primers are available as a system for powder topcoats and are recommended for use in harsh environments to prevent corrosion.

European vs. North American Coating Practices

Due to differing criteria of quality, specification practices and supply chain infrastructure, powder coatings have been preferred for aluminum substrates in Europe, while liquid coatings have been the standard in North America.

In Europe, architectural powder coatings are typically not formulated to meet AAMA 2605-13 requirements. Their polyester formulations meet a local standard (Qualicoat), not recognized in North America.

The highest Qualicoat standard requires less exposure to the elements and also calls for routine washing of all exterior metal building components, which is an expensive proposition for North American building owners.

Because of the significant difference in standards, most European extrusion coating infrastructure is dedicated to powder coatings. In North America, most finishing capacity in the construction market is dedicated to liquid coatings.

Next-generation powder coatings, however, complement existing and new advanced liquid coating technologies, and are formulated to reduce risk and meet market demands in North America.

Still other factors, like color appearance and expense, come into play when selecting the best technology for your building project.

Expanded Appearance Options

Color restrictions, due mainly to manufacturing limitations, have been a major drawback for traditional powder coatings.

Traditional powder coatings are made by melting raw materials (resins, pigments and additives) together, then cooling and extruding the mixture into chips which are ground into a fine finished powder coating to be sprayed on to a metal substrate. Unfortunately, until that entire process is complete, it is impossible for

Liquid fluoropolymer coatings have traditionally been favored by North American architects for their color advantages and small-batching capabilities. Next-generation powder coatings based on liquid coating formulations now provide many of the same benefits.
a powder coatings manufacturer to determine the exact color of the coating it has just created.

If the specifying architect determines that the color is wrong or does not meet its intended match, the process has to be repeated until the final, desired color is achieved.

With new manufacturing and color blend technologies, next-generation powder coatings make it easier and more affordable to generate small batches of customized and custom-matched colors.

Liquid coatings have an advantage in their ability to achieve bright metallic finishes. Architectural powder coatings can be formulated with mica to produce a pearlescent effect, but the additional manufacturing processes required for the bright aluminum flake may cause the metallic to get lost in the paint film and inhibit the desired look.

This is significant in North America, where architects have a strong affinity for shiny metallic effects. Nevertheless, powder coatings manufacturers are working to address these perceived color limitations.

Cost Is Critical

Cost considerations are also critical to any material selection decision in construction materials. A final cost comparison of installed powder and liquid fluoropolymer coatings must weigh several factors.

While there are potential manufacturing, production, transfer efficiency and shipping cost benefits associated with powder coatings, they can sometimes be overridden by application, color and other cost advantages associated with liquid coatings.

In the end, actual installed cost is a function of customer requirements, such as job size, recyclability, geographic location and the competitive bidding environment. Market conditions and pricing through the entire coating supply value chain are difficult to predict with accuracy.

The best way to obtain competitive bids without adding undue risk is to work with a coatings manufacturer who produces both liquid and powder coatings, and who has an established program to approve and certify coatings applicators. Certified applicators generally deliver the highest quality because their training and standards minimize pretreatment and application variability, unlike job shops that are not highly experienced with commercial construction projects.

Proven Chemistry and Pigmentation Technologies

Although powder coatings have been used in Europe for decades, North America’s construction practices, specifications and requirements and maintenance practices are significantly different.

These differences are driving development of powder coatings that meet the demand for greener products and reduce specifier risk through chemistry and pigmentation technologies that already are proven in North America.

Due to the design preference for bright metallics and the existing coatings industry infrastructure, it is unlikely that powder coatings will ever gain the same level of market ascendence in North America that they enjoy in Europe.

However, thanks to their environmental advantages and their expanding new color and small-batch capabilities, the next generation of powder coatings is likely to emerge as a popular complementary product to liquid coatings in North America.