

Kynar Paint: The Right Chemistry for High Performance, Long-Lasting Building Envelopes

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Introduction

Metal has rapidly become the material of choice for commercial roofing, facades and window and door components. Metal is long lasting, saves energy, is fire resistant and holds its beauty far longer than other roofing and building materials provided that it is protected by a Kynar 500 PVDF resin-based finish.

Since 1965, Kynar 500 PVDF resin-based metal coatings have provided billions of square feet of protection against weathering, atmospheric pollution, heat, salt, dirt and other environmental stressors. In addition, they have provided the longest lasting color retention and ease of cleaning for iconic buildings globally. Kynar 500 based metal finishes are the material of choice for architects and specifiers worldwide.

Architectural extrusions, roofing products and curtain wall panels coated with Kynar 500 resin based metal finishes surpass the American Architectural Manufacturers Association (AAMA), now FGIA (Fenestration and Glazing Industry Alliance) publication 2605 (Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels). AAMA 2605 is the highest standard available for organic coatings on architectural metals.

While metal is durable and long lasting, it must be protected from environmental degradation by a coating system that will keep the appearance looking rich and vibrant for many years. Because of the unique properties of Kynar 500 PVDF resin, finishes do not chalk and erode, thus maintaining the appearance and protection of the metal substrate. In fact, many buildings around the world that utilized this technology well over 40 years ago still look great and the finishes continue to provide protection to the underlying metals.

In order for a topcoat finish to provide protection of the underlying substrate, it must not erode or lose thickness over the design life of commercial properties. AAMA 2605 requires that the paint film erode 10 percent or less over ten years of weathering exposure. Kynar 500 based metal finishes surpass AAMA 2605 performance requirements and, in one 15-year Arizona study, were shown to maintain 100 percent of the original film thickness.

Kynar 500 based finishes are factory-applied (typically coil or spray coating) on metal substrates (typically aluminum, galvanized steel and aluminized steel) and are baked in ovens at elevated temperatures

(approximately 400°F).

Kynar 500 resin-based finishes are available worldwide through a strict licensing program. This licensed distribution ensures the quality, consistency and high performance of Kynar 500 resin-based coatings. It also ensures that building owners actually receive the products that they have asked for and obtain the long-lasting performance that they have come to expect.

While Kynar 500 resin has been the material of choice by architects worldwide for 55 years, many new architects and specifications professionals may not understand why this “established” technology is still the best performing coating technology available today.

The Kynar Technology Platform

Kynar PVDF is a thermoplastic fluoropolymer resin used in many other demanding applications worldwide from piping systems for corrosive liquids to linings on piping systems for the oil and gas industry. The unique properties and performance attributes of Kynar PVDF resin are due to the chemical structure of this polymer. Many of these unique performance attributes of the Kynar family of polymer grades are seen in architectural coatings produced from Kynar 500 PVDF polymer and include:

- UV Resistance
- Chemical Resistance
- Mold and Mildew Resistance
- Low Surface Energy (reduced dirt pickup), ease of cleaning and stain resistance
- Toughness and abrasion resistance

Kynar 500 polyvinylidene fluoride (PVDF) homopolymer is universally known within the architectural community as the world’s most weather-resistant coatings resin. Kynar 500 resin is the main resin ingredient in these coating systems and it provides the



defense against weathering. The excellent durability found in PVDF is a result of the chemical composition of the resin relying on many carbon-fluorine (C-F) molecular bonds. The carbon-fluorine bond is a polar covalent bond between carbon and fluorine atoms. It is one of the strongest bonds in organic chemistry. The strength of these C-F bonds gives the polymer binder its resistance to UV degradation and chemical resistance. In fact, these bonds are so strong that the polymer is extremely resistant to UV degradation. The UV energy from sunlight is not absorbed by Kynar PVDF polymer. The high-performance chemistry behind these premium exterior finishes is transparent to ultraviolet rays and, when combined with durable pigments, creates a coating system that prevents the color from fading and protects the underlying substrate.

Other coating technologies contain other polymer binders like acrylics, urethanes, polyesters, etc. These binders are not resistant to UV degradation and actually deteriorate relatively quickly in strong sunlight because they absorb the UV energy from the sun. This absorption causes the chemical bonds in the polymer to break, resulting in chalking and film thickness erosion.

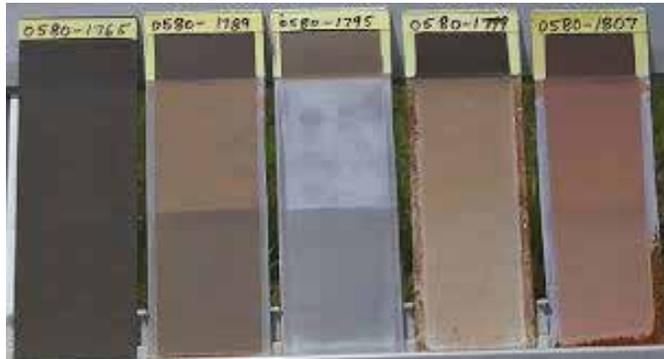
Quality Control Through Licensing

The number and variety of building components that are protected with Kynar 500 resin-based coatings continue to grow. Examples include spandrel panels, wall panels, curtain walls, metal roofing systems, storefronts, column covers, entranceways, louvers, mullions, window and doorframes, metal trim and fascia. When specifying a Kynar 500 resin-based paint system for ultimate performance on a building project, the following terminology should be used:

The final coating for aluminum, galvanized steel or aluminized steel shall be a factory-applied, oven-baked finish based on 70 percent KYNAR 500® FSF® polyvinylidene fluoride resin.

Product consistency, quality and availability are managed on a worldwide basis through a rigorous licensing program. A license is granted only to quality coating companies and only after a rigorous testing program is completed. This program encompasses both outdoor exposure testing and extensive laboratory testing. The license grants the licensee the right to identify their products formulated from Kynar 500 PVDF resins with the Kynar 500 trademark. Licensees must use nothing less than 70 percent Kynar 500 PVDF resin. This minimum establishes the base level of performance for licensed Kynar 500 resin-based coatings that the industry has come to expect and requires. A current listing of Kynar 500 licensees is maintained at <https://www.kynar500.com/en/consistency-through-licensing/>.

Coatings After 17 Years of Florida Exposure (Figure 1)



A Strong Performance Record

Kynar 500 PVDF resin-based coatings have been thoroughly analyzed since they were first introduced to the market 55 years ago. Coatings made with this fluoropolymer are time-tested in harsh climates, internationally evaluated and rewarded by being the product of choice for architects and designers who specify durable pre-painted metal components in the construction industry.

The performance of Kynar 500 PVDF resin-based coatings compared to other common paint systems used in the metal construction industry is illustrated in Figure 1 (above). The superior resistance to fade exhibited by the Kynar 500 resin-based coating (swatch on left edge of figure) is obvious after 17 years of exposure at an independent test-fence facility in Southern Florida. It is difficult to retain dark colors over time, and yet even in the dark color used, fading was insignificant with the Kynar 500 resin-based coating.

In other colors, the performance of Kynar 500 PVDF based paint finishes is noted in Figure 2 (page 32). After 50 years of South Florida Exposure, these colors are still looking great.

Nothing Works Better Longer

In applications worldwide, Kynar 500 PVDF resin-based metal coatings show superior performance compared to other coatings technologies. The performance comparisons in Figure 3 (page 32) were

Fluorine Content of Formulated Coatings (Table 1)

Fluoropolymer/ Coresin Ratio	Weight Percent Fluorine	
	Kynar 500	FEVE (Typical)
100/0	59 %	26 %
90/10	53 %	24 %
80/20	48 %	21 %
70/30	42 %	18 %

Kynar 500® Coatings after 50-plus Years Exposure in South Florida (Figure 2)



compiled by an independent, accredited testing laboratory and are based on actual exposure time in Southern Florida as required by high performance, organic coating specifications AAMA 2605.

Kynar 500 PVDF Resin-Based Coatings Outperform FEVE

Tests show that Kynar 500 resin-based finishes outperform coatings based on the fluoropolymer resin commonly known as fluorinated ethylene vinyl ether [FEVE]. The reason: coatings formulated with FEVE claim to be 100 percent fluoropolymer resin, but actually contain far less fluorine than Kynar 500 resin-based coating formulations. Because the C-F bond is one of the strongest bonds known, the higher percentages of fluorine content in a coating results in superior, long-term protection. Figure 4 (page 34) demonstrates the gloss retention of the two technologies after exposure in South Florida.

In typical formulations, see the shaded areas in Table 1 (page 30), Kynar 500 resin-based coatings contain significantly higher fluorine levels than FEVE-based coatings,

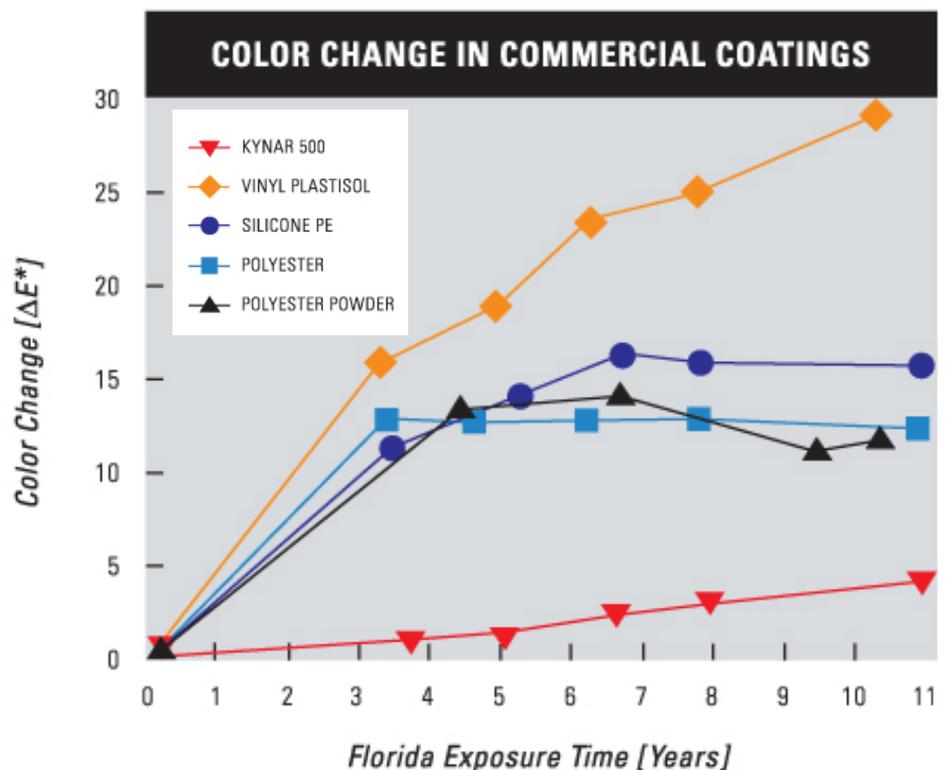
resulting in greater resiliency, color and gloss retention.

Weather Resistance is Paramount

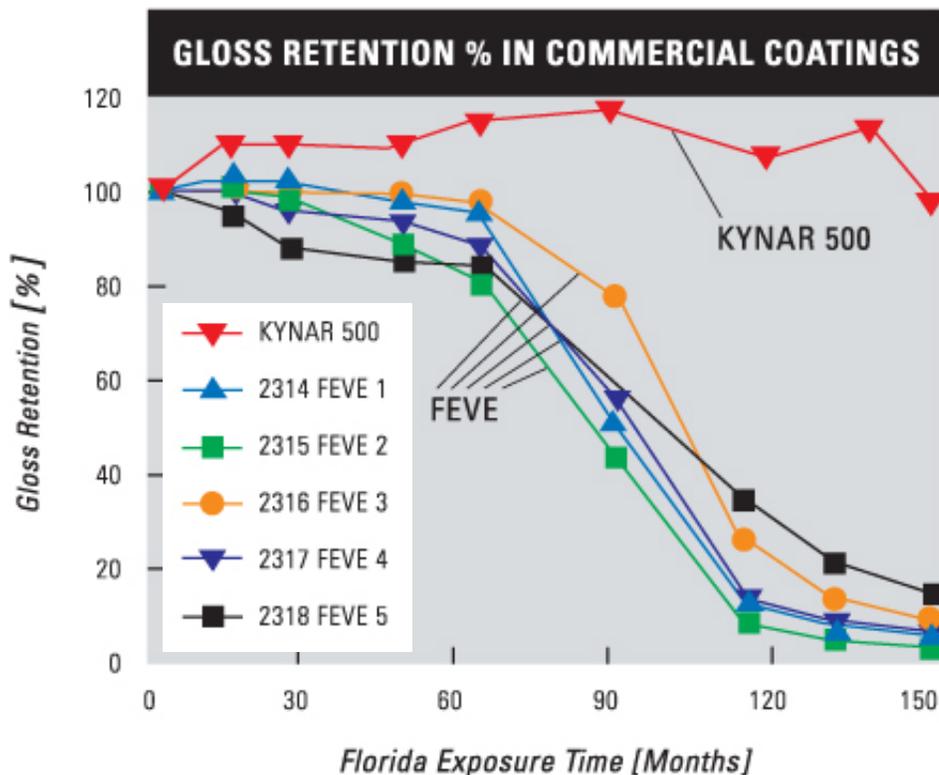
Color creates a mood and makes that desired first impression quickly and more effectively than almost any other architectural component. While architects like to use color to create a statement or image with a building, retaining its beauty and vibrancy can be very difficult. Exterior paints naturally degrade from exposure to heat, humidity and harmful ultraviolet rays. Sunlight can quickly turn brown to tan, red to pink or a deep blue to sky blue. Deterioration can also be evident in the loss of gloss and adhesion, as well as the appearance of chalking.

More than 95 percent of architects in a national survey considered weatherability as “critical” or “very important” to specifying for metal roof and wall panels. Nearly 9 out of 10 of these same architects rated Kynar 500 PVDF resin-based metal coatings as “good or excellent” in terms of weatherability and color

Color Change in Commercial Coatings (Figure 3)



Gloss Retention Percentage in Commercial Coatings (Figure 4)



retention and said they prefer coatings formulated with Kynar 500 PVDF resins.

Green Building Solutions

With energy codes becoming more rigorous, cool roofing is becoming a more popular means of energy efficient building. Sustainable design calls for the reduction in energy consumption as a cost savings to the building owner and as a direct reduction in the greenhouse gas emissions at the power plant generating the energy for the building.

The choice of roofing material has the greatest impact on the energy conservation of a home. Cool metal roof products, which feature a Kynar 500 PVDF resin-based coating, can reduce energy consumption by up to 40 percent as part of a total system design [as reported by the Oak Ridge National Laboratory].

Kynar 500 based painted metal roofing, which offers advanced resistance to UV degradation, can achieve solar reflectance of over 70 percent. Reflected solar energy allows the roof surface to remain cool, which means less heat is transferred into the building. As a result, use of cool metal roofing products featuring Kynar 500 PVDF based paints is one proven way to limit the urban heat island effect.

Kynar 500 PVDF based coatings offer superior long-term color retention, allowing the building owner to enjoy the original color specified over the life of the building with little to no change over time. Unlike

conventional products, which are regularly destroyed by UV energy, heat and moisture, colors in a Kynar 500 based paint system remain rich and vibrant due to the resin's resistance to UV solar radiation. With restoration not being required as often as it is with competitive products, environmental impact is reduced. The reduction in restoration and reconstruction results in lower amounts of VOC's (Volatile Organic Compounds) emitted into the atmosphere. These features of a Kynar 500 PVDF system make it a sustainable green building product.

Sustainability Never Looked So Good

As you may have heard in the news, evidence has accumulated that PFAS Surfactants – a family of manufactured chemicals not otherwise found in nature – might be persistent in the bloodstreams of animals. In

fact, the United States EPA and many states are looking at this matter closely. It is important to note that Arkema's Kynar 500 FSF PVDF resin is manufactured through an innovative and patented process that uses no PFAS surfactants or any other fluorosurfactants whatsoever.

Since no PFAS Surfactants are used in the ingredients or manufacturing process of Kynar 500, we call it Kynar 500 FSF - indeed it is FluoroSurfactant Free.

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Ron Partridge is a Sr. Account Manager in the Technical Polymers Business unit at Arkema. Ron is responsible for the sales of Kynar® PVDF polymer into the NA coatings market. He has over 30 years experience in the polymer industry in sales, business development, technical service and R&D. He has worked for Arkema for the last seventeen years. He received his BS degree in Chemistry and Materials Science from The State University of New York at Stony Brook in 1984. Kynar, Kynar 500, and FSF are registered trademarks of Arkema Inc. An industry standard for over five decades, Kynar 500 PVDF resin-based coatings remain architects preferred choice for protecting metal against weathering and corrosion.