

Fluoropolymer Finishes

Kynar® 500 - Hylar® 5000

Many customers want to know more about these finishes—how they were developed, the way they work, and the differences among various types. This paper will address those questions, and provide more information about the history and application of these finishes.

History of Fluoropolymer

DuPont Corporation invented and patented **polyvinyl fluoride** film in 1948. Pennwalt Chemicals acquired the rights and developed the licensing program that allowed the first widespread commercial use as a pigmented liquid coating. This coating was sold under the **Kynar® 500** trade name in the mid 1960s. In the 1980s Pennwalt was acquired by Elf Atochem (now Atofina). The Federal Trade Commission mandated that Elf divest one of its production facilities. Ausimont, USA (now Solvay Solexis) acquired it and became the second major supplier of PVDF coatings (under the trade name **Hylar® 5000**).

The development of fluoropolymer continues with water-based and powder coating technologies. This paper will focus on the solvent-based liquid coatings in widespread use today.

Liquid Coatings

Any liquid coating consists of the following key ingredients:

1. Polymeric Binder (Resin)
2. Pigment
3. Additives (for flow, leveling or UVA)
4. Solvent or Water

The physical properties and performance features of the dry film coating are derived primarily from the Binder and somewhat from the pigments. Exterior durability and chemical resistance are obtained from the resin's high molecular weight.

Resins

The performance criteria expected from exterior coatings today were unthinkable a few decades ago. We demand that the coating act as a continuous barrier, adhere tightly, and not flake, chip, peel, fade, chalk, lose gloss or stain. The coating must be hard enough to resist incidental scratches but not so brittle as to crack during metal forming, and it should be resistant to atmospheric chemicals, salt, and ultraviolet. Any choice of an exterior coating requires some compromise to these criteria.

There are three primary resins used for the coating of exterior metal. **Polyester** coatings are traditionally the low end of the coatings market. Polyester offers a hard, scratch resistant surface and a wide range of gloss, but is prone to chalking when exposed to UV. Polyesters are often recommended for soffits, rainware, entry doors or other applications without full sun exposure. **Silicone-modified polyesters** use silicone to improve the

chalk performance and gloss retention of polyesters and offer a low-cost middle ground. **Polyvinylidene fluoride** is acknowledged as the **premium resin** for exterior metal coating.

Polyvinylidene fluoride is popularly known by its original trade name Kynar— it is a fluoropolymer (PVDF or PVF2), a family that includes Teflon and Halar. The key to this resin is the bond created between carbon and fluorine, the strongest possible polymeric connection. Years of testing demonstrate that PVDF is most durable when it makes up 70% of the resin. Several companies sell 50% formulations that are less costly but the performance drops off considerably. More than 70% does not coat well. Only 70% versions may be sold under the Kynar 500 or Hylar 5000 trade names.

Pigments

Pigments are the solid material used to impart color, control gloss, improve performance and provide protection to a coating. Color stability is to some extent dependent on the light fastness of the pigment chosen. Pigments are divided into two general classes.

Organic or carbon-based pigments are inexpensive to make and offer a broad range of color. They have a fairly weak molecular bond and are easily broken down by moisture, UV, and pollutants and are prone to fading. On the positive side, organic pigments offer a high gloss range and bright colors.

Inorganic pigments are those that do not contain carbon and may be naturally occurring or manufactured. As a general rule, inorganic pigments offer better UV resistance and durability.

Additives

Additives such as a clear coat may be used to extend the life of less durable pigments. Metallic oxides or metal flakes (aluminum, copper, stainless or bronze) may be added to impart special effects. Metal Oxide coated Mica pigments offer a somewhat metallic look combined with outstanding durability. Pigment additives that reflect infrared energy are of particular interest today.

PVDF Coating Companies

Four companies – Akzo Nobel, BASF, PPG, and Valspar make all of the PDVF coatings used today as well as most of the polyester and silicone polyesters coatings. If these names don't sound that familiar it's due to consolidation of the industry. In 2000, BASF bought Morton which had acquired Whittaker. The same year, Valspar bought Lilly which had purchased Glidden. Akzo Noble, a European chemical giant, entered the US market in the 1990s.

Company Name	Kynar or Hylar Name	Reflective Pigment	Pearlescent (Mica)
Akzo Nobel	Trinar	Cool Chemistry	Ceram-A-Star
BASF	Fluoroceram	Ultra-Cool	UltraMet
PPG	Duranar	Duranar SPF	Sunstorm
Valspar	Fluropon	Fluropon SR	Fluropon Classic

Application Methods

These four companies listed above are licensed to blend and distribute Kynar 500 or Hylar 5000 coatings to Approved Applicators. There are two primary methods of applying Kynar or Hylar coatings to sheet metal.

Coil coating is an extremely efficient method of painting sheet metal before fabrication. This method is also called pre-coat or pre-finish. A raw metal coil is unwound at one end of a long process line, then it is cleaned, treated, primed, top-coated and then re-wound on the other end. This highly automated system provides consistent quality at the most reasonable cost. Since the process is continuous, including decreasing, cleaning, drying, painting, and high temperature ovens to cure the resins at 400-800 degrees, the line doesn't stop. Accumulators take up slack long enough to splice in another coil of metal keeping the line moving. Coil widths range from 48 to 72 inches and line speeds can exceed 700 feet per minute. The painted coil may be slit or re-coiled for use in roll formers to produce panels or it may be sheeted into usable sizes for other products. This is why coil coating is also known as pre-finish. The metal is painted or finished before it is fabricated into an end use product. Due to the speed and quantity of the material that this process produces, availability of gauge and color options are very limited.

The other application method is called **post-finished** or **post-coated** process. Products are fabricated from unfinished sheet stock or from an extruded shape. The product is then sent to a **spray applicator** to be finished or coated after fabrication. Spray application is most economical way to provide custom color in less than 10,000 square feet quantities.

Kynar 500® is a registered trademark of Atofina and Hylar 5000® is a registered trademark of Solvay Solexis. Technical Information for this paper was obtained from them as well.