



SILBERLINE[®]
The Architects of Light[®]

Metallic Pigments for The Plastics Market

Product Data and Processing Guide

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Metallic Pigments for the Plastics Market Products and Processing Guide

Our Products

Silberline products for plastics have a proven track record of consistent high quality and are backed by a strong technical service and support team. Our ability to provide the right product for the right application has always been at the forefront of our commitment to the plastics industry. The diversity of visual effects that can be created with Silberline metallic pigments is unlimited. Our products can be used within the polymer to create the same high-gloss, high-definition appearance of a painted part without the concerns of VOC or over spray. Polymers containing our metallic pigments can be molded or extruded to produce parts with intricate detail and the appearance of having been made from solid metal. Consumer goods and packaging have been made using our products to add both dazzle and shelf appeal thereby increasing value. This aesthetics can be enhanced when combined with chromatic pigments and dyes to provide pearlescent, copper, gold, bronze, and even stoneware effects. In addition to these aesthetic properties, metallic pigments also have the functional ability to reflect UV, infrared, and visible light. These pigments can be used effectively to increase hiding power in applications where opacity or light sensitivity is critical. Other functional properties of metallic pigments include: absorption, reflection and detection in applications such as laser marking, radar sensing, and thermal conductivity. The characteristics of metallic pigments are also used in polymer applications for properties such as corrosion inhibition

Our History

Ernest Scheller had a vision in 1945 to create a business that would provide the highest quality products and customized solutions, all while topping the industry in customer service. Today we are recognized as a world leader in both the manufacture and supply of aluminum effect pigments to a variety of end use markets including automotive, graphic arts and printing inks, plastics and industrial coatings. It is our focus at Silberline to do more, offer more and give more than our customers expect. With over 70 years in the business and over 700 employees world-wide, Silberline provides state of the art, real world testing, technical and sales expertise throughout Europe, Asia and North and South America. Silberline's innovative special effect and performance-enhancing pigments add beauty and value to your products. What can we do to enhance your product?

Welcome to Silberline!

Carrier Selection

SILVEX® Dampened Powder/Paste

In 1959, Silberline introduced aluminum pigments that were wetted with a high boiling plasticizer carrier with very low residual solvent content. These could be safely used in most polymer processing applications, replacing non-recommended dry and solvent paste aluminum pigments.

SILVEX C - Uses mineral oil as a carrier in a concentration from 10–30% to form a dampened powder/paste which has proven to be safe in typical processing equipment. The pharmaceutical-grade carrier allows the formulator to use SILVEX C products in select food-contact applications.

SILVEX DOA - Uses dioctyl adipate (DOA) as a carrier in a concentration of 15–25% to create a safe dampened powder/paste. DOA is commonly used for flexible PVC applications due to its excellent compatibility with the base resin. SILVEX DOA products also have utility in food-contact applications.

COMPATIBILITY WITH POLYMERS

These carriers are used based on higher boiling temperatures than many polymers are processed (SILVEX C-430°F; SILVEX DOA-405°F). SILVEX grades can be used for liquid systems such as liquid color concentrates, plastisol, caulking, gel coats, and some two-part thermoset materials. Some processors use SILVEX in resins compounded above the respective flash point; in this process, the carrier is removed via vacuum devolatilization. This allows the aluminum pigment to be incorporated into the polymer with the least effect on physical properties.

SILVET®—Solid Carrier

Silberline introduced SILVET pigments in 1982. This technology provides aluminum pigment in a low-dusting, low- VOC pellet or granule for a variety of polymers. Suitable for an extensive range of functional and aesthetic applications, the high metal content and carrier types allow the formulator flexibility with selected designs. SILVET products are currently offered as three types: SILVET E, SILVET E1, and SILVET P.

SILVET E—produced with a polyethylene wax carrier typically at 20-25%. Carried in a 3 millimeter compact rod form, these grades offer ease of handling, low residual solvent content, and low dusting.

SILVET E1—produced with a polyethylene wax carrier, typically at 30%. SILVET E1 pellets are typically 1.5 millimeters in diameter and possess a lower density than related SILVET E grades.

SILVET P—produced with an acrylic carrier, typically at 20%. SILVET P granules are manufactured with a typical diameter of 2.5 millimeters which results in highly concentrated pigment.

COMPATIBILITY WITH POLYMERS

Each SILVET carrier is compatible with a wide range of high temperature thermoplastic systems.

SILVET E and SILVET E1 - Achieve the best compatibility with Polyolefin, Polyamides, and show use with select engineering thermoplastics.

SILVET P - Suited for engineering thermoplastics such as PC, ASA, ABS, PMMA, PVC, and Nylons.

SILVEX



SILVET PELLETS



SILVET GRANULES



Manufacturing Process

SILVEX C

SILVEX C Pigment is produced with aluminum and mineral oil. Several process steps ultimately result in a dampened powder at 70- 90% aluminum content by weight with a low VOC. It is recommended for use with rigid PVC, polyolefin, PMMA and polystyrene resin. SILVEX C may be used with Flexible PVC or engineering resin. As the mineral oil carrier has a flash point of 220° C, it may cause gassing at higher temperatures and pressures.

SILVEX DOA

SILVEX DOA Pigment is produced with aluminum and dioctyl-adipate. Several process steps ultimately result in a dampened powder at 70- 90% aluminum content by weight with a low VOC. It is recommended for use with Flexible PVC, polyolefin, PMMA, polystyrene, and select engineering resins. SILVEX DOA may should not be used with Rigid PVC due the chance of embrittlment in final parts. As the DOA carrier has a flash point of 205° C, it may cause gassing at higher temperatures and pressures.

SILVET E

SILVET E Pigment is produced with aluminum and polyethylene wax. Several process steps ultimately result in a solid compact pellet form at 75-80% aluminum content by weight. The low VOC, low dusting, and ease of handling characteristics make SILVET E suitable for use in polyolefin, rigid PVC and a wide range of engineering thermoplastics. Higher temperature processing is possible, consult the SDS or a Silberline representative for details.

SILVET E1

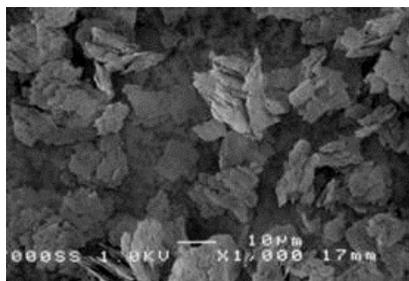
SILVET E1 Pigment is produced with aluminum and polyethylene wax. Several process steps ultimately result in a softer granule form for ease dispersion at 70-90% aluminum content by weight. With a low VOC, low dusting, ease of handling, and excellent dispersion, SILVET E1 for use in polyolefin, polyamides, rigid PVC and a wide range of engineering thermoplastics to improve appearance beyond typical aluminum pigment products. Higher temperature processing is possible, consult the SDS or a Silberline representative for details.

SILVET P

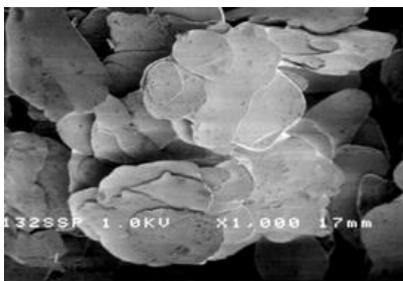
SILVET P Pigment is produced with aluminum and acrylic. Several process steps ultimately result in a softer granule pellet form for ease with dispersion at 80-90% aluminum content by weight with a low VOC, very low dusting and ease of handling. It is recommended for use in ABS, PC, ASA, Nylon, PMMA, PS, and a wide range of engineering thermoplastics where high-clarity aesthetics are desired. Higher temperature processing is possible, consult the SDS or a Silberline representative for details.

Product Flake Type

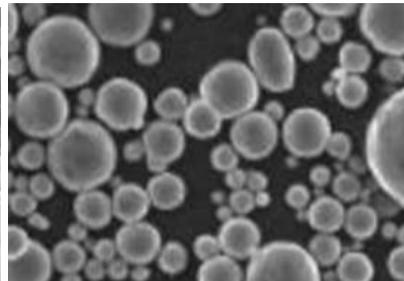
Corn Flake



Round Flake



Spherical



Pre-Blending Processing Guide

There are several methods for blending aluminum pigment with polymer prior to extrusion. Aluminum and polymer should be mixed for at least 5 minutes and not more than 15 minutes for better dispersion and more uniform mixture. Aluminum pigment may be blended with colored pigment to achieve the desired effect. Here are most common mixers for the plastics market.

Mixer	Products	Mixing Operations	Comments
High Intensity Mixer	SILVEX	Liquid and Solids	Add aluminum pigment during last part of the cycle and lower speed to reduce flake damage
Ribbon Mixer	SILVET/SILVEX	Solids	Add aluminum pigment with polymer and lower speed to reduce flake damage
V-Blender	SILVET/SILVEX	Solids	Add aluminum pigment with polymer
Drum Tumbler	SILVET	Solids	Add aluminum pigment with polymer

Drum Tumbler



Ribbon Mixer



V-Blender



High intensity mixer



Feeding Processing Guide

SILVEX & SILVET- After pre-blending, the most suitable method for feeding and introducing material into the extruder hopper is through gravimetric or volumetric feeders. Loss-in-weight belt feeders may also be used.

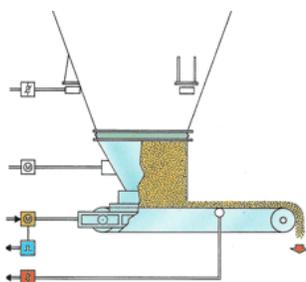
SILVET E- Since this grade is low dust and a near-uniform shape, direct feed is the most suitable method for feeding SILVET into the extruder using gravimetric loss-in-weight feeders. In contrast, volumetric dosing equipment is suitable for SILVET E, but not recommended for additions of SILVET E1 and SILVET P due to varying granule length.

Although not always practical, the use of a downstream feed port for the aluminum pigments (past the high-shear mixing stage) is ideal as it reduces flake damage.

Gravimetric/Volumetric



loss-in-weight belt



Multiple Gravimetric



Processing Extrusion Guide

Compounding Extrusion - When preparing color concentrates, for SILVET E it is recommended to use a screw configuration with sufficient shear. Kneading melt-mixing is required to disperse most chromatic pigments. Since aggressive processing may create a graying effect on aluminum pigments SILVEX, SILVET E1 and SILVET P grades, low-shear incorporation of these aluminum pigments is essential to retain metallic brightness. This is ideally accomplished by down-stream addition, which introduces aluminum flake into the molten polymer after high-shear extrusion processing of the polymer.

Direct Extrusion or Injection Molding - SILVET E1, SILVET P and SILVEX grades are occasionally used in direct extrusion and injection molding without pre-compounding due to their small size, carrier types, and ease of dispersion. While SILVEX, SILVET E1, and SILVET P are the best selections for this technique, it is recommended that the final product be evaluated for desired effect. As a rule, fine grades are more difficult to gain complete dispersion compared to coarser flakes. In the event that color variation is observed, the use of a pigment concentrate or pre-compounded resin is advised.

Processing Options

- Film Extrusion
- Sheet Extrusion
- Profile Extrusion
- Injection Mold
- Blown Film Extrusion

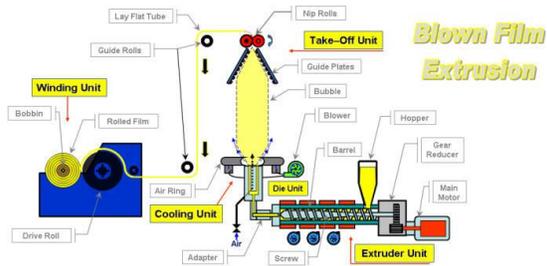
Master Batch/compounding process



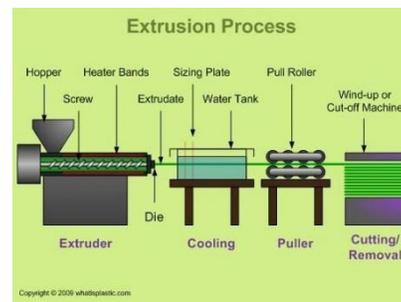
Film/Sheet Film Extrusion process



Blow Film Extrusion Process



Profile Extrusion Process



Injection Mold Process



For additional technical advice on the process of Silberline aluminum pigments for the plastic market, contact our technical representative experts at 570-668-6050 or toll free at 800-348-4824