



Color stylists and coatings formulators continually look for new and exciting special effect pigments to deliver novel aesthetics through liquid coatings. Current styling trends in the automotive and consumer goods markets demand the flash and eye-catching appeal of brushed metallic and liquid metal effects. Because this smooth, mirror-like metallic effect cannot be achieved with conventional ball-milled aluminum pigments, STARBRITE Vacuum Metallized Flake (VMF) pigments have become of great interest to the coatings formulator.

STARBRITE Products

STARBRITE VMF pigments are commercially available in three distinctively reflective grades carried in ethyl acetate (EAC). The first family developed by Silberline is STARBRITE 2100EAC, it has a D(50) of 10-microns and a non-volatile of 10%. This product is recommended for applications requiring high reflectivity and a brushed metal effect. The second family developed was an "ultra" reflective version designated as STARBRITE 4102EAC which has a D(50) of 12-microns and a non-volatile of 10%. Silberline's latest addition to the STARBRITE VMF family is STARBRITE 5102EAC which, when properly formulated will produce a deeper blue, chrome-like effect with a significantly enhanced DOI versus the previous versions of STARBRITE. Moreover, current studies of STARBRITE 5102EAC in our acrylic-based test formulation have shown it to provide ~20-25% more hiding than the STARBRITE 4102EAC VMF pigment. STARBRITE 5102EAC has a D(50) of 12-microns and a non-volatile of 10%.

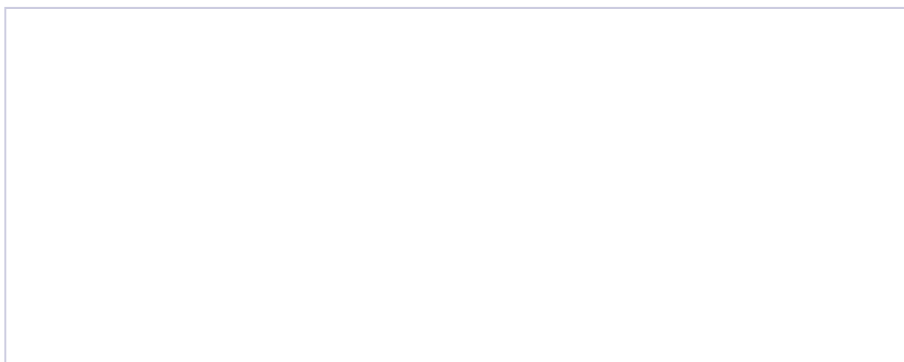
If ethyl acetate is not the most compatible solvent with the resin system employed, Silberline offers a variety of alternative solvents upon request. For more information, please contact your Silberline sales representative to inquire about the availability of made-to-order products specific for your application.

Solventborne STARBRITE Display Formulation

STARBRITE 2100EAC

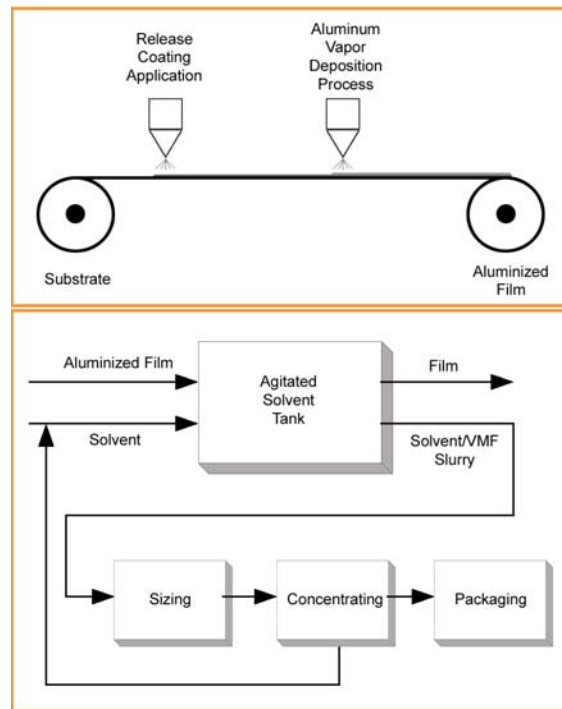
STARBRITE 4102EAC

STARBRITE 5102EAC



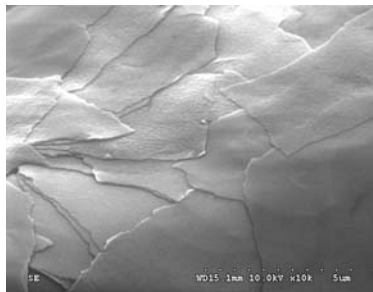
Product Description

STARBRITE Vacuum Metallized Flake (VMF) is a platelet-like aluminum pigment with exceptionally high surface area and aspect ratio. These characteristics allow the formulator to deliver highly reflective, brilliant finishes for the color stylists. STARBRITE VMF pigments are manufactured through a completely unique process, unlike conventionally milled aluminum flakes. With STARBRITE, high purity aluminum metal is physically vapor deposited in a vacuum chamber onto a flexible web that is surface treated with a release coating. The metal is deposited in a dimensionally consistent layer and subsequently removed from the web by dissolving the release coating in a solvent bath. The metal is then appropriately sized, concentrated and packaged for sale. A flow diagram of this process is shown in Figure 1.

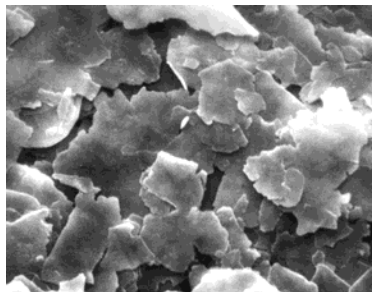


The extremely smooth surface characteristics of STARBRITE pigments are evident when compared to conventionally milled aluminum pigments. (See Figure 2) Traditionally ball-milled aluminum pigments come in two varieties: cornflake and round flake. Pigments with cornflake geometry have very irregular surfaces with jagged edges. These properties influence reflected light causing it to diffuse and scatter. Pigments with round flake geometry, commonly referred to as “silver dollars,” are an improvement over cornflake geometry because they possess rounded edges and polished surfaces. However even “silver dollar” flakes contain some surface imperfections and will not impart a mirror-like

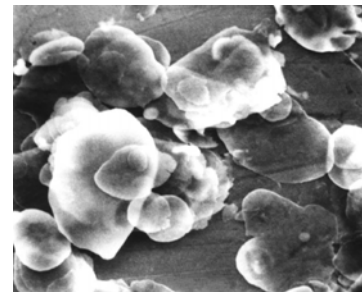
Figure 1 Process Flow



STARBRITE Flake



Cornflake



Round Flake

Figure 2: Flake Geometries



appearance. In contrast, STARBRITE pigments have an extremely smooth surface that produces coatings with the reflectance that mimics a liquid metal effect. The unique attributes of VMF pigments require a non-traditional approach when developing and applying coating formulations. The remainder of this booklet will address specific recommendations for dispersing, storing, formulating and applying STARBRITE VMF pigments for general industrial coating applications.

General Guidelines

Because the EAC solvent used as the carrier for most of the STARBRITE products evaporates at an extremely fast rate, it is advisable to keep STARBRITE products tightly sealed when not in use or while stored. Additionally, while mixing STARBRITE prior to incorporation into a coating system, it would be prudent to keep the mixing vessel covered as much as possible to avoid loss of volatiles.

STARBRITE Dispersion Instructions

STARBRITE is a very low solids product and, as such, is prone to settling. An efficient re-dispersing procedure for this product is to mix it for 10 to 15 minutes with a propeller blade, keeping the material covered as much as possible. An alternate, but effective, method for dispersing this product is to place the sealed container onto a paint shaker for 5-6 minutes of agitation. The material should be homogenous at the end of that time. Note that STARBRITE should be used as soon as is practical, as settling of the aluminum flakes will occur if the product is allowed to sit for extended periods of time.

Formulating Guidelines

STARBRITE VMF pigments behave in ways that are unlike those of conventional milled aluminum flakes and special considerations need to be made when formulating.

Pigment/Binder

Unlike many typical solvent based aluminum masstone systems, STARBRITE VMF formulations are very low in solids content and have extremely high pigment to binder ratios.

The best aesthetics are achieved when STARBRITE VMF pigments are formulated with pigment to binder ratios of as low as 1:1 or as high as 10:1. It is not unusual to have a solvent-based formulation that is less than 4% solids or even as low as 1.5% solids by total weight. A formulation such as this will have an extremely thin viscosity, typically between 8 and 11 seconds in a Zahn 3 cup. This is critical to support proper flake orientation and maximize reflectance.

Solvents

When formulating, try to maintain relatively high levels of fast solvents (generally above evaporation rates of 600-700 compared to Butyl Acetate) and use low levels (about 15% of the



total solvent weight) of the slower tailing diluents. The choice of solvents will depend upon the resin system used and also upon the substrate that you wish to cover. This does not present a problem for coating metal substrates, but should you wish to coat other materials, like plastics or primed metals, you will have to consider the effect that the solvents will have on the materials. Improper solvent combinations can cause marring, hazing, or etching of the surface resulting in severely degraded aesthetics.

Substrates

The substrate must be virtually flawless, as any defect or dirt particle on the surface will be telegraphed through the final coating. It has been found that the smoothest substrate surfaces result in the most chrome-like appearance of the finished coating when using vacuum metallized flake.

A primer/sealer coat may be pre-applied to the substrate to cover any visible surface flaws. However, careful selection of the primer/sealer system, as well as any potential top-coat, should be practiced to avoid interactions of the solvents. Interaction between layers could cause crazing or flake disorientation problems.

Application

Due to the extremely light viscosity inherent in a properly formulated STARBRITE VMF system, ponding, flooding, and runoff are difficult to avoid or control. Systems such as this lend themselves best to automated air assisted siphon spray applications. It is strongly recommended that the operator apply multiple thin coats at low film build for maximum brightness.

A final Dried Film Thickness (DFT) of 0.1 - 0.2 mils will give the best aesthetics. However, a compromise of a higher DFT may be needed to improve intercoat adhesion and chip resistant characteristics.

Clearcoat

If a clearcoat is employed, the basecoat should be fully cured before application of the clearcoat. This reduces the chance of solvent "strike in" between the basecoat and the clearcoat that could cause disruption of flake orientation and detract from brightness and chrome-like appearance of the final coating.



Starting Point Formulations and Application Guidelines

First Side Formulation on Black ABS Plastic

P/B = 2/1		Panel 1	Panel 2	Panel 3	
	Density	Pounds	Pounds	Pounds	Gallons
STARBRITE 2100EAC	8.03	9.00	//	//	1.12
STARBRITE 4102 EAC	8.03	//	9.00	//	1.12
STARBRITE 5102 EAC	8.03	//	//	9.00	1.12
Paraloid B84	8.10	1.00	1.00	1.00	0.12
TBAc	7.26	80.00	80.00	80.00	11.02
MEK	6.71	5.00	5.00	5.00	0.75
DIBK	6.73	5.00	5.00	5.00	0.74
Totals		100.00	100.00	100.00	13.75

First and Second Side Clear PMMA Plastic Formulation

P/B = 2/1		Panel 4	Panel 5	
	Density	Pounds	Pounds	Gallons
STARBRITE 4102 EAC	8.03	9.00	-	1.12
STARBRITE 5102 EAC	8.03	-	9.00	1.12
Paraloid B84	8.10	1.00	1.00	0.12
TBAc	7.26	85.00	85.00	11.71
DIBK	6.73	5.00	5.00	0.64
Totals		100.00	100.00	13.70

Mixing Instructions:

First charge the container with DIBK, TBAc and Paraloid B-84 resin. Stir at low speed with a propeller blade for approximately 5-10 minutes until thoroughly dispersed. Add the STARBRITE under gentle agitation and continue to mix for an additional 5-10 minutes until thoroughly dispersed. Paraloid B-67 can be substituted for Paraloid B-84 in the above formulations.

Storage Considerations

The ethyl acetate solvent used as a carrier for STARBRITE VMF pigments evaporates at an extremely high rate. Therefore, precautions should be taken when working with STARBRITE



VMF pigments to minimize this evaporation. Common practices such as keeping materials tightly sealed when not in use, minimizing exposure to high temperatures, and storing the product in cool, dry locations are recommended.

Due to the ethyl acetate solvent, STARBRITE 2100EAC, STARBRITE 4102EAC and STARBRITE 5102EAC are classified as a flammable liquid. All of these products should be handled and stored in accordance with the requirements of The National Fire Protection Association (NFPA) 30, "Flammable and Combustible Liquids Code."

Suppliers of Suggested Raw Materials

Paraloid B-84
Univar
Middletown, PA
1-717-944-7471

Tert-Butyl Acetate (TBAc)
Brenntag
Reading, PA
1-888-926-4151

Di-Isobutyl Ketone (DIBK)
Brenntag
Reading, PA
1-888-926-4151

Methyl Ethyl Ketone (MEK)
Brenntag
Reading, PA
1-888-926-4151

STARBRITE®

Vacuum Metallized Flake (VMF) Pigments



SILBERLINE®

The Global Supplier of Effect Pigments™



www.silberline.com

World Headquarters:
130 Lincoln Drive, PO Box B
Tamaqua, PA 18252-0420

Plants in Lansford and
Hometown, Pennsylvania;
Decatur, Indiana;
Leven, Fife, Scotland;
and Singapore.

Sales, Marketing and
Warehousing Operations
in Brazil, China & Mexico.

United States and Canada:

Tel: 1-800-348-4824
order@silberline.com

International Orders:

Tel: 570-668-6050
intorder@silberline.com

For All General Inquiries / Correspondence, and Samples:

Tel: 1-570-668-6050
Fax: 1-570-668-2621
samples@silberline.com

Technical Service Department:

Tel: 1-877-492-7881
Fax: 1-570-668-4227
technology@silberline.com



Contact Us:

Silberline Global Headquarters

130 Lincoln Drive
PO Box B
Tamaqua, PA 18252
Phone: 570-668-6050
Toll-Free (USA & Canada): 800-348-4824
Fax: 570-668-0197
E-Mail: order@silberline.com



Silberline Brasil Limitada

Rua Dr. Tirso Martins, 100, Cj. 701
Vila Mariana
Sao Paulo – Cep. 04120-050
Brazil
Phone: 55-11-3562-2780
Fax: 55-11-3562-2783

An ISO
9001
Registered
Company

Ernest Scheller III Center for Technical Functions & Advanced Manufacturing

36 Progress Avenue, PO Box 152
Tamaqua, PA 18252
Phone: 570-668-2773
Toll-Free (USA & Canada): 877-492-7881
Fax: 570-668-4227



Silberline Pigmentos, SRL de CV

Blvd. Atlixcayotl
Torre Bosques II #5320-200
Reserva Territorial Atlixcayotl
San Andres Cholula
Puebla – CP 72810
Mexico
Phone: 52-222-2252774

Silberline Limited

Banbeath Road
Leven, Fife
Scotland KY8 5HD
Phone: 44-1-333-424734
Fax: 44-1-333-421369
E-Mail: euinfo@silberline.com



Silberline Pigment (Suzhou) Company Limited

Suchun Industrial Area
428 Xinglong Street, Unit 26B
Suzhou, China 215126
Phone: 86-512-67333150
Fax: 86-512-62723540

Silberline Asia Pacific Pte. Ltd.

50 Science Park Road
#04-01/02 The Kendall
Singapore Science Park II
Singapore 117406
Phone: 65-6411-0170
Fax: 65-6779-0080
E-Mail: sapmkt@silberline.com



Silberline Specialty Effect Pigments India Private Limited

Plot No. 248
Jawahar Co-Op Industrial Estate
Kamothe, Panvel — 410 209
Dist: Raigad
Maharashtra, India
Phone: 91-99-2076-7723

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