Silver Conductive Coating

RoHS Compliant

Description

The MC002969 Silver Conductive Coating is a one-part durable acrylic lacquer pigmented with an extremely conductive silver flake. It utilizes a solvent based system with no heat cure necessary. The cured coating is smooth, hard, and abrasion resistant. It provides good adhesion to plastics, extreme conductivity, high frequency shielding, and extreme corrosion resistance, even in harsh marine environments.

Applications and Usages

The MC002969 is designed to provide a conductive coating to the interior of plastic electronic enclosures to suppress EMI/RFI emissions. It excels when the highest level of shielding is required.

Its effectiveness at high frequencies and thin minimum layer makes it suitable for board level applications in miniaturized electronics.

It is optimal for military, medical, or other mission critical applications where the highest levels of attenuation are essential.

The MC002969 is commonly used by manufacturers of these devices:

- Medical equipment
- Military equipment
- Scientific equipment
- Test Equipment
- Communication devices
- Cellphones, laptops, PDA's
- Consumer electronics
- Automotive applications
- Aerospace applications
- Drones and other RC vehicles

Other applications for MC002969 include:

- Repairing damage to existing shielding
- Conductive undercoat for electroplating
- Providing electric continuity for circuits
- Circuit repair

It is a simple effective solution to impart excellent conductivity to a surface.

Benefits and Features

- Provides extreme EMI/RFI shielding over a broad frequency range
- Volume resistivity of 0.0001Ω*cm
- Smooth, durable, and abrasion resistant
- Can be applied by spray or brush
- Available in aerosol format
- Can be applied very thin, 0.5 mil minimum coating thickness
- Quick dry time, no heat cure required
- Mild solvent system
- Strong adhesion to acrylic, ABS, polycarbonate, and other injection molded plastics
- Excellent adhesion to wood and ceramics
- Extremely corrosion resistant, suitable for harsh marine environments
- Low VOC; HAP Free; Does not contain toluene, xylene, or MEK

Silver Conductive Coating

Usage Parameters

Properties	Value
Recoat Time (liquid) [a]	3 min
Drying Time @25 °C (77 °F)	24 hour
Drying Time @65 °C (149 °F)	30 min
Shelf Life	2 years
Theoretical HVLP Spray	≤59600 cm^2/L
Coverage [b]	≤5.9 m^2/L
	≤35100 in^2/gal
	≤240 ft^2/gal

[a] Assumes let 2:1 let down with Thinner Cleaner Solvent

[b] Idealized estimate based on a coat thickness of 25µm (1.0 mil) and 65% transfer efficiency

Temperature Ranges

Properties	Value
Constant Service Temperature	-40 to 120°C
	(-40 to 248°F)
Intermittent Temperature Limit	-50 to 125°C
	(-58 to 257°F)
Storage Temperature of Unmixed Parts [c]	-5 to 40°C
	(23 to 104°F)

[c] The product must stay within the storage temperature limits stated.

Principal Components

Silver
Acrylic Resin
Acetone
Dimethyl carbonate
Heptan-2-one

Properties of Cured MC002969

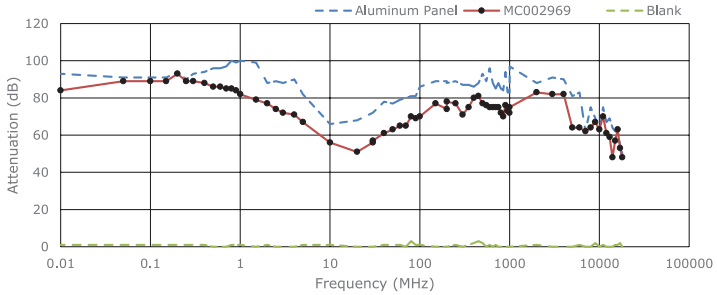
Electric and Magnetic Properties	Method	Value	
Volume Resistivity	Method 5011.5 in MIL-STD-883H	0.0001Ω*cm	9337 S/cm
Surface Resistance		Resistance [a]	Conductance
1 coat @ 0.9 mil	Square Probe	0.01 Ω/sq [a]	> 100 S
2 coats @ 1.8 mil	Square Probe	0.01 Ω/sq [a]	> 100 S
3 coats @ 2.9 mil	Square Probe	0.01 Ω/sq [a]	> 100 S
Magnetic Class		Diamagnetic (Non-magnetic)	
Relative Permeability		< 1.0	
Shielding Attenuation for 33µm (1.0 mil)	IEEE STD 299-1997		
>10 to 100 kHz	″	84 dB to 89 dB	
>100 kHz to 1 MHz	″	82 dB to 93 dB	
>1 MHz to 10 MHz	″	56 dB to 79 dB	
>10 MHz to 100 MHz	″	51 dB to 70 dB	
>100 MHz to 1 GHz	″	70 dB to 81 dB	
>1 GHz to 10 GHz	″	62 dB to 83 dB	
>10 GHz to 18 GHz	″	48 dB to 70 dB	
Physical Properties	**Method**	**Value**	
Paint Type	-	Lacquer (Thermoplastic)	
Colour	Visual	Light Grey	

Electric and Magnetic Properties	Method	Value
Abrasion Resistant	-	Yes
Blister Resistant	-	Yes
Peeling Resistant	-	Yes
Water Resistant	-	Yes
Mechanical Properties	**Method**	**Value**
Adhesion [b)]	ASTM D3359	5B
Pencil Hardness [b)]	ASTM D3363	3H, Hard
Environmental and Ageing Study	**Method**	**Value**
Salt Fog Test @35°C (95°F), 96 h b)	ASTM B117-2011	
Resistivity before	MG-ELEC-120	< 0.01Ω/sq [a)]
Resistivity after	MG-ELEC-120	0.05Ω/sq
% Conductivity after	MG-ELEC-120	<20%
Cross-Hatch Adhesion	ASTM D3359-2009	5B
Cracking, unwashed area	ASTM D661-93	None
Visual Color, unwashed area	ASTM D1729-96	Slightly yellowing

[a)] Readings less than 0.01Ω/sq are below the detection limit of the handheld multimeter and square probe method.

[b)] Tested on acrylonitrile butadiene styrene (ABS) material.

Shielding Attenuation



Attenuation of MC002969 coating at different frequencies

Properties of Uncured MC002969

Physical Properties	Mixture
Colour	Light Grey
Density @25 °C (77 °F)	1.7 g/mL
Solids Percentage (wt/wt)	61%
Viscosity @25°C (77°F) [a)]	873 cP (503mm^2/s)
Flash Point	-17°C (1.4°F)
Odour	Acetone-like

[a)] Brookfield viscometer at 30 RPM with spindle LV S62

Compatibility

Chemical - The silver filler is quite resistant to oxidation, except in environments that contain contaminants like H2S or ozone which tarnish its surface. Unlike many other metal oxides, silver oxide remains conductive so degradation due to oxidation is not as bad.

The thermoplastic resin is dissolved by common paint solvents like toluene, xylene, acetone, and MEK. This allows great coating repair and work characteristics, but it does make the coating unsuitable for solvent rich environments.

Adhesion - The MC002969 coating adheres to most plastics used to house printed circuit assemblies; however, it is not compatible with contaminants like water, oil, and greasy flux residues that may affect adhesion. If contamination is present, clean the surface to be coated first.

MC002969 Adherence Compatibility

Substrate	Note
Acrylonitrile Butadiene Styrene (ABS)	Chemically etches [a)] and adheres well to this substrate.
Polybutlylene Terephtalate (PBT)	Chemically etches [a)] and adheres well to this substrate.
Polycarbonate	Chemically etches [a)] and adheres well to this substrate.
Polyvinyl Acetate (PVA)	Chemically etches [a)] and adheres well to this substrate.
Polyvinyl Chloride (PVC)	Chemically etches [a)] and adheres well to this substrate.
Acrylics or Acrylic Paints	Adheres well to clean surface
Epoxy, FR4 substrate	Adheres well to clean surface
Polyurethane	Adheres well to clean surface for most urethane types
Wood	Adheres well with surface preparation

[a)] Etching is similar to sanding, except that it also softens the surface helping to meld the paint to the plastic for superior adhesion.

ATTENTION! Do not use on thin plastics or on plastics where you want to keep original surface intact. The MC002968 spray contains a controlled amount of solvents designed to chemically etch plastic surfaces to help adhesion by melding the acrylic coating into the plastic substrate. This prevents flaking or peeling. Using the thinner lessens the etching effects for chemically sensitive substrates.

Storage

Store between -5 and 40°C (23 and 104°F) in dry area.

Application Instructions

The MC002969 Silver Conductive Coating can be easily applied by the paintbrush, spray gun, or dip method.

For best results, apply thin wet coats as opposed to using thick coats. We recommend a final dry film thickness of at least 1mil (25µm). Follow the procedure below for ensure optimal conductivity.

Material & Equipment

- Mixing spatula
- Clean paint brush OR HVLP spray gun OR dip tank systems
- Liquid agitator, agitated pot, or recirculation system
- Thinner/solvent
- Personal protection equipment (See MC002969-Liquid SDS)

Paint Dilution Ratios

For brush applications, the MG conductive paints are ready-to-use without dilution. You may however dilute it to help achieve better coat leveling and easier brush application.

For spray application, we recommend a 2:1 paint-to-thinner ratio as a starting point. To achieve the best results, adjust this dilution ratio based on the equipment and operator's preferences.

Surface Preparation

Clean oil, dust, water, solvents, and other contaminants and let the surface dry fully.

Spray Gun Application Instructions

Read the procedure below fully and make necessary adjustments to get the required coat thickness for your needs. For a 2:1 dilution, one spray coat typically results in a dry film thickness of roughly 1.0 mil (50µm).

Spray Equipment

Use a HVLP (high-volume, low pressure) using the initial settings described in the following table. Adjust these settings and recommendations as required.

Initial Setting Recommendations

Air Cap	#3 HVLP		
Pressure	Inlet	Air flow	Air cap
	23 psi	13.5 SCFM [a)]	10 psi
Fluid Tip	1.3mm (0.051”)	1.5mm (0.059”) [b)]	-

Note: These recommendations are based on a generic paint gun and may differ by brands. Please consult your spray gun manufacturer’s guide.

[a)] SCFM = standard cubic foot per minute

[b)] If no or reduced let down is performed, this may be a better tip choice.

To apply the coating

1. Mix paint thoroughly with mechanized paint shaker, paint mixer, or spatula.
2. Let down the paint with a 2:1 (Paint:Thinner) ratio.
3. Make a test spray. Adjust the spray settings for best flow and spray quality, and establish an appropriate distance to avoid paint runs. A distance between 20 and 25 cm (8 to 10 in) is recommended.
4. Spray a thin and even coat onto a vertical surface to be coated. For best results, start your movement off-surface, press the trigger, and only release off-surface at the end of the stroke. Use a uniform movement of the spray gun parallel to the surface.
5. Wait 3 to 5 minutes and spray another coat. The delay avoids trapping solvent between coats.
6. Apply additional coats until desired thickness is achieved. (Go to Step 3.)
7. Let dry for 5 minutes (flash off time) at room temperature.

NOTE: Ideally, your spray gun will be equipped with liquid agitation system. If not, swirling the paint gun container slightly in between spray applications slows settling.

ATTENTION! Spraying overly thick coats may cause paint runs and hamper solvent evaporation. Prefer the application of many thin mist coats rather than fewer thicker wet coats.

To cure at Room temperature

Let air dry 24 hours

To accelerate cure by heat

After flash off, put in oven or under heat lamp at 65°C for 30min.

NOTE: Coats that are very thick require more time to dry. Heat curing ensures optimal performance.

ATTENTION! If heat curing, do not exceed 65 °C as this may cause surface defects due to solvents evaporating off too quickly.

Packaging

Packaging	Net Volume		Net Weight	
Pen	5.0 mL	0.16 fl oz	8.69 g	0.3 oz

Part Number Table

Description	Part Number
Silver Conductive Coating, 5mL, Pen	MC002969