Nickel Conductive Coating

RoHS Compliant

Description

The MC002968 Nickel Conductive Coating is a one-part durable acrylic lacquer pigmented with a highly conductive nickel flake. It utilizes a solvent based system with no heat cure necessary. The cured coating is smooth, hard, and abrasion resistant. It provides strong adhesion to plastics, excellent conductivity, and strong corrosion resistance, even in marine environments.

Applications and Usages

The MC002968 is designed to provide a conductive coating to the interior of plastic electronic enclosures to suppress EMI/RFI emissions. It excels when corrosion resistance is a concern.

The MC002968 is commonly used by manufacturers of these devices:

- Sensors
- Controllers
- Receivers
- Test equipment
- Scientific equipment
- Medical equipment
- Communication devices
- Satellite dishes and radar systems
- Antennas
- Aerospace applications
- Electric vehicles
- Cable boxes
- Networking gear, firewalls
- Military equipment
- Cellphones, laptops, PDA's
- GPS's, navigation systems
- TV's, monitor's, and displays
- Consumer electronics
- Electronic sporting equipment
- Audio equipment
- Electric guitars and other amplified instruments
- Drones and other RC vehicles

Other applications for MC002968 include:

- Repairing damage to existing shielding
- Conductive undercoat for electroplating
- Protecting metal surfaces from oxidation
- Providing electric continuity for circuits
- Grounding

Benefits and Features

- UL Recognized
- Provides effective EMI/RFI shielding over a broad frequency range
- Volume resistivity of 0.0040Ω*cm
- Smooth, durable and, abrasion resistant
- Can be applied by spray or brush

Nickel Conductive Coating

- Available in aerosol format
- 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
- Corrosion resistant, suitable for marine environments
- Low VOC; HAP Free; Does not contain toluene, xylene, or MEK

Usage Parameters

Properties	Value
Recoat Time (liquid) a)	3 min
Drying Time @22 °C (72 °F)	24 hour
Drying Time @65 °C (149 °F)	30 min
Shelf Life	2 years
Theoretical HVLP Spray	≤29600 cm^2/L
Coverage b)	≤2.96 m^2/L
	≤17300 in^2/gal
	≤120 ft^2/gal

a) Assumes let 2:1 let down with Thinner Cleaner Solvent

b) Idealized estimate based on a coat thickness of 50µm (2.0 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

Nickel Flake (high purity)
Acrylic Resin
Acetone
Dimethyn carbonate
Heptan-2-one

Properties of Cured MC002968

Electric and Magnetic Properties	Method	Value	
Volume Resistivity	Method 5011.5 in MIL-STD-883H	0.0040Ω*cm	250 S/cm
Surface Resistance		Resistance a)	Conductance a)
1 coat @ 1.6 mil	Square Probe	0.52 Ω/sq	1.9 S
2 coats @ 4.0 mil	Square Probe	0.38 Ω/sq	2.6 S
3 coats @ 5.8 mil	Square Probe	0.29 Ω/sq	3.4 S
Magnetic Class		Ferromagnetic	
Relative Permeability		≥ 100	
Shielding Attenuation for 51µm (2.0 mil)	IEEE STD 299-1997		
>10 to 100 kHz	″	84 dB to 89 dB	
>100 kHz to 1 MHz	″	65 dB to 88 dB	

Electric and Magnetic Properties	Method	Value
>1 MHz to 10 MHz	"	39 dB to 60 dB
>10 MHz to 100 MHz	"	32 dB to 52 dB
>100 MHz to 1 GHz	"	52 dB to 61 dB
>1 GHz to 10 GHz	"	56 dB to 74 dB
>10 GHz to 18 GHz	"	49 dB to 68 dB
Physical Properties	**Method**	**Value**
Paint Type	-	Lacquer (Thermoplastic)
Colour	Visual	Dark Grey
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 & Ageing Study	**Method**	**Value**
Salt Fog Test @35 °C (95 °F), 96 h b)	ASTM B117-2011	
Resistivity before	MG-ELEC-120	380 mΩ/sq
Resistivity after	MG-ELEC-120	510 mΩ/sq
% Conductivity after	MG-ELEC-120	75%
Cross-Hatch Adhesion	ASTM D3359-2009	5B
Cracking, unwashed area	ASTM D661-93	None
Visual Color, unwashed area	ASTM D1729-96	Slightly darker

[a)] Surface resistance is given in Ω/sq and the corresponding conductance in Siemens (S or Ω-1)

[b)] Tested using HVLP spray gun application on acrylonitrile butadiene styrene (ABS) coupons.

The coating surface resistance and attenuation are plotted in Figures 1 and 2.

Surface Resistance by Coating Thickness

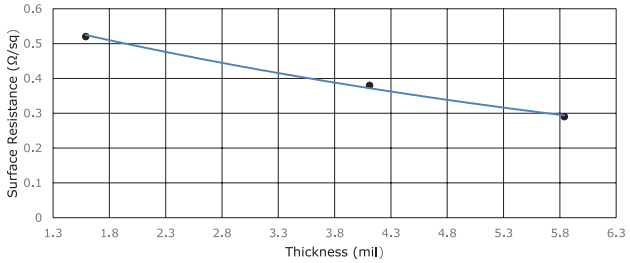

Figure 1. Nickel conductive coating surface resistance at different thicknesses (the dots indicate typical successive coat thicknesses)

Shielding Attenuation

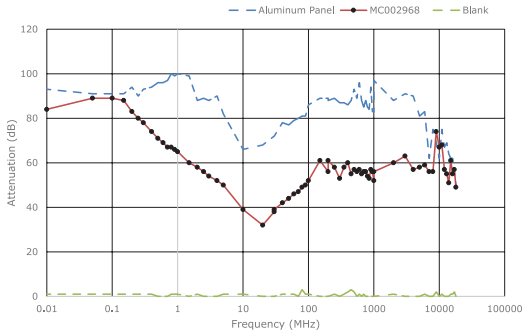

Figure 2. Attenuation of MC002968 coating at different frequencies.

Properties of Uncured MC002968

Physical Properties	Mixture
Colour	Dark Grey
Density @25 °C (77 °F)	1.7 g/mL
Solids Percentage (wt/wt)	57%
Viscosity @25°C (77°F) [a)]	1460 cP (863 mm^2/s)
Flash Point	-17°C (1.4°F)
Odour	Acetone-like

[a)] Brookfield viscometer at 20 RPM with spindle LV S62

Compatibility

Chemical - Nickel has good resistance to oxidation in a variety of corrosive environments, including marine environments. In normal atmosphere or freshwater, nickel typically corrodes less than 0.0025 mm per year. Since nickel forms a passive protective film on its surface that slows down or stops further corrosion, the passive nickel resists corrosion better than pure copper fillers. In addition, nickel is harder than its silver or copper filled counterparts, helping provide greater durability.

The thermoplastic acrylic resin is incompatible common paint solvents like toluene, xylene, acetone, and MEK. Further, it will not withstand chronic exposures to engine oils, fuels and other similar hydrocarbons. While this makes the coating unsuitable for solvent rich environments, it does offers great repair and rework characteristics.

Adhesion - The MC002968 coating adheres to ABS, PBT, and most materials found on 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.

MC002968 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

Substrate	Note
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 MC002968 Nickel 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 1.0 mil (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 MC002968-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 spray procedure 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 2.0 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 23 and 30 cm (9 to 12 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	
Aerosol	232 mL	7.84 fl oz	340 g	12 oz

Part Number Table

Description	Part Number
Nickel Conductive Coating, 232mL, Aerosol	MC002968