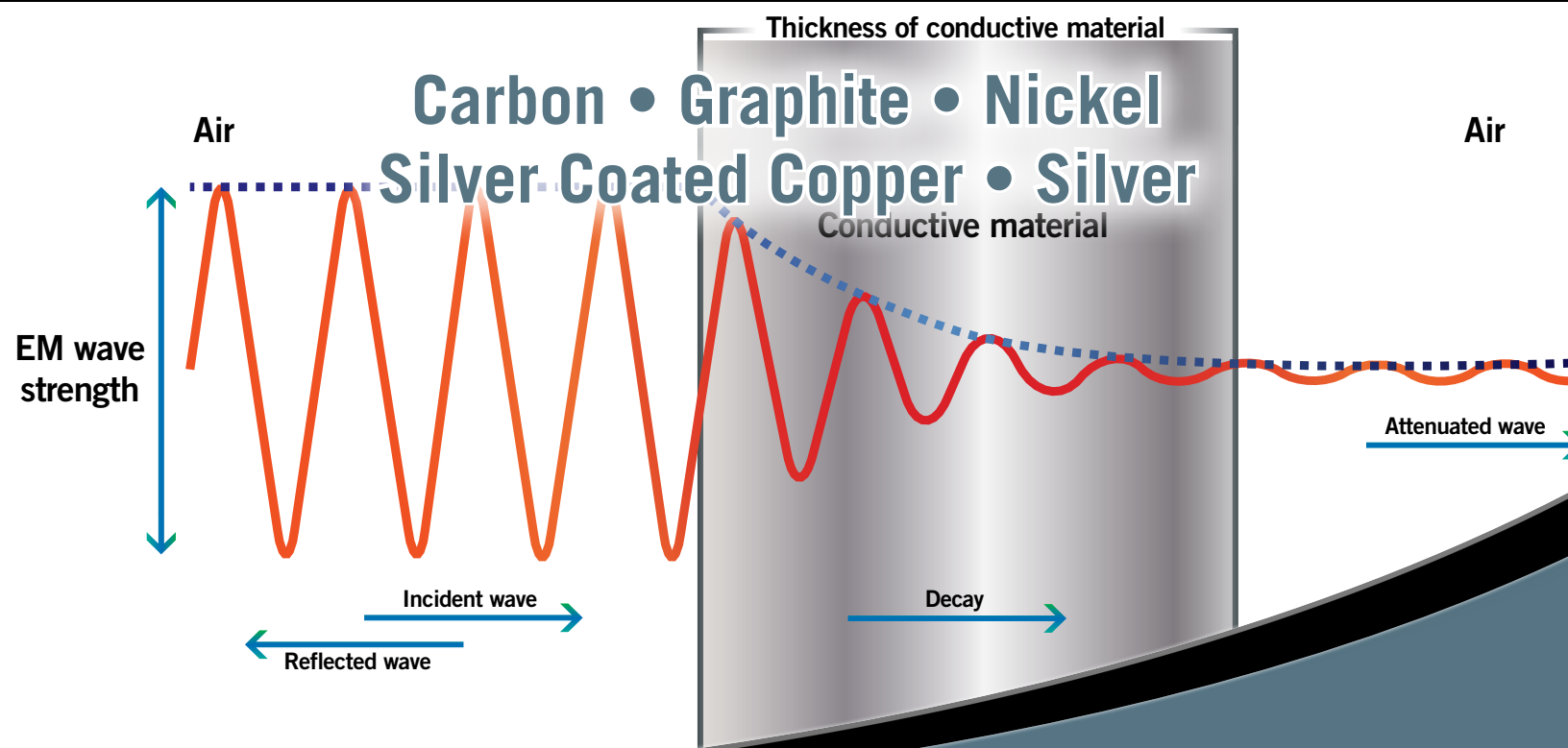


# EMI / RFI SHIELDING

## CONDUCTIVE PAINTS FOR SHIELDING AGAINST EM & RF INTERFERENCE



[mgchemicals.com](http://mgchemicals.com)

**MG Chemicals**

*Serving you since 1955*



## Who is MG Chemicals

M.G. Chemicals is a manufacturer and wholesaler of chemical products for the electronics industry. Our chemical products include dusters and circuit coolers, electronic cleaners, flux removers, contact cleaners, protective coatings, epoxies, adhesives, RTV silicones, lubricants, EMI/RFI shielding coatings, thermal management products, prototyping supplies, solders, and more. We also distribute related non-chemical products, such as wipes, swabs, brushes, desoldering braid, and copper clad boards.



## MG Service

M.G. Chemicals recognizes that setting up a production comes with various challenges. Our service team offers a wide variety of experience in material production, equipment, and technical issues you may encounter during planning, pilot studies, and production runs. To overcome these challenges, we offer professional services.

As a service, MG Chemical can

- Provide advice on equipment and material
- Assist with setup and troubleshooting
- Review your proposed application processes
- Suggest ways of optimizing and customizing processes to best meet your needs
- Offer training on the proper use of the shielding products

## Quality Assurance

Since 1955, M.G. Chemicals has provided the North American electronics industry with a full line of high performance chemicals and accessories. The M.G. Chemicals manufacturing facility operates under the ISO 9001 Quality System Standard. All products undergo M.G. Chemicals' design process including the testing and analysis of each product to maximize performance, user safety, environmental safeguards and market desirability.

## Customer Care

Customer care is what separates M.G. Chemicals from the rest. Our commitment to all of these principles focus on getting you the quality product and support you deserve.

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Application Instructions

Spray Gun Application Instructions

Read the procedure below fully and make necessary adjustments to get the required coat thickness for your needs. Typically, one coat results in a dry film thickness of roughly:

- 1 to 1.5 mil [25 to 38 µm] for our 838AR Graphite Coatings
- 1 to 1.5 mil [25 to 38 µm] for our 841AR Nickel Coating
- 0.75 to 1.25 mil [19 to 32 µm] for our 843AR Silver Coated Copper Coating
- 0.75 to 1.25 mil [25 to 38 µm] for our 842AR Silver Coating

Spray Equipment

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

Initial Setting Recommendations

<b>Air Cap</b>	#3 HPLV		
	Inlet	Air flow	Air cap
<b>Pressure</b>	23 psi	13.5	10 psi
<b>Fluid Tip</b>	1.3 mm	(1.5 mm) <sup>a)</sup>	

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

To apply the required thickness by weight

1. Mix paint thoroughly with a spatula or with mechanized paint mixer.
2. Let down the paint with at a 1:1 (Paint: Thinner) ratio. See *Supporting Products* below.
3. Spray a test pattern. This step ensures good flow quality and helps establish appropriate distance to avoid runs.
4. At a distance of 23 to 30 cm (9 to 12 inches), spray a thin and even coat onto a vertical surface. For best results, use spray-and-release strokes with an even motion to avoid excess paint in one spot. Start and end each stroke off the surface.
5. Wait 2 to 3 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.

Supporting Products

Thinner/Cleaner 4351-1L (for sensitive plastics) or 435-1L (for quick cure on other substrates).

Note

These recommendations are based on a DeVilbiss FinishLine paint gun, and may differ with other brands. Please consult your spray gun manufacturer's guide.

Note

Swirling the paint gun container slightly while waiting prevents settling.

ATTENTION!

- Coats that are applied too thick cause runs and hampers solvent evaporation. Prefer the application of many mist coats rather than fewer thicker wet coats.
- Spraying onto horizontal surfaces is not recommended due to possible uneven settling of metallic filler.

## Application Instructions for Liquid

These coatings can be easily applied by paint brush, spray gun, or dip method.

For best results, apply many thin coats as opposed to using fewer thick coats. We recommend a coat with a dry film thickness of roughly 1.5 mil [33 µm]. Follow the procedure below for ensure optimal conductivity.

Prerequisites:

Clean and dry the surface of the substrate to remove

- Oil, dust, water, solvents, and other contaminants
- Mixing spatula
- Clean paint brush OR HPLV spray gun OR dip tank system
- Thinner/Cleaner solvent
- Personal protection equipment (See Liquid MSDS)

### Note

In all cases, the mixture should be kept slightly agitated during use to avoid premature settling of the solids.

### Disclaimer

This information is believed to be accurate. It is intended for professional end users having the skills to evaluate and use the data properly. M.G. Chemicals Ltd. does not guarantee the accuracy of the data and assumes no liability in connection with damages incurred while using it.

### LIQUID COMPARATIVE CHART

SPECIFICATIONS		843ER EPOXY -AG COATED CU	841WB WATER BASED NICKEL	841AR LIQUID ACRYLIC- NICKEL	843AR READY TO SPRAY- SI COATED CU	842AR LIQUID ACRYLIC- SILVER	838AR LIQUID ACRYLIC- CARBON	842WB WATER BASED SILVER	
Let-Down require or ready to spray		Ready to spray	Ready to spray	Let down (100:50 by vol.)	Ready to spray	Let down (100:50 by vol.)	Let down (100:50 by vol.)	Ready to spray	
Typical Properties									
Density (g/cc3)	MG-MET-140	Part A   Part B 1.196 0.870 Mixed density (1.0292)	1.7631	1.688	1.0917	1.7377	0.8537	1.3368	
Viscosity (25C)	MG-MECH-140	Part A   Part B 35.0   9.0	250±50	1456.8 cP	<30 cP	873.5 cP	153.5 cP	47.6 cP	
Working time (25C)		8 hours @ 25C	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	
Mix ratio:		100 Part A : 28 part B by weight 100 Part A : 36 part B by volume	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	
Recoat time		3-5 minutes	For Brush application: 60 minutes For Spray application: 30 minutes	3-5 minutes	3-5 minutes	3-5 minutes	3-5 minutes	For Brush application: 60 minutes For Spray application: 30 minutes	
Cure Schedule									
Elevated temperature cure		2 hours @ 80C	3 hours @ 65C	30min@65C	30min@65C	30min@65C	30min@65C	3 hours @ 65C	
Ambient temperature cure		24 hours @ 25C	24 hours @ 25C	24 hours @ 25C	24 hours @ 25C	24 hours @ 25C	24 hours @ 25C	24 hours @ 25C	
Service temperature									
Service temperature		-40C to 100C	-40C to 120C	-40C to 120C	-40C to 120C	-40C to 120C	-40C to 120C	-40C to 120C	
Min withstanding temp.		-60C	-45C	-45C	-45C	-45C	-45C	-45C	
Max withstanding temp.		+125C	+125C	+125C	+125C	+125C	+125C	+125C	
Electrical Properties:									
Volume resistivity (Ohm.cm)	MG-ELEC-140	0.0018	0.0121	0.004033	0.0003059	0.0001071	0.3277	0.00009354	
Surface resistivity (Ohm/sq)	MG-ELEC-140	0.234 @ 3.14 mils	0.764 @ 7.8 mils	0.5558 @ 2.83 mil	0.0938 @ 3.27 mil	0.0293 @ 1.377 mil	113.74 @ 1.18 mil	0.0282	
Surface resistance (Ohm/sq)	MG-ELEC-121	0.26 @ 2.2 mils 0.19 @ 4.0 mils Not required	5.0 ohm/sq (Roller brush application- 2 coats) 0.8 ohm/sq (Spray application- 2 coats)	0.52 @ 1.59 mil 0.38 @ 4.11 mil 0.29 @ 5.84 mil	0.071 @ 2.28 mil 0.018 @ 3.95 mil 0.011 @ 5.36	<0.00 for all thicknesses (values are not reported due to negative readings - out of range on multimeter)	168.13 @ 0.97 mil 59.91 @ 1.69 mil 48.4 @ 2.28 mil	<0.00 for all thicknesses (values are not reported due to negative readings - out of range on multimeter)	
Attenuation		TBD	TBD	TBD	TBD	TBD	TBD	TBD	
Mechanical Properties									
Adhesion	MG-MECH-100 ASTM D 3359	5B (ABS)	5B (Dry wall- Brush & Spray application - 2 coats (24 hours @ RT cure)	5B (ABS)	5B (ABS)	5B (ABS)	5B (ABS)	5B (dry wall)	

# Total Ground™ Carbon Conductive Coating



ENVIRONMENT  
Meets RoHS directive

The 838AR Total Ground Carbon Conductive Coating is an economical acrylic paint that is used to create conductive, static free surfaces. Coated surfaces also serve to reduce electromagnetic or radio frequency interference (EMI/RFI) to some degree. The durable acrylic resin affords long-term protection that minimizes loss of carbon through rubbing. The cured coat withstands large temperature changes and marine environmental conditions without cracking, which makes it suitable for a wide range of application.

### Applications & Usages:

Its primary applications are to ground working surfaces and to avoid static, but it can also be used to provide low cost EMI/RFI shielding, as a conductive base for some electroplating process, or anywhere in a manufacturing process where it is necessary to impart conductivity to a surface.

### Benefits and Features

- Conductive Material Classification—Low Surface resistivity of 114 Ω/sq for one coat (~1 mil)
- Tough and durable coating with excellent weatherability
- Repairable and removable thermoplastic paint system
- Stronger adhesion than water based coatings
- Corrosion-proof coat—slows or prevents substrate oxidation
- Rub off resistant

### Important Usage Info for 838AR Aerosol

Do not use on thin plastics or on plastics where you want to keep original surface intact. The 838 spray contains solvents is designed to chemically etch plastic surfaces to help adhesion by melting the acrylic coating into the plastic substrate. This prevents flaking or peeling.

### CURING & WORK SCHEDULE

Properties	Value
Dry to Touch (liquid) <sup>a)</sup>	3 to 5 min
Recoat time (liquid) <sup>a)</sup>	5 min
Full Cure @25 °C [77 °F]	24 h
Full Cure @65 °C [149 °F]	30 min
Shelf Life	3 y
Storage Temperature Limits <sup>b)</sup>	-5 to +40 °C [+23 to +104°F]

### SERVICE RANGES

Properties	Value
Constant Service Temperature	-40 to +120 °C [-40 to +248 °F]
Maximum Coverage per 1L <sup>c)</sup>	<25 000 cm <sup>2</sup> [<72 ft <sup>2</sup> ]
Maximum Coverage per US gallon <sup>c)</sup>	<114 000 cm <sup>2</sup> [<122 ft <sup>2</sup> ]

a) Assumes let 2:1 let down with MG 4351 Thinner 1 Cleaner Solvent

b) The product must stay within the storage temperature limits stated.

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



## Properties of Cured 838AR (LIQUID)

<i>Electric &amp; Magnetic Properties</i>	<i>Method</i>	<i>Value</i>
Volume Resistivity	Method 5011.5 in MIL-STD-883H	0.33Ω·cm      3.1 S/cm
Surface Resistance		<i>Resistance</i> <sup>a)</sup> <i>Conductance</i> <sup>a)</sup>
: 1 × coat @ 0.97 mil	Square probe	168 Ω/sq      0.006 S
: 2 × coats @ 1.7 mil	Square probe	60 Ω/sq      0.017 S
: 3 × coats @ 2.3 mil	Square probe	48 Ω/sq      0.021 S
Magnetic Class		Diamagnetic (Non-magnetic)
Relative Permeability		<1.0
Shielding Attenuation for 33 μm [1.0 mil]	IEEE STD 299-1997	
>10 to 100 kHz	"	84 dB to 88 dB
>100 kHz to 1 MHz	"	52 dB to 74 dB
>1 MHz to 10 MHz	"	14 dB to 46 dB
>10 MHz to 100 MHz	"	0 dB to 6 dB
>100 MHz to 1 GHz	"	6 dB to 14 dB
>1 GHz to 10 GHz	"	5 dB to 11 dB
>10 GHz to 18 GHz	"	6 dB to 12 dB
<i>Physical Properties</i>	<i>Method</i>	<i>Value</i>
Paint Type	—	Lacquer (Thermoplastic)
Color	Visual	Dark Grey
Abrasion Resistant	—	Yes
Blister Resistant	—	Yes
Peeling Resistant	—	Yes
Water Resistant	—	Yes
<i>Mechanical Properties</i>	<i>Method</i>	<i>Value</i>
Adhesion <sup>b)</sup>	ASTM D3359	5B
Pencil Hardness	ASTM D3363	2H, hard

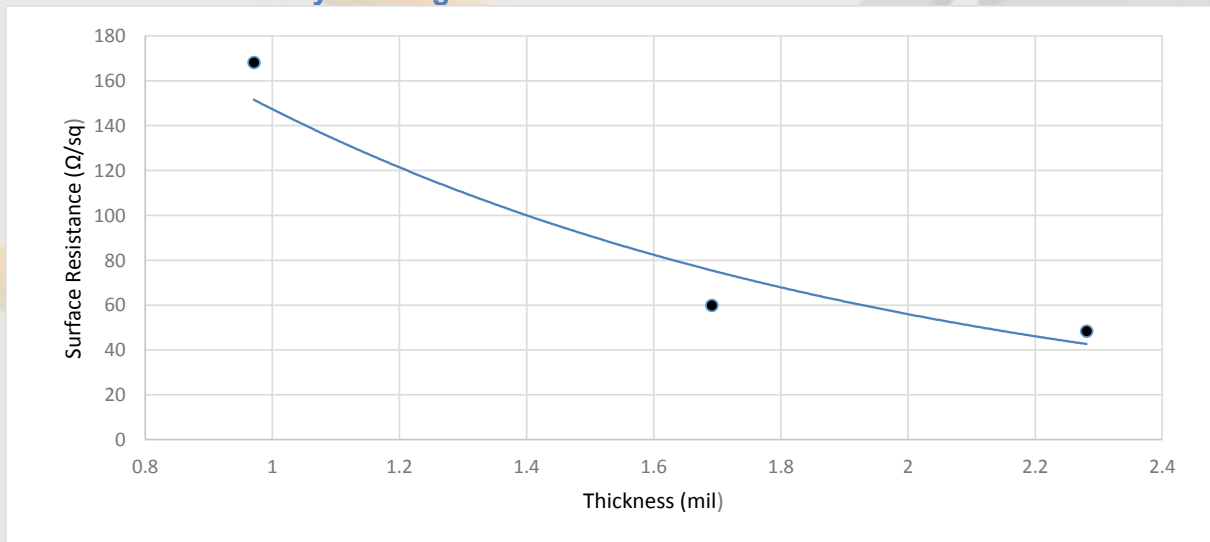
a) Surface resistance is given in Ω/sq and the corresponding conductance in Siemens (S or Ω<sup>-1</sup>)

b) Tested on acrylonitrile butadiene styrene (ABS) material

<i>Environmental &amp; Ageing Study</i>	<i>Method</i>	<i>Value</i>
Salt Spray Test: 7 day @35 °C +Salt/Fog	ASTM B117-2011	TBD
Cross-Hatch Adhesion	ASTM D3359-2009	"
Cracking, unwashed area	ASTM D661-93	"
Visual Color, unwashed area	ASTM D1729-96	"
Peeling, unwashed area	ASTM D1729-96	"

Note: The first coat thickness is typically around 1.0 mil [25 μm].

### Surface Resistance by Coating Thickness



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

## Properties of Uncured 838AR

<i>Physical Property</i>	<i>Mixture</i>
Color	Dark Grey
Density @25 °C [77 °F]	0.85 g/mL
Solids Percentage (wt/wt) <sup>a)</sup>	TBD
Viscosity @25 °C [77 °F] <sup>b)</sup>	154 cP [180 mm <sup>2</sup> /s]
Flash Point	-17 °C [1.4 °F]
Odor	Ethereal

a) Percentage for liquid only (without propellant)

b) Brookfield viscometer at 100 RPM with spindle LV1

### Compatibility

**Chemical**—Carbon doesn't oxidize or deteriorate under a normal environment and conditions, including marine environments as seen by the salt spray test results (see page 2).

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 offer great repair and rework characteristics.

**Adhesion**—The 838AR coating adheres to most materials 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.

### 838AR Adherence Compatibility

<i>Substrate</i>	<i>Note</i>
Acrylonitrile Butadiene Styrene (ABS)	Chemically etches <sup>a)</sup> and adheres well to this substrate.
Polybutylene Terephthalate (PBT)	"
Polycarbonate	"
Polyvinyl Acetate (PVA)	"
Acrylics or Acrylic Paints	Adheres well to clean surface
Copper, Lead, Tin	"
Epoxy, FR4 substrate	"
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.

### Storage

Store between -5 °C and 40 °C [23°F and 104 °F] in dry area.

PACKAGING AND SUPPORTING PRODUCTS						
<i>Cat. No.</i>	<i>Form</i>	<i>Net Volume</i>		<i>Net Weight</i>		<i>Shipping Weight</i>
838AR-15ML	Liquid	15 mL	0.5 fl oz	12g	0.4 oz	TBD
838AR-150ML	Liquid	150 mL	5.0 fl oz	0.12 kg	4.11 oz	TBD
838AR-900ML	Liquid	900 mL	30 fl oz	0.76 kg	2.7 oz	TBD
838AR-3.78L	Liquid	3.60 L	121 fl oz	3.0 kg	98 oz	TBD

### Thinners & Conductive Coating Removers

\* Available in ready to spray 12 oz aerosol can

- Thinner: Cat. No. 435-1L, 435-4L
- Thinner 1: Cat. No. 4351-1L, 4351-4L



## Super Shield™ Nickel Conductive Coating



### ENVIRONMENT

RoHS Compliant  
Low-VOC

### Benefits and Features

- Provides effective EMI/RFI shielding over a broad frequency range
- Low volume resistivity of  $0.0040 \Omega \cdot \text{cm}$
- Durable and abrasion resistant
- Quick dry time, no heat cure required, easy to apply
- Mild solvent system, safe on polystyrenes
- Strong adhesion to acrylic, ABS, polycarbonate, and other injection molded plastics
- Corrosion resistant
- Low VOC; HAP Free; Does not contain toluene, xylene, or MEK

The 841AR Super Shield™ Nickel Conductive Coating protects electronic devices in plastic enclosures from electromagnetic and radio frequency interference (EMI/RFI). This easy-to-use, one-part, solvent-based system can be air-cured at room temperature. The cured coating is a durable acrylic lacquer pigmented with a high purity nickel flake. It offers excellent conductivity, strong adhesion to plastics, great corrosion resistance, and it has a wide variety of applications.

### Applications & Usages

The 841AR is designed to provide a conductive surface within plastic electronic enclosures. It suppresses EMI/RFI emissions and protects the device from external EMI/RFI, allowing compliance to FCC rules and preventing possible malfunctions. It may also be used to shield different circuits or components within a device from each other (crosstalk suppression).

The 841AR 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
- 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 841AR include:

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

841AR adheres well to wood, copper, aluminum, and many other surfaces beyond just plastics.

### CURING & WORK SCHEDULE

Properties	Value
Dry to Touch (liquid) <sup>a)</sup>	3 to 5 min
Recoat time (liquid) <sup>a)</sup>	5 min
Full Cure @25 °C [77 °F]	24 h
Full Cure @65 °C [149 °F]	30 min
Shelf Life	3 y
Storage Temperature Limits <sup>b)</sup>	-5 to +40 °C [+23 to +104°F]

### SERVICE RANGES

Properties	Value
Constant Service Temperature	-40 to +120 °C
	[-40 to +248 °F]
Maximum Coverage per 1L <sup>c)</sup>	<29 000 cm <sup>2</sup> [32 ft <sup>2</sup> ]
Maximum Coverage per US gallon <sup>c)</sup>	<57 000 cm <sup>2</sup> [<61 ft <sup>2</sup> ]

## Properties of Cured 841AR

<b>Electric &amp; Magnetic Properties</b>	<b>Method</b>	<b>Value</b>
Volume Resistivity	Method 5011.5 in MIL-STD-883H	0.0040 $\Omega \cdot \text{cm}$ 250 S/cm
Surface Resistance		<i>Resistance</i> <sup>a)</sup> <i>Conductance</i> <sup>a)</sup>
1 × coat @ 1.6 mil	Square probe	0.52 $\Omega/\text{sq}$ 1.9 S
2 × coats @ 4.0 mil	Square probe	0.38 $\Omega/\text{sq}$ 2.6 S
3 × coats @ 5.8 mil	Square probe	0.29 $\Omega/\text{sq}$ 3.4 S
Magnetic Class		Ferromagnetic
Relative Permeability		$\geq 100$
Shielding Attenuation for 33 $\mu\text{m}$ [1.0 mil]	IEEE STD 299-1997	
>10 to 100 kHz	"	84 dB to 89 dB
>100 kHz to 1 MHz	"	65 dB to 88 dB
>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
<b>Physical Properties</b>	<b>Method</b>	<b>Value</b>
Paint Type	—	Lacquer (Thermoplastic)
Color	Visual	Dark grey
Abrasion Resistant	—	Yes
Blister Resistant	—	Yes
Peeling Resistant	—	Yes
Water Resistant	—	Yes
<b>Mechanical Properties</b>	<b>Method</b>	<b>Value</b>
Adhesion <sup>b)</sup>	ASTM D3359	5B
Pencil Hardness	ASTM D3363	HB, soft

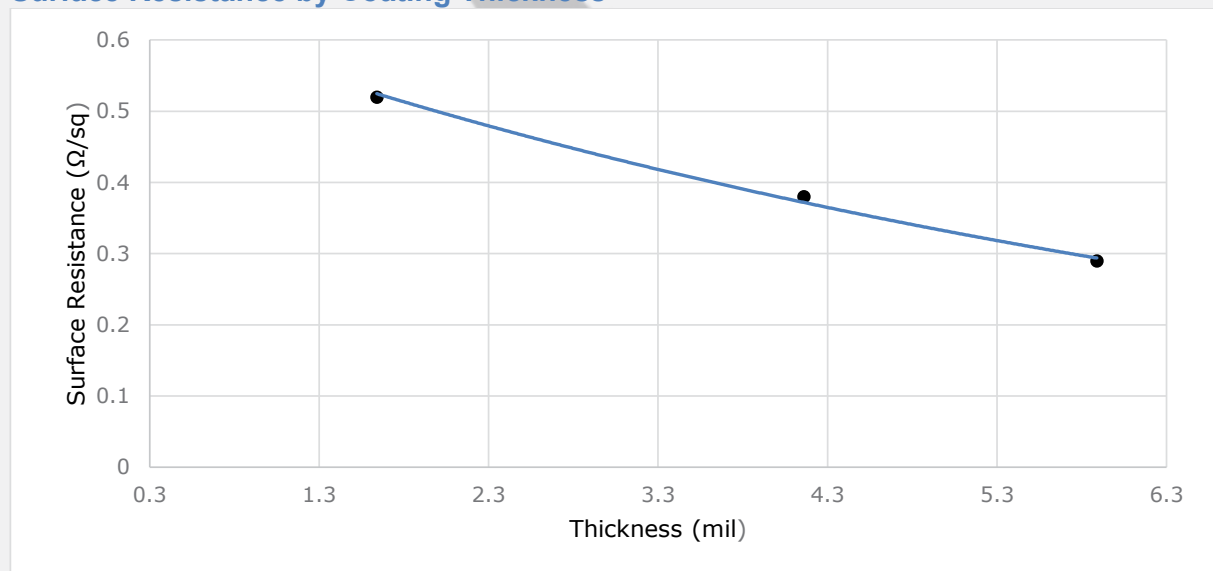
a) Surface resistance is given in  $\Omega/\text{sq}$  and the corresponding conductance in Siemens (S or  $\Omega^{-1}$ )

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

<b>Environmental &amp; Ageing Study</b>	<b>Method</b>	<b>Value</b>
Salt Spray Test: 7 day @35 °C +Salt/Fog	ASTM B117-2011	TBD
Cross-Hatch Adhesion	ASTM D3359-2009	"
Cracking, unwashed area	ASTM D661-93	"
Visual Color, unwashed area	ASTM D1729-96	"
Peeling, unwashed area	ASTM D1729-96	"

Note: The first coat thickness is typically around 2.0 mil [50  $\mu\text{m}$ ].

### Surface Resistance by Coating Thickness



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

<i>Physical Property</i>	<i>Mixture</i>
Color	Dark grey
Density @25 °C [77 °F]	1.7 g/mL
Solids Percentage (wt/wt) <sup>a)</sup>	57%
Viscosity @25 °C [77 °F] <sup>b)</sup>	1460 cP [863 mm <sup>2</sup> /s]
Flash Point	-17 °C [1.4 °F]
Odor	Acetone-like

a) Percentage for liquid only (without propellant)

b) Brookfield viscometer at 20 RPM with spindle LV2

## 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 841AR 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.

## 841AR Adherence Compatibility

<i>Substrate</i>	<i>Note</i>
Acrylonitrile Butadiene Styrene (ABS)	Chemically etches <sup>a)</sup> and adheres well to this substrate.
Polybutylene Terephthalate (PBT)	"
Polycarbonate	"
Polyvinyl Acetate (PVA)	"
Acrylics or Acrylic Paints	Adheres well to clean surface
Copper, Lead, Tin	"
Epoxy, FR4 substrate	"
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.

## Storage

Store between -5 °C and 40 °C [23°F and 104 °F] in dry area.

PACKAGING AND SUPPORTING PRODUCTS						
<i>Cat. No.</i>	<i>Form</i>	<i>Net Volume</i>		<i>Net Weight</i>		<i>Shipping Weight</i>
841AR-15ML	Liquid	15 mL	0.5 fl oz	25g	0.8 oz	TBD
841AR-150ML	Liquid	150 mL	5.0 fl oz	253 kg	8 oz	TBD
841AR-900ML	Liquid	900 mL	30 fl oz	1.5 kg	3.3 oz	TBD
841AR-3.78L	Liquid	3.60 L	121 fl oz	6.0 kg	13 oz	TBD

## Thinners & Conductive Coating Removers

\* Available in ready to spray 12 oz aerosol can

- Thinner: Cat. No. 435-1L, 435-4L
- Thinner 1: Cat. No. 4351-1L, 4351-4L



# Super Shield™ Silver Coated Copper Conductive Coating



ENVIRONMENT  
Meets RoHS directive

## Benefits and Features

- Provides effective EMI/RFI shielding over a broad frequency range
- Low volume resistivity of 0.0040 Ω·cm
- Durable and abrasion resistant
- Quick dry time, no heat cure required, easy to apply
- Mild solvent system, safe on polystyrenes
- Strong adhesion to acrylic, ABS, polycarbonate, and other injection molded plastics
- Corrosion resistant
- Low VOC; HAP Free; Does not contain toluene, xylene, or MEK

a) The product must stay within the storage temperature limits stated.

b) Idealized estimate based on a coat thickness of 2.0 mil [50 µm] and 65% transfer efficiency

The 843AR Super Shield™ Silver Coated Copper Conductive Coating protects electronic devices in plastic enclosures from electromagnetic and radio frequency interference (EMI/RFI). This easy-to-use, ready-to-spray, solvent-based system can be air-cured at room temperature. The cured coating is a durable acrylic lacquer pigmented with high-purity silvered copper flake. It offers effective shielding attenuation with only one coat. It further offers excellent conductivity and strong adhesion to plastics; and it has a wide variety of applications.

## Applications & Usages

The 843AR is designed to provide a very conductive surface within plastic electronic enclosures. It strongly suppresses EMI/RFI emissions and protects devices from external EMI/RFI, allowing compliance to FCC rules and preventing possible malfunctions. It may also be used to diminish crosstalk by shielding different circuits or device components from one another.

The 843AR 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
- 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 841AR include:

- Repairing damage to existing shielding
- Conductive undercoat for electroplating
- Providing electric continuity for circuits
- Anti-static protection
- Grounding

841AR adheres well to wood, copper, aluminum, and many other surfaces beyond just plastics.

## CURING & WORK SCHEDULE

Properties	Value
Dry to Touch (liquid)	3 to 5 min
Recoat time (liquid)	5 min
Full Cure @25 °C [77 °F]	24 h
Full Cure @65 °C [149 °F]	30 min
Shelf Life	3 y
Storage Temperature Limits <sup>a)</sup>	-5 to +40 °C [+23 to +104°F]

## SERVICE RANGES

Properties	Value
Constant Service Temperature	-40 to +120 °C
Maximum Coverage per 1L <sup>b)</sup>	<15 000 cm <sup>2</sup> [<16ft <sup>2</sup> ]
Maximum Coverage per US gallon <sup>b)</sup>	<57 000 cm <sup>2</sup> [<61 ft <sup>2</sup> ]

## Properties of Cured 843AR

<b>Electric &amp; Magnetic Properties</b>	<b>Method</b>	<b>Value</b>
Volume Resistivity	Method 5011.5 in MIL-STD-883H	0.00030 $\Omega \cdot \text{cm}$ 3300 S/cm
Surface Resistance		<i>Resistance</i> <sup>a)</sup> <i>Conductance</i> <sup>a)</sup>
: 1 × coat @ 2.3 mil	Square probe	0.071 $\Omega/\text{sq}$ 14 S
: 2 × coats @ 4.0 mil	Square probe	0.018 $\Omega/\text{sq}$ 55 S
: 3 × coats @ 5.4 mil	Square probe	0.011 $\Omega/\text{sq}$ 91 S
Magnetic Class		Diamagnetic (Non-magnetic)
Relative Permeability		<1.0
Shielding Attenuation for 33 $\mu\text{m}$ [1.0 mil]	IEEE STD 299-1997	
>10 to 100 kHz	"	84 dB to 89 dB
>100 kHz to 1 MHz	"	73 dB to 89 dB
>1 MHz to 10 MHz	"	47 dB to 70 dB
>10 MHz to 100 MHz	"	41 dB to 60 dB
>100 MHz to 1 GHz	"	59 dB to 71 dB
>1 GHz to 10 GHz	"	58 dB to 67 dB
>10 GHz to 18 GHz	"	48 dB to 68 dB
<b>Physical Properties</b>	<b>Method</b>	<b>Value</b>
Paint Type	—	Lacquer (Thermoplastic)
Color	Visual	Light metallic brown
Abrasion Resistant	—	Yes
Blister Resistant	—	Yes
Peeling Resistant	—	Yes
Water Resistant	—	Yes
<b>Mechanical Properties</b>	<b>Method</b>	<b>Value</b>
Adhesion <sup>b)</sup>	ASTM D3359	5B
Pencil Hardness	ASTM D3363	TBD

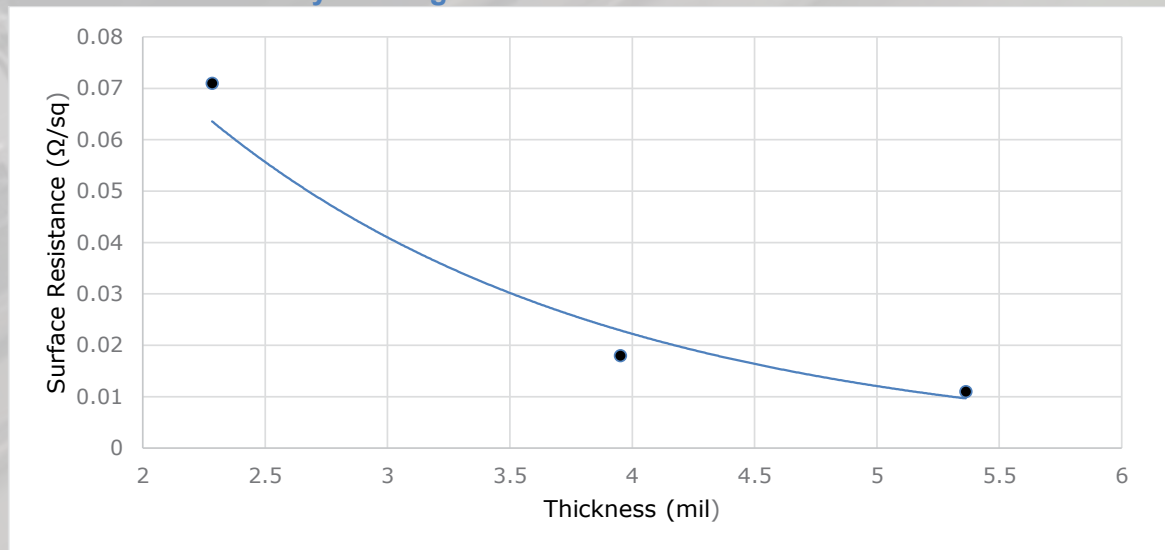
a) Surface resistance is given in  $\Omega/\text{sq}$  and the corresponding conductance in Siemens (S or  $\Omega^{-1}$ )

b) Tested on acrylonitrile butadiene styrene (ABS) material

<b>Environmental &amp; Ageing Study</b>	<b>Method</b>	<b>Value</b>
Salt Spray Test: 7 day @35 °C +Salt/Fog	ASTM B117-2011	TBD
Cross-Hatch Adhesion	ASTM D3359-2009	"
Cracking, unwashed area	ASTM D661-93	"
Visual Color, unwashed area	ASTM D1729-96	"
Peeling, unwashed area	ASTM D1729-96	"

Note: The first coat thickness is typically around 2.0 mil [50  $\mu\text{m}$ ].

### Surface Resistance by Coating Thickness



**Figure 1.** Silvered copper coating surface resistance at different thicknesses (the dots indicate typical successive coat thicknesses)



## Properties of Uncured 843AR

<i>Physical Property</i>	<i>Mixture</i>
Color	Light metallic brown
Density @25 °C [77 °F]	1.1 g/mL
Solids Percentage (wt/wt)	31%
Viscosity @25 °C [77 °F]	<30 cP
Flash Point	-17 °C [1.4 °F]
Odor	Sweetish

### Compatibility

**Chemical**—The silver coated copper is quite resistant to oxidation, except in environments that contain contaminants like H<sub>2</sub>S or ozone which tarnish its surface.

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 843AR 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.

### 843AR Adherence Compatibility

<i>Substrate</i>	<i>Note</i>
Acrylonitrile Butadiene Styrene (ABS)	Chemically etches <sup>a)</sup> and adheres well to this substrate.
Polybutylene Terephthalate (PBT)	"
Polycarbonate	"
Polyvinyl Acetate (PVA)	"
Acrylics or Acrylic Paints	Adheres well to clean surface
Copper, Lead, Tin	"
Epoxy, FR4 substrate	"
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.

### Storage

Store between -5 °C and 40 °C [23°F and 104 °F] in dry area.

PACKAGING AND SUPPORTING PRODUCTS						
<i>Cat. No.</i>	<i>Form</i>	<i>Net Volume</i>		<i>Net Weight</i>		<i>Shipping Weight</i>
843AR-900ML	Liquid	0.9 L	30 fl oz	0.9 kg	2.1 lb	TBD
843AR-3.78L	Liquid	3.60 L	121 fl oz	3.9 kg	8.6 lb	TBD

\* Available in ready to spray 12 oz aerosol can

### Thinners & Conductive Coating Removers

- Thinner: Cat. No. 435-1L, 435-4L
- Thinner 1: Cat. No. 4351-1L, 4351-4L



## Super Shield™ Silver Conductive Coating



### Benefits and Features



- Provides extremely effective EMI/RFI shielding over a broad frequency range
- Extremely low volume resistivity of  $7.6 \times 10^{-5} \Omega \cdot \text{cm}$
- Durable and abrasion resistant
- Can be applied at less than 1 mil
- Quick dry time, no heat cure required, easy to apply
- Mild solvent system, safe on polystyrenes
- Strong adhesion to acrylic, ABS, polycarbonate, and other injection molded plastics
- Oxidation resistant
- Non-magnetic
- Low VOC; HAP Free; Does not contain toluene, xylene, or MEK

a) Assumes let 2:1 let down with MG 4351 Thinner 1 Cleaner Solvent

b) The product must stay within the storage temperature limits stated.

c) Idealized estimate based on a coat thickness of  $25 \mu\text{m}$  [1.0 mil] and 65% transfer efficiency

The 842AR Super Shield™ Silver Conductive Coating is a highly conductive coating that protects electronic devices in plastic enclosures from high frequency electromagnetic and radio frequency interference (EMI/RFI). The cured coating is a durable acrylic lacquer pigmented with a high-purity silver flake. This one-part, easy-to-use, solvent-based system can be air-cured at room temperature. It offers excellent conductivity, strong adhesion to plastics, great oxidation resistance; and it has a wide variety of applications.

### Applications & Usages

The 842AR is designed to provide a highly conductive surface within plastic electronic enclosures. It suppresses internal high frequency EMI/RFI emissions and protects the device from external EMI/RFI, allowing compliance to FCC rules and preventing possible malfunction.

Silver offers the strongest EMI/RFI suppression in MG's conductive coating line—especially at higher frequencies. Because it can be applied thinly without losing shielding, it can be used to diminish crosstalk between components in compact devices. It is our best conductive-coating filler for short range EMI applications, such as board level or component to component applications. It is also optimal for military, medical, or other mission critical applications, where the highest levels of attenuation are essential.

The 842AR 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 842AR include:

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

842AR adheres well to wood, copper, aluminum, and many other non-plastics. It is a simple and effective solution to many applications where it is necessary to impart maximum conductivity to a surface.

### CURING & WORK SCHEDULE

Properties	Value
Dry to Touch (liquid) <sup>a)</sup>	3 to 5 min
Recoat time (liquid) <sup>a)</sup>	5 min
Full Cure @25 °C [77 °F]	24 h
Full Cure @65 °C [149 °F]	30 min
Shelf Life	3 y
Storage Temperature Limits <sup>b)</sup>	-5 to +40 °C [+23 to +104°F]

### SERVICE RANGES

Properties	Value
Constant Service Temperature	-40 to +120 °C
Maximum Coverage per 1L <sup>c)</sup>	<59 000 cm <sup>2</sup> [64 ft <sup>2</sup> ]
Maximum Coverage per US gallon <sup>c)</sup>	<114 000 cm <sup>2</sup> [<122 ft <sup>2</sup> ]

## Properties of Cured 842AR

<i>Electric &amp; Magnetic Properties</i>	<i>Method</i>	<i>Value</i>
Volume Resistivity	Method 5011.5 in MIL-STD-883H	$1.07 \times 10^{-4} \Omega \cdot \text{cm}$ 9337 S/cm
Surface Resistance		<i>Resistance</i> <sup>a)</sup>
1 × coat	Square probe	N/A
2 × coats	Square probe	N/A
3 × coats	Square probe	N/A
Magnetic Class		Diamagnetic (Non-magnetic)
Relative Permeability		<1.0
Shielding Attenuation for 33 μm [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
<i>Physical Properties</i>	<i>Method</i>	<i>Value</i>
Paint Type	—	Lacquer (Thermoplastic)
Color	Visual	Metallic Silver Grey
Abrasion Resistant	—	Yes
Blister Resistant	—	Yes
Peeling Resistant	—	Yes
Water Resistant	—	Yes
<i>Mechanical Properties</i>	<i>Method</i>	<i>Value</i>
Adhesion <sup>b)</sup>	ASTM D3359	5B
Pencil Hardness	ASTM D3363	H, Hard

a) Due to the sensitivity of the handheld multimeter, readings less than  $0.01 \Omega \cdot \text{cm}$  are not reportable

b) Tested on acrylonitrile butadiene styrene (ABS) material

<i>Environmental &amp; Ageing Study</i>	<i>Method</i>	<i>Value</i>
Salt Spray Test: 7 day @35 °C +Salt/Fog	ASTM B117-2011	TBD
Cross-Hatch Adhesion	ASTM D3359-2009	"
Cracking, unwashed area	ASTM D661-93	"
Visual Color, unwashed area	ASTM D1729-96	"
Peeling, unwashed area	ASTM D1729-96	"

Note: The first coat thickness is typically around 1.0 mil [25 μm].

## Properties of Uncured 842AR

<i>Physical Property</i>	<i>Mixture</i>
Color	Metallic Silver
Density @25 °C [77 °F]	1.7 g/mL
Solids Percentage (wt/wt) <sup>a)</sup>	61%
Viscosity @25 °C [77 °F] <sup>b)</sup>	873 cP [503 mm <sup>2</sup> /s]
Flash Point	-17 °C [1.4 °F]
Odor	Acetone-like

a) Percentage for liquid only (without propellant)

b) Brookfield viscometer at 30 RPM with spindle LV2

## Compatibility

**Chemical**—The silver filler is quite resistant to oxidation, except in environments that contain contaminants like H<sub>2</sub>S 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 842AR 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.

### 842AR Adherence Compatibility

Substrate	Note
Acrylonitrile Butadiene Styrene (ABS)	Chemically etches <sup>a)</sup> and adheres well to this substrate.
Polybutylene Terephthalate (PBT)	"
Polycarbonate	"
Polyvinyl Acetate (PVA)	"
Acrylics or Acrylic Paints	Adheres well to clean surface
Copper, Lead, Tin	"
Epoxy, FR4 substrate	"
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.

## Storage

Store between -5 °C and 40 °C [23°F and 104 °F] in dry area.

PACKAGING AND SUPPORTING PRODUCTS						
Cat. No.	Form	Net Volume		Net Weight		Shipping Weight
842AR-15ML	Liquid	15 mL	0.5 fl oz	26 g	0.8 oz	TBD
842AR-150ML	Liquid	150 mL	5.0 fl oz	260 g	8.3 oz	TBD
842AR-900ML	Liquid	900 mL	30 fl oz	1.5 kg	3.4 oz	TBD
842AR-3.78L	Liquid	3.60 L	121 fl oz	6.2 kg	13 oz	TBD

## Thinners & Conductive Coating Removers

\* Available in ready to spray 12 oz aerosol can

- Thinner: Cat. No. 435-1L, 435-4L
- Thinner 1: Cat. No. 4351-1L, 4351-4L



# Super Shield™ Water Based Nickel Conductive Coating



## ENVIRONMENT

RoHS Compliant  
Low-VOC

## Important Usage Info for 841 Water Base

Do NOT freeze. The product gels  
irreversibly below 0 °C [32 °F]

The 841WB Super Shield™ Water Based Nickel Conductive Coating is a conductive paint designed to reduce electromagnetic or radio frequency interference (EMI/RFI) in architectural and electronic applications. It is a one-part, easy-to-use, ready-to-spray coating that combines a durable water-based urethane binder with high-purity nickel flakes to provide long-term protection.

## Applications & Usages:

Water-based conductive paints are the only choice for architectural RFI shielding because regulations promote products with higher safety and prohibit the use of high VOC solvent systems in architectural coatings. Large applications of water-based paints are less hazardous than their solvent-based counterparts since they don't emit large quantities of solvent vapors that can lead to fire, smog, and health hazards. Because they are less hazardous than solvent-based systems, water based paints often can be shipped as non-dangerous goods. Lastly, the water-based paints like the 841WB offer great performance and shielding characteristics for uses in electronic devices, homes, and buildings.

The 841WB shielding paint bonds well to drywall and can easily be painted over with regular architectural paints. The cured coating is tough, durable, and provides effective shielding. Typical applications include containing internal RFI interferences within a room, such as an engine room, to avoid creating EMI/RFI noise in nearby rooms and external areas. It also protects rooms containing sensitive electronic equipment—such as server rooms, laboratories, and surgical rooms—from external interference sources, which is especially important if there is a strong noise source nearby, such as a cell phone or radio tower.

At an electronic device level, the 841WB can be used instead of solvent-based shielding paints. For example, it can provide EMI/RFI shielding for electronic enclosures used in sensors, test equipment, portable controllers, and communication devices. Unlike the more aggressive solvent-based systems, it is safe-to-use even on the most delicate plastic enclosures. Where greater work safety and comfort are desired, the 841WB reduces or eliminates strong workplace odors and high flammable vapor levels.

It is also good for trace repair and home electronics hobbies.

## Benefits and Features

- Provides effective EMI/RFI shielding over a broad range of frequencies
- Can be applied by spray gun, roller, or brush
- One-part, ready-to-use system—no dilution required
- Excellent adhesion to drywall and plastics
- Can be painted over with common architectural paints
- Safe on the most delicate plastics
- Good environmental resistance
- Non-flammable
- Low toxicity
- No noxious odor
- Ships as Non-DG by Air
- Cures at room temperature
- Low Regulated VOC content of 59.6 g/L

**CURING & WORK SCHEDULE**

<b>Properties</b>	<b>Value</b>
Dry to Touch (liquid)	30 min
Recoat time (brush)	1 h
Recoat time (spray)	30 min
Full Cure (at room temp.)	24 h
Full Cure (at 65 °C)	3 h
Shelf Life	To be determined
Storage Temperature Limits	5 to +40 °C [+41 to +104°F]

**SERVICE RANGES**

<b>Properties</b>	<b>Value</b>
Constant Service	-40 to +120 °C
Temperature	[-40 to +248 °F]
Maximum Coverage per 1L <sup>d)</sup>	<52 000 cm <sup>2</sup> [<56ft <sup>2</sup> ]
Maximum Coverage per US gallon <sup>d)</sup>	<198 000 cm <sup>2</sup> [<213 ft <sup>2</sup> ]

a) Assumes no let down was performed.

b) Idealized estimate based on a coat thickness of 51 µm [2.0 mil] and 100% transfer efficiency.

**Properties of Cured 841WB**

<b>Electric Properties</b>	<b>Method</b>	<b>Value</b>
Volume Resistivity	Method 5011.5 in MIL-STD-883H	<i>Resistance</i> <sup>a)</sup> <i>Conductance</i> <sup>a)</sup> 0.012 Ω•cm 82 S/cm
Surface Resistivity @7.8 mil	Calculated	≤0.76 Ω/sq 1.3 S
Magnetic Class		Ferromagnetic (magnetic)
Relative Permeability		≥100
Shielding Attenuation <sup>b)</sup> for 50 µm [2 mil]	IEEE STD 299-1997	
10 to 100 kHz	"	84 dB to 89 dB
>100 kHz to 1 MHz	"	55 dB to 87 dB
>1 MHz to 10 MHz	"	26 dB to 50 dB
>10 MHz to 100 MHz	"	19 dB to 39 dB
>100 MHz to 1 GHz	"	37 dB to 47 dB
>1 GHz to 10 GHz	"	36 dB to 47 dB
>10 GHz to 18 GHz	"	35 dB to 45 dB
<b>Physical Properties</b>	<b>Method</b>	<b>Value</b>
Paint Type	—	Aliphatic polyurethane (Thermoset)
Color	Visual	Grey
Abrasion Resistant	—	Yes
Blister Resistant	—	Yes
Peeling Resistant	—	Yes
Water and Salt Spray Resistant	—	Yes

Note: One coat thickness is typically around 38 µm [1.5 mil]. TBD = To be determined.

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

b) Shield attenuation (with respect to a reference sample without shield isolation) is given for adjacent frequency ranges and provides the minimal and maximal value registered within these ranges.

<b>Environmental &amp; Ageing Study</b>	<b>Method</b>	<b>Value</b>
Salt Spray Test: 7 day @35 °C +Salt/Fog	ASTM B117-2011	TBD
Cross-Hatch Adhesion	ASTM D3359-2009	"
Cracking, unwashed area	ASTM D661-93	"
Visual Color, unwashed area	ASTM D1729-96	"
Peeling, unwashed area	ASTM D1729-96	"

Note: TBD = To be determined.

a) Tested by an external and independent laboratory using four point probe



## Properties of Uncured 841WB

<i>Physical Property</i>	<i>Mixture</i>
Color	Dark grey
Viscosity @25 °C [77 °F] <sup>a)</sup>	250 cP ± 50 cP [0.25 Pa·s ± 0.05 Pa·s]
Density @25 °C [77 °F]	1.76 g/mL
Solids Percentage (wt/wt) <sup>b)</sup>	58%
Flash Point	None
Odor	Musty

a) Brookfield viscometer at 30 RPM with spindle LV4

## 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 841WB coating adheres to typical drywall coatings including latex paints and other water based polyurethanes, and may be painted over with such paints as well.

## Storage

Store between 5 °C and 40 °C [41 °F and 104 °F] in dry area.

## PACKAGING AND SUPPORTING PRODUCTS

<i>Cat. No.</i>	<i>Form</i>	<i>Net Volume</i>		<i>Net Weight</i>		<i>Shipping Weight</i>
841WB-15ML	Liquid	15 mL	0.5 fl oz	26g	0.8 oz	TBD
841WB-150ML	Liquid	150 mL	5.0 fl oz	0.26 kg	0.58 lb	TBD
841WB-900ML	Liquid	0.85 L	28.7 fl oz	1.4 kg	3.3 lb	TBD
841WB-3.78L	Liquid	3.78 L	127 fl oz	6.6 kg	14 oz	TBD

Note: TBD = To be determined.

\* Available in ready to spray 12 oz aerosol can



## Super Shield™ Water Based Silver Conductive Coating



ENVIRONMENT  
RoHS Compliant  
Low-VOC

### Important Usage Info for 842 Water Base

Do NOT freeze. The product gels  
irreversibly below 0 °C [32 °F]

The 842WB Super Shield Water Based Silver Conductive Coating is a highly conductive paint designed to reduce high frequency electromagnetic or radio frequency interference (EMI/RFI) in architectural and electronic applications. It is a one-part, easy-to-use, ready-to-spray coating that combines a durable water-based urethane binder with high purity silver flakes to provide long-term protection.

### Applications & Usages:

Water based conductive paints are the only choice for architectural RFI shielding applications because regulations promote products with higher safety and prohibit the use of high VOC solvent systems in architectural coatings. Large applications of water-based paints are less hazardous than their solvent-based counterparts since they don't emit large quantities of solvent vapors that can lead to fire, smog, and health hazards. Because they are less hazardous than solvent-based systems, water based paints often can be shipped as non-dangerous goods. Lastly, the water-based paints like the 842WB offer great performance and shielding characteristics for uses in electronic devices, homes, and buildings.

The 842WB shielding paint bonds well to drywall and can easily be painted over with regular architectural paints. The cured coating is tough, durable, and provides effective shielding. Typical applications include containing internal RFI interferences within a room, such as an engine room, to avoid creating EMI/RFI noise in nearby rooms and external areas. It also protects rooms containing sensitive electronic equipment—such as server rooms, laboratories, and surgical rooms—from external interference sources, which is especially important if there is a strong noise source nearby, such as a cell phone or radio tower.

At an electronic device level, the 842WB can be used instead of solvent-based shielding paints. Its high conductivity provides excellent protection against intense short range EMI. For example, it can provide EMI/RFI shielding for electronic enclosures used in sensors, test equipment, portable controllers, and communication devices. Unlike the more aggressive solvent-based systems, it is safe-to-use even on the most delicate plastic enclosures. Where greater work safety and comfort are desired, the 842WB reduces or eliminates strong workplace odors and high flammable vapor levels.

It is also good for trace repair, and home electronics hobbies.

### Benefits and Features

- Provides excellent EMI / RFI shielding over a broad range of frequencies
- Can be applied by spray gun, roller, or brush
- One-part, ready-to-use system—no dilution required
- Excellent adhesion to drywall and plastics
- Can be painted over with common architectural paints
- Safe on the most delicate plastics
- Good environmental resistance
- Non-flammable
- Low toxicity and no noxious odor
- Ships as Non-DG by Air
- Cures at room temperature
- Low Regulated VOC of 58.6 g/L

## CURING & WORK SCHEDULE

Properties	Value
Dry to Touch (liquid)	30 min
Recoat time (brush)	1 h
Recoat time (spray)	30 min
Full Cure (at room temp.)	24 h
Full Cure (at 65 °C)	3 h
Shelf Life	To be determined
Storage Temperature Limits	5 to +40 °C [+41 to +104°F]

## SERVICE RANGES

Properties	Value
Constant Service	-40 to +120 °C
Temperature	[-40 to +248 °F]
Maximum Coverage per 1L <sup>c)</sup>	<50 000 cm <sup>2</sup> [<54 ft <sup>2</sup> ]
Maximum Coverage per US gallon <sup>c)</sup>	<190 000 cm <sup>2</sup> [<204 ft <sup>2</sup> ]

a) Assumes no let down was performed.

c) Idealized estimate based on a coat thickness of 51 µm [2.0 mil] and 100% transfer efficiency.

## Properties of Cured 842WB

Electric Properties	Method	Value
Volume Resistivity	Method 5011.5 in MIL-STD-883H	Resistance <sup>a)</sup> 9.35x10 <sup>-5</sup> Ω•cm
Surface Resistivity @ 1 mil	Calculated	Conductance <sup>a)</sup> 10 700 S/cm
Magnetic Class		0.03 Ω/sq
Relative Permeability		33.3 S
Shielding Attenuation <sup>b)</sup> for 50 µm [2 mil]	IEEE STD 299-1997	Diamagnetic (non-magnetic)
10 to 100 kHz	"	<1.0
>100 kHz to 1 MHz	"	84 dB to 89 dB
>1 MHz to 10 MHz	"	73 dB to 89 dB
>10 MHz to 100 MHz	"	49 dB to 69 dB
>100 MHz to 1 GHz	"	42 dB to 62 dB
>1 GHz to 10 GHz	"	60 dB to 70 dB
>10 GHz to 18 GHz	"	57 dB to 67 dB
		47 dB to 68 dB
Physical Properties	Method	Value
Paint Type	—	Aliphatic polyurethane (Thermoset)
Color	Visual	Silver
Abrasion Resistant	—	Yes
Blister Resistant	—	Yes
Peeling Resistant	—	Yes
Water and Salt Spray Resistant	—	Yes
Physical Properties	Method	Value
Adhesion <sup>c)</sup>	ASTM D3359	5B
Pencil Hardness	ASTM D3363	4B, soft

Note: One coat thickness is typically around 38 µm [1.5 mil]. TBD = To be determined.

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

b) Shield attenuation (with respect to a reference sample without shield isolation) is given for adjacent frequency ranges and provides the minimal and maximal value registered within these ranges.

c) Tested on dry wall

Environmental & Ageing Study	Method	Value
Salt Spray Test: 7 day @35 °C +Salt/Fog	ASTM B117-2011	TBD
Cross-Hatch Adhesion	ASTM D3359-2009	"
Cracking, unwashed area	ASTM D661-93	"
Visual Color, unwashed area	ASTM D1729-96	"
Peeling, unwashed area	ASTM D1729-96	"

Note: TBD = To be determined.

a) Tested by an external and independent laboratory using four point probe



## Properties of Uncured 842WB

<i>Physical Property</i>	<i>Mixture</i>
Color	Silver
Viscosity @25 °C [77 °F] <sup>a)</sup>	48 cP [36 mm <sup>2</sup> /s]
Density @25 °C [77 °F]	1.3 g/mL
Solids Percentage (wt/wt)	58%
Flash Point	None
Odor	Musty

a) Brookfield viscometer at 100 RPM with spindle LV1

## Compatibility

**Chemical**—The silver filler is quite resistant to oxidation, except in environments that contain contaminants like H<sub>2</sub>S 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 842WB coating adheres to typical drywall coatings including latex paints and other water based polyurethanes, and may be painted over with such paints as well.

## Storage

Store between 5 °C and 40 °C [41 °F and 104 °F] in dry area.

## PACKAGING AND SUPPORTING PRODUCTS

<i>Cat. No.</i>	<i>Form</i>	<i>Net Volume</i>		<i>Net Weight</i>		<i>Shipping Weight</i>
842WB-15ML	Liquid	15 mL	0.5 fl oz	20 g	0.6 oz	TBD
842WB-150ML	Liquid	150 mL	5.0 fl oz	0.20 kg	0.44 lb	TBD
842WB-900ML	Liquid	0.85 L	28.7 fl oz	1.1 kg	2.5 lb	TBD
842WB-3.78L	Liquid	3.78 L	127 fl oz	5.0 kg	11 oz	TBD

\* Available in ready to spray 12 oz aerosol can



# Super Shield™ Silver Coated Copper Epoxy Conductive Coating

## ENVIRONMENT

RoHS Compliant  
Low-VOC

## Important Usage Info for 843 Epoxy Base

Perform a compatibility test in a representative environment prior to use to determine if other incompatibilities may be present.

## Storage

Store between 16 and 27 °C [60 and 80 °F] in dry area away from sunlight. Prolonged storage or storage at or near freezing temperatures can result in crystallization.

If crystallization occurs, reconstitute the component to its original state by temporarily warming it to 50 to 60 °C [122 to 140 °F]. To ensure full homogeneity, stir thoroughly the warm component, reincorporating all settled material. Re-secure container lid and let cool down before use.

The 843ER Super Shield™ Silver Coated Copper Epoxy Conductive Coating is an extremely durable, highly conductive epoxy paint. It is a cost effective solution for attenuating high frequency EMI/RFI interference in harsh environments. Extremely tough, as well as vibration and abrasion resistant, it adheres strongly to many substrates, including chemically resistant and low surface energy plastics. Intended for extreme environments, it remains highly conductive even after long term exposure to humidity, salt fog, and temperature extremes.

## Applications & Usages:

Its primary application is to provide an affordable, high-frequency EMI/RFI shielding in harsh or mission critical environments. Because of its outstanding shielding properties environmental resistance, 843ER is perfect for controllers, communication devices, man portable sensors, and other electronic equipment which may be exposed to environments such as hot and humid equatorial regions, cold artic regions, ocean air, salt water fog, and environments where the air is corrosive because of acid or other aggressive contaminants. For example, its toughness, adhesion, abrasion resistance, and vibration resistance also make it suitable for mission critical applications in military and transportation applications.

There are many other applications.

- It is also useful for shielding electronics permanently installed in such environments, such as controllers or sensors in engines, chemical plants, farms, ships, and naval installations.
- It may also act as a conductive base for electroplating, grounding, or for any other manufacturing processes where it is necessary to impart conductivity to a surface.
- It is suitable for microwave transmissions applications since the silvered copper powder is non- magnetic, offering a low relative permeability that provides reasonable skin depths.

## Benefits and Features

### Provides excellent EMI / RFI shielding across a broad range of frequencies

- **Very low volume resistivity of 0.0018 Ω cm**
- **Very strong adhesion to plastic, metal, and many other surfaces**
- **Extremely durable; vibration, abrasion, and impact resistant**
- **Will not scratch or flake**
- **Stands up to harsh environments**
- **Resists corrosion, salt fog, and chemicals**

**CURING & WORK SCHEDULE**

<b>Properties</b>	<b>Value</b>
Working Life @23 °C	8 h
Recoat time	3 min
Full Cure @25 °C [77 °F]	24 h
Full Cure @80 °C [176 °F]	2 h
Shelf Life	9 months
Storage Temperature	16 to 27 °C [60 to +80 °F]

**SERVICE RANGES**

<b>Properties</b>	<b>Value</b>
Constant Service	-40 to 100 °C
Temperature	[-40 to 212 °F]
Maximum Intermittent	-60 to 125 °C
Temperature <sup>a)</sup>	[-76 to 257 °F]
Maximum Coverage per	<182 000 cm <sup>2</sup>
US gallon (3.785 L) <sup>b)</sup>	[<196 ft <sup>2</sup> ]

a) The maximum intermittent temperature provides temperature extremes that can be withstood without damage for short periods of time only

b) Idealized estimate based on a coat thickness of 50 µm [2.0 mil] and 100% transfer efficiency.

**Properties of Cured 843ER**

<b>Physical Properties</b>	<b>Method</b>	<b>Value</b>
Color	Visual	Metallic brown
Resin technology		Epoxy
Conductive Filler		Silver coated copper
Density @26 °C	ASTM D 792	1.03 g/cm <sup>3</sup>
Pencil Hardness	ASTM D 3363	6H, Hard
Cross Hatch Adhesion (ABS plastic)	ASTM D 3359	5B
<b>Electric &amp; Magnetic Properties</b>	<b>Method</b>	<b>Value</b>
Volume Resistivity @0.078"	Method 5011.5 in MIL-STD-883H	<i>Resistance</i> 1.80 x 10 <sup>-3</sup> Ω•cm <i>Conductance</i> 556 S/cm
Surface Resistance <sup>a)</sup> @2.2 mil [56 µm]	MG-ELEC-121	0.26 Ω/sq      3.8 S
@4.0 mil [102 µm]	MG-ELEC-121	0.19 Ω/sq      5.3 S
Magnetic class		Diamagnetic (Non-magnetic)
Relative Permeability		<1.0
<b>EMI/RFI Shielding</b>	<b>Method</b>	<b>Value</b>
Shielding Attenuation for 51 µm [2.0 mil]	IEEE STD 299-1997	
10 to 100 kHz	"	84 dB to 89 dB
100 kHz to 1 MHz	"	67 dB to 87 dB
1 MHz to 10 MHz	"	42 dB to 62 dB
10 MHz to 100 MHz	"	34 dB to 54 dB
100 MHz to 1 GHz	"	54 dB to 65 dB
1 GHz to 10 GHz	"	54 dB to 63 dB
10 GHz to 18 GHz	"	43 dB to 64 dB

Note: Properties measured on samples cured for 30 minute at room temperature and 2 h at 80 °C.

TBD = To Be Determined

a) The surface (sheet) resistivity unit is commonly referred to as "Ohm per square"

<b>Environmental &amp; Ageing Study</b>	<b>Method</b>	<b>Value</b>
Salt Spray Test: 7 day @35 °C +Salt/Fog	ASTM B117-2011	TBD
Cross-Hatch Adhesion	ASTM D3359-2009	"
Cracking, unwashed area	ASTM D661-93	"
Visual Color, unwashed area	ASTM D1729-96	"
Peeling, unwashed area	ASTM D1729-96	"

Note: TBD = To Be Determined

## Properties of Uncured 843ER

<i>Physical Property</i>	<i>Mixture (2A:1B)</i>	
Color	Metallic brown	
Viscosity at 20 °C [73 °F]	TBD	
Density	1.03 g/mL	
Mix Ratio by Weight (A:B)	100:28	
Mix Ratio by Volume (A:B)	100:38	
Solids Content (w/w)	30%	
<i>Physical Property</i>	<i>Part A</i>	<i>Part B</i>
Color	Metallic brown	Clear, amber
Viscosity <sup>a)</sup> at 24°C [73 °F]	35 cP [0.035 Pa·s]	9.0 cP [0.009 Pa·s]
Density	1.20 g/mL	0.87 g/mL
Flash Point	≥-3 °C [≥26.6 °F]	≥-3 °C [≥26.6 °F]
Odor	Mild	Ammonia-like

Note: TBD = To Be Determined

a) Brookfield viscometer at 100 RPM with spindle LV S61

### Compatibility

**Chemical**— Silver coated copper flakes are resistant to oxidation, except in environments that contain oxidizers, H<sub>2</sub>S, or ozone, which tarnish their surface. Also avoid hydrochloric acid or other strong acids which can react with the metal filler.


Because epoxies are heavily crosslinked (thermoset) plastics, they are generally very resistant to solvents. Long term chemical exposure to solvents usually leads to negligible absorption and swelling, except in a few cases. For a few very aggressive organic solvents, the degree of softening and swelling can lead to fracturing. The chemical solvent resistance chart presents typical percent weight changes of the cured epoxy for typical solvents.

### Chemical Solvent Resistance

<i>Physical Properties</i>	<i>Weight Change 3 days</i>	<i>Weight Change 45 days</i>
Water	< 0.0 %	< 1%
Hydrochloric Acid	< 0.0 %	< 1%
Isopropyl alcohol	0.3%	< 1%
Mineral spirits	0.3 %	0.3 %
Xylene	2 %	9 %
Ethyl Lactate	3 %	7 %
Isohexane	5 %	8%
Acetone	7 %	Severe swelling & fracturing

**Adhesion**—As seen in the substrate adhesion table, the 843ER epoxy coating adheres to 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 printed circuit assembly with electronic cleaner such as MG Chemicals 4050 Safety Wash, 406B Superwash, or 824 Isopropyl Alcohol.

### Substrate Adhesion in Decreasing Order

<i>Physical Properties</i>	<i>Adhesion</i>
Aluminum	<p>Stronger</p>  <p>Weaker</p>
Steel	
Fiberglass	
Wood	
Glass	
Polycarbonate	
Acrylic	
Polypropylene	

### PACKAGING AND SUPPORTING PRODUCTS

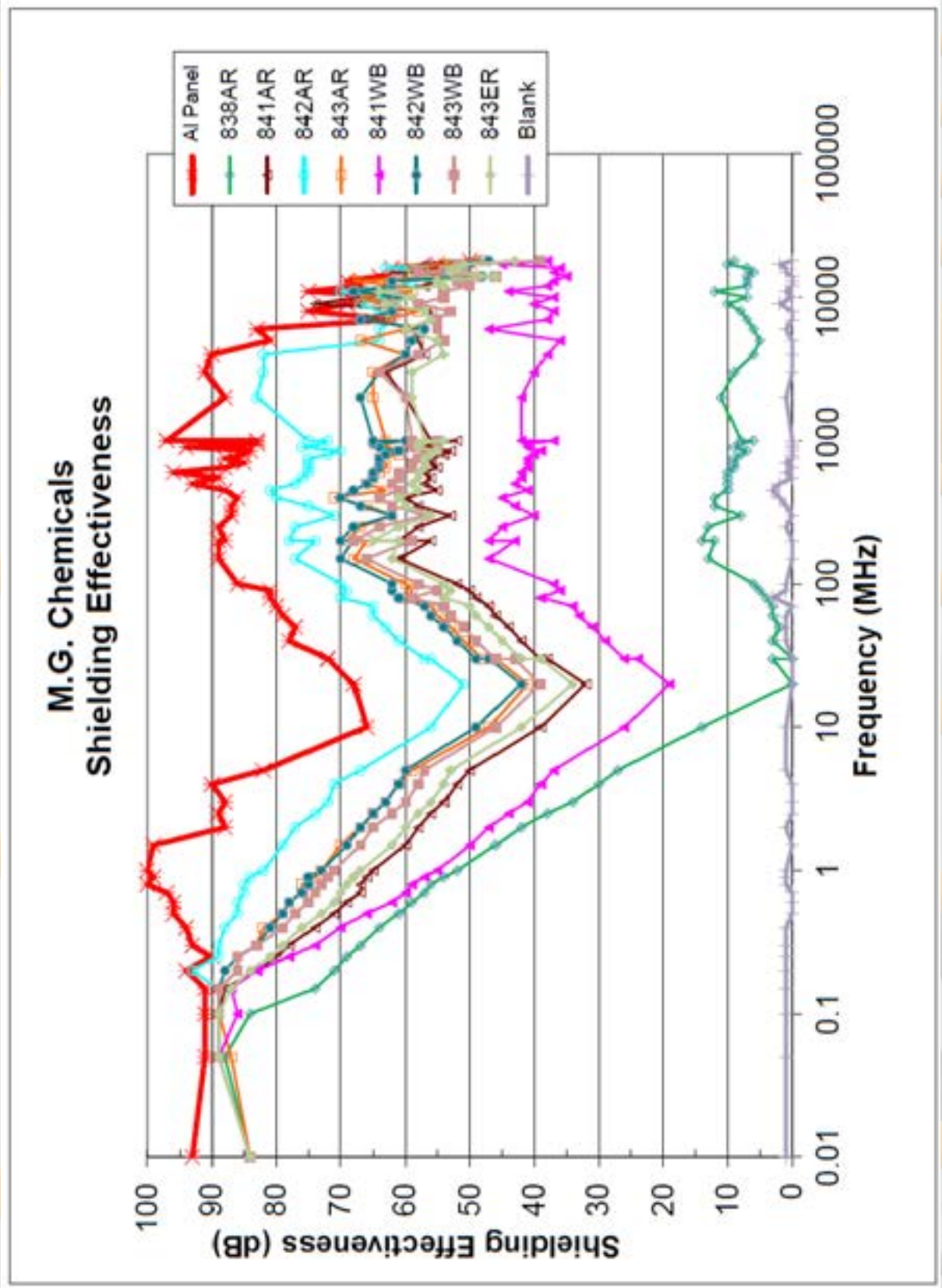
<i>Cat. No.</i>	<i>Form</i>	<i>Net Volume</i>	<i>Net Weight Shipping Weight</i>			
843ER-8 00ML	Liquid	810 mL 27 fl oz	859 g	1.97 lb	TBD	
843ER-3.25L	Liquid	3.25 L 0.87 gal	3.6 kg	7.9 lb	TBD	

\* Available in ready to spray 12 oz aerosol can



# Test Data

All Panels



## Thinners 435

### Important Usage Info for Thinner 435

It is preferable to use this thinner system in a temperature controlled environment. Avoid high temperatures or humidity, which can lead to dry spray and blushing respectively.

The 435 Thinner is a super fast drying thinner, low VOC solvent for use with the MG Chemical's conformal and EMI/RFI shielding coating products. It is designed to ensure good adherence to plastic substrates.

### Application

This fast drying time of the 435 makes it a good choice for spray application of EMI/RFI shielding and conformal coatings that require low VOC and need quick drying times.

### Benefits and Features

- Low VOC
- Fast Evaporation Rate
- Enhances Adhesion to Plastic Substrates
- Highly Miscible with Other Common Organic Solvents
- Compatible with most substrates used in electronic parts and enclosures

## Properties

<i>Physical Property</i>	<i>Method</i>	<i>Value</i>
Color	—	Clear
Odor		Ketone, nail polish remover
Density at 25°C [77 °F]	Brookfield SP1	0.81 g/mL
Viscosity at 25°C [77 °F]		0.5 cP [0.0005 Pa·s]
Flash Point	Closed Cup	-18 °C [-0.4 °F]
Freezing Point		-94 °C [-70 °F]
Boiling Point		56 °C [133 °F]
Vapor Pressure at 25°C [77 °F]		21.7 kPa [163 mm of Hg]
Relative Evap. Rate (BuAc = 1)		~6
Volatile Organic Content (VOC)		7.5% [60 g/mL]
MIR value		0.52 g O <sub>3</sub> / g of product

<i>Solvation Parameters</i>		<i>Value</i>
Solubility in water	Total Non-Polar Polar Hydrogen Bonding	Highly soluble
Hansen Solubility Parameters <sup>a)</sup> (cal/cm <sup>3</sup> ) <sup>1/2</sup> ; [MPa] <sup>1/2</sup>		9.7 [19.8]
		7.3 [14.9]
		5.1 [10.3]
		3.3 [6.8]

a) Hansen parameters calculate using component literature values and volume fraction composition.

## Compatibility

Substrate Compatibility: The 435 Thinner is compatible with most substrate materials found on printed circuit assemblies. Its etching action can remove the need for surface preparation steps for plastics. The high solvent power can also cut through residual contaminants.

### PACKAGING AND SUPPORTING PRODUCTS

<i>Cat. No.</i>	<i>Form</i>	<i>Net Volume</i>	<i>Net Weight</i>	<i>Shipping Weight</i>
435-1L	Liquid	950 mL 32 fl oz	0.77 kg 1.7lb	5.5 kg 11.5 lb (x5) <sup>a)</sup>
435-4L	Liquid	3.8 L 1gal	3.10 kg 6.8 lb	3.8 kg 8.3 lb

a) Pack of five bottles

Contact MG Chemicals if custom packaging or sizes are required

## Thinner 1 4351

The 4351 Thinner 1 is a mild diluents designed for MG Chemical's EMI/RFI shielding products.

### Applications & Usages

This thinner is used to dilute EMI/RFI shielding coatings that require mild, plastic safe solvents. When preparing a surface to be painted, this solvent is also effective at removing various contaminants like oil and greasy flux residues without harming the substrate.

### Benefits

- **Plastic Safe:** compatible with most sensitive substrate used in electronic parts and enclosures
- **Moderately Fast Evaporation Rate**

### Important Usage Info for Thinner 1 4351

Some degree of surface etching is often desirable to ensure good adhesion to some substrates. If adhesion failures are observed, the more aggressive 435 Thinner Cleaner may provide better adhesion characteristics.

As an electronic cleaner or shielding enclosure cleaner, it helps remove moisture, wax, greases, oils, and other contaminants that can cause coating defects.

## Properties

<i>Physical Property</i>	<i>Method</i>	<i>Value</i>
Color		Clear
Odor	—	Rubbing alcohol
Viscosity at 25°C [77 °F]	Brookfield SP1	~1 cP [0.01 Pa·s]
Density at 25°C [77 °F]		0.80 g/mL
Flash Point	Closed Cup	15°C [59 °F]
Boiling Point		65 °C [149 °F]
Vapor Pressure at 25°C [77 °F]		7.5 kPa [56 mm of Hg]
Volatile Organic Content (VOC)		100% [800 g/mL]

### Compatibility

The 4351 Thinner 1 is a mild solvent system compatible with most materials found on printed circuit assemblies and with chemically sensitive plastics like ABS and PVC.

### PACKAGING AND SUPPORTING PRODUCTS

<i>Cat. No.</i>	<i>Form</i>	<i>Net Volume</i>	<i>Net Weight</i>	<i>Shipping Weight</i>
4351-1L	Liquid	950 mL 33 fl oz	0.76 kg 1.7lb	5.5 kg 11.5 lb (x5) <sup>b)</sup>
4351-4L	Liquid	3.8 L 1 gal	3.0 kg 6.7 lb	3.8 kg 8.3 lb

a) Pack of ten cans

b) Pack of five bottles

Contact MG Chemicals if custom packaging or sizes are required



## Thinners 2 4352

The 4352 Thinner 2 is a moderately fast drying thinner for use with MG Chemical's conformal products. It is compatible with film forming paint products with acrylic, alkyd, cellulose acetate butyrate, epoxy, nitrocellulose, or polyester resins. Together with these type of resin systems, the 4352 thinner promotes good flow properties and suppresses blushing.

### Benefits and Features

- Plastic Safe: compatible with most sensitive substrate used in electronic parts and enclosures
- Blush Resistant
- Moderate Evaporation Rate
- Excellent Leveling and Gloss
- Not Classified as a "Hazardous Air Pollutant"
- Highly Miscible with Other Common Organic Solvents

### Properties

<i>Physical Property</i>	<i>Method</i>	<i>Value</i>
Color	—	Clear
Odor		fruity
Density at 25°C [77 °F]		0.883 g/mL
Viscosity at 25°C [77 °F]	Brookfield SP1 Tag Closed Cup	28 cP [0.028 Pa·s]
Flash Point		27°C [81 °F]
Freezing Point		-77 °C [126 °F]
Boiling Point		127 °C [257 °F]
Vapor Pressure at 25°C [77 °F]		1.33 kPa [10.0 mm of Hg]
Relative Evap. Rate (BuAc = 1)		1
Volatile Organic Content (VOC)		100% [883 g/mL]
MIR value		0.78

<i>Solvation Parameters</i>		<i>Value</i>
Solubility in water (%wt)	Total Non-Polar Polar Hydrogen Bonding	0.7%
Solubility for water (%wt)		1.6%
Hansen Solubility Parameters (MPa) <sup>1/2</sup> ; [cal/cm <sup>3</sup> ] <sup>1/2</sup>		17.2 [8.4]
		15.3 [7.5]
		3.2 [1.6]
		6.8 [3.3]
Dielectric constant @20 °C		5.07

### Compatibility

Substrate Compatibility: The 4352 Thinner 2 is compatible with most substrate materials found on printed circuit assemblies.

Solvent Miscibility: The 4352 is highly miscible with other common organic solvent. It can be mixed with • Alcohols • Aldehydes • Aromatic and Aliphatic Hydrocarbons • Ethers • Glycols • Glycol Ethers • Ketones

PACKAGING AND SUPPORTING PRODUCTS						
<i>Cat. No.</i>	<i>Form</i>	<i>Net Volume</i>		<i>Net Weight</i>		<i>Shipping Weight</i>
4352-1L	Liquid	950 mL	32 fl oz	0.84 kg	1.8 lb	5.5 kg 11.5 lb (x5) <sup>b)</sup>
435-4L	Liquid	3.8 L	1 gal	3.36 kg	7.4 lb	3.8 kg 8.3 lb

a) Pack of ten cans

b) Pack of five bottles

Contact MG Chemicals if custom packaging or sizes are required

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#### For Material Safety Data Sheet

visit [www.mgchemicals.com/msds](http://www.mgchemicals.com/msds)

#### For Technical Support

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