Super Shield™ Nickel Epoxy Conductive Coating 841ER Technical Data Sheet

Description

The 841ER *Super Shield™ Nickel Epoxy Conductive Coating* is a two-part system pigmented with highly conductive nickel flake. The cured coating is smooth and extremely hard. It is abrasion, scratch, and mar resistant. It also provides good chemical resistance and adheres strongly to plastics, including chemically resistant and low energy plastics.

Applications & Usages

This is a conductive coating for applications requiring extreme durability and corrosion resistance.

It is suitable for use in military, automotive, aerospace, oil and gas applications, as well as on engines and aluminum flanges.

It may also act as a sprayable conductive adhesive, a conductive base for electroplating, grounding, or for any process where it is necessary to create a durable conductivity surface.

Benefits and Features

- **Volume resistivity of 0.1 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**
- **Strong chemical resistance**

Usage Parameters

Properties	*Value*
Working Time @22 °C [72 °F]	4 h
Recoat Time @22 °C [72 °F]	5 min
Elevated Temperature Step Cure	
First 22 °C [72 °F], then	30 min
65 °C [149 °F], then	4 h
22 °C [72 °F]	1 h
Shelf Life	1 y
Theoretical HVLP Spray Coverage [a)]	≤40 900 cm^2/L ≤4 m^2/L ≤24 000 in^2/gal ≤160 ft^2/gal

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

Temperature Ranges

Properties	*Value*
Constant Service Temperature	-40 to 150 °C [-40 to 302 °F]
Intermittent Temperature Limits	-50 to 165 °C [-58 to 329 °F]
Storage Temperature Limits [b)]	16 to 27 °C [60 to 80 °F]

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

Date: 12 June 2017 / Ver. 1.01

Principal Components

Name	CAS Number
Part A: Nickel	*7440-02-0*
N-butyl acetate	*123-86-4*
1-Butanol	*71-36-3*
Bisphenol-A epoxy resin	*25068-38-6*
Part B: Nickel	*7440-02-0*
N-butyl acetate	*123-86-4*
1-Butanol	*71-36-3*
Polyamide Polymer	*68410-23-1*
Triethylenetetramine	*112-24-3*

Properties of Cured 841ER

Physical Properties	*Method*	*Value*	
Color	Visual	Grey	
Resin Technology		Epoxy	
Conductive Filler		Nickel	
Density @22 °C [72 °F]	Calculated	1.61 g/mL	
Mechanical Properties	***Method***	***Value***	
Adhesion	ASTM D3359		
Acrylonitrile butadiene styrene (ABS)	"	5B	
Polycarbonate (PC)	"	5B	
Polyvinyl chloride (PVC)	"	5B	
Glass	"	5B	
Aluminum	"	5B	
Pencil Hardness on ABS	ASTM D3363	4H, Hard	
Electrical & Magnetic Properties	***Method***	***Value***	
Volume Resistivity	Method 5011.5 in MIL-STD-883H	0.1 Ω·cm	11 S/cm
Surface Resistance		*Resistance* [a]	*Conductance* [a]
1 coat @0.9 mil	Square probe	72 Ω/sq	0.01 S
2 coats @3.6 mil	Square probe	21 Ω/sq	0.04 S
3 coats @6.5 mil	Square probe	7 Ω/sq	0.14 S
Magnetic Class		Ferromagnetic	
Relative Permeability		≥100	
Shielding Attenuation for 51 μm [2.0 mil]	IEEE STD 299-1997		
>10 to 100 kHz	"	TBD	
>100 kHz to 1 MHz	"	"	
>1 MHz to 10 MHz	"	"	
>10 MHz to 100 MHz	"	"	
>100 MHz to 1 GHz	"	"	
>1 GHz to 10 GHz	"	"	
>10 GHz to 18 GHz	"	"	

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

Environmental & Ageing Study	Method	Value
Salt Fog Test @35 °C [95 °F], 96 h	ASTM B117-2011	
Resistivity before	MG-ELEC-120	TBD
Resistivity after	"	"
% Conductivity after	"	"
Cross-Hatch Adhesion	ASTM D3359-2009	"
Cracking, unwashed area	ASTM D661-93	"
Visual Color, unwashed area	ASTM D1729-96	"

TBD = To be determined

Properties of Uncured 841ER

Physical Properties	Mixture
Color	Grey
Density	1.64 g/mL
Mix Ratio by Weight (A:B)	4:1
Mix Ratio by Volume (A:B)	100:38

Physical Property	Part A	Part B
Color	Grey	Grey
Viscosity @25 °C [77 °F]	200 cP [0.20 Pa·s] a)	18 cP [0.018 Pa·s] b)
Density	1.81 g/mL	1.19 g/mL
Flash Point	-9 °C [16 °F]	-9 °C [16 °F]
Odor	Alcohol-like	Ammonia-like

a. Brookfield viscometer at 100 RPM with spindle LV S62
b. Brookfield viscometer at 100 RPM with spindle LV S61

The coating surface resistance are plotted in Figure 1.

Surface Resistance by Coating Thickness

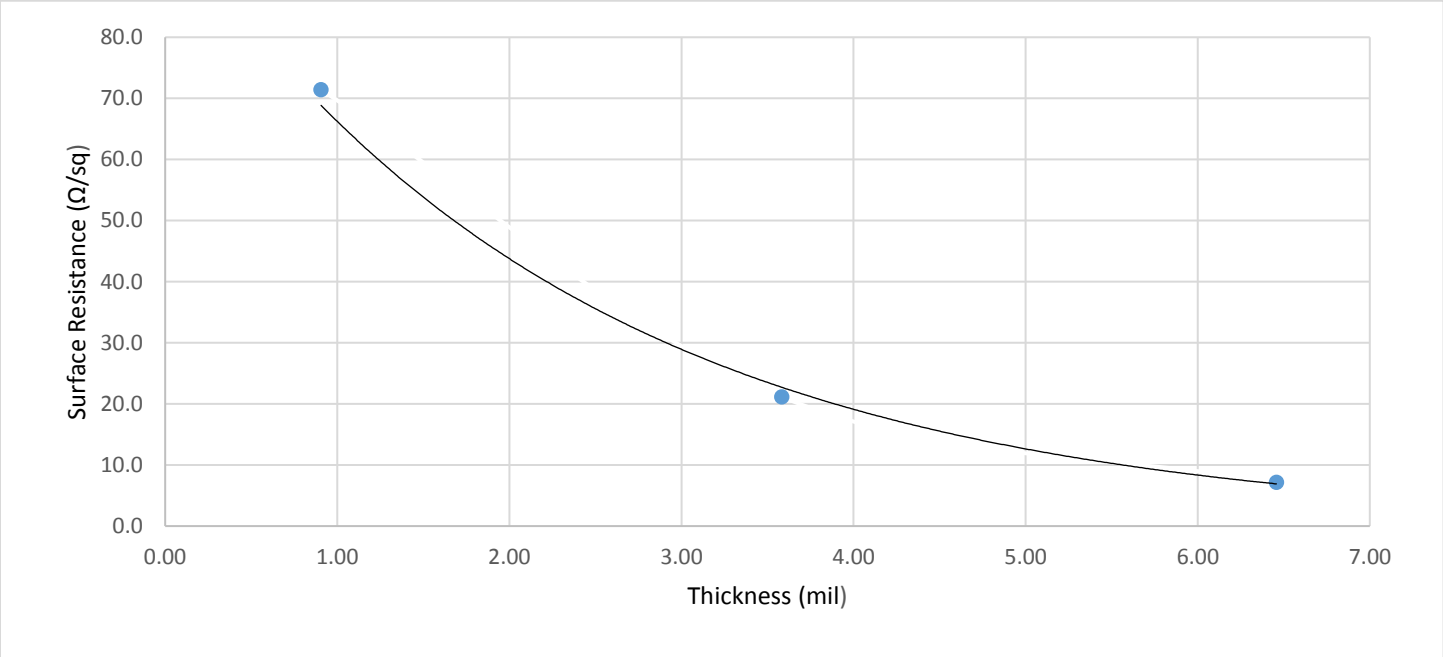


Figure 1. Nickel epoxy conductive coating surface resistance at different thicknesses (the dots indicate typical successive coat thicknesses)

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.

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

Adhesion—The 841ER 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 working surface with electronic cleaner such as MG Chemicals 4050 Safety Wash, 406B Superwash, or 824 Isopropyl Alcohol.

Storage

Store between 16 and 27 °C [60 and 80 °F] in dry area away from sunlight.

Health, Safety, and Environmental Awareness

Please see the 841ER **Safety Data Sheet** (SDS) parts A and B for more details on transportation, storage, handling and other security guidelines.

Environmental Impact: The calculated VOC (Volatile Organic Compound) content is 42% (753 g/L) for part A and 70% (835 g/L) part B. The calculated VOC (Volatile Organic Compound) of the mixture is 49% (811 g/L). Reactive components become part of the solid epoxy; therefore, they are no-longer VOCs in their final form.

Health and Safety: Both 841ER parts, A and B, are classified as highly flammable liquid and vapor.

Wear safety glasses or goggles and disposable polyvinyl chloride, neoprene, or nitrile gloves while handling liquids. Part A & B can cause eye damage and skin irritation. Skin sensitization may occur after repeated or prolonged exposures.

Inhalation can cause dizziness or drowsiness. Use in well-ventilated area or outdoors.

Wash hands thoroughly after use or if skin contact occurs. Do not ingest. Avoid breathing vapors, mist, or spray.

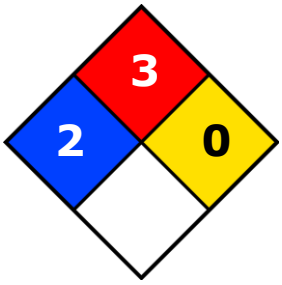
The cured coating—in a non-dust form—presents no classifiable hazard.

Part A

HMIS® RATING

HEALTH:	* 2
FLAMMABILITY:	3
PHYSICAL HAZARD:	0
PERSONAL PROTECTION:	

NFPA® 704 CODES

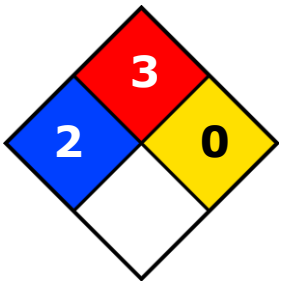


Part B

HMIS® RATING

HEALTH:	* 2
FLAMMABILITY:	3
PHYSICAL HAZARD:	0
PERSONAL PROTECTION:	

NFPA® 704 CODES



Approximate HMIS and NFPA Risk Ratings Legend:
0 (Low or none); 1 (Slight); 2 (Moderate); 3 (Serious); 4 (Severe)

Application Instructions

Follow the procedure below for best results. If you have little or no experience with the 841ER epoxy coating, please follow the long instructions instead. The short instructions provided here are not suitable for first time users.

Equipment and Supplies

- Mixing spatulas and mixing container
- Clean paint brush ***OR*** HVLP spray gun with agitator cup ***OR*** dip tank system
- Thinner/Cleaner solvent (for cleaning brush, spray gun, or spills)
- Personal protection equipment (See 841ER-2 parts SDS)

Preparation

Clean and dry the surface of the substrate to remove oil, dust, water, solvents, and other contaminants.

To prepare 4:1 (A:B) by weight epoxy mixture

- Scrape any settled material in the ***Part A*** container, and stir until homogenous.
- Scrape any settled material in the ***Part B*** container, and stir until homogenous.
- Weigh a desired amount of pre-stirred ***A*** into a mixing container.
- Multiply the measured weight of ***A*** by **0.25** and add this amount of pre-stirred ***B*** to the mixing container.
- Mix thoroughly and pour into a clean, spray gun cup with agitator.

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 1-2 mil [25-51 μm].

Spray Equipment

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

Initial Setting Recommendations

Air Cap	#3 HVLP		
Pressure	*Inlet* 23 psi	*Air flow* 13.5 SCFM [a)]	*Air cap* 10 psi
Fluid Tip	1.3 mm [0.051”]	1.5 mm [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. Spray a test pattern. This step ensures good flow quality and helps establish appropriate distance to avoid runs.
2. 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.
3. Wait 5 minutes and spray another coat. The delay avoids trapping solvent between coats.
4. Apply additional coats until desired thickness is achieved. Go back to Step 3.
5. Let dry for 5 minutes (flash off time) at room temperature.

To cure the coating

1. Let cure for 30 minutes at room temperature, then
2. Heat cure at 65 °C [149 °F] for 4 hours, then
3. Let cure for 1 hour at room temperature.

TIP! If you don't have an agitator in your spray gun, swirling the paint gun container while waiting prevents settling.

ATTENTION!

- Coats that are applied too thick cause runs and hampers solvent evaporation. Apply many thin wet coats rather than a single thick coat.
- Spraying onto horizontal surfaces is not recommended due to possible uneven settling of metallic filler.

Packaging and Supporting Products

Cat. No.	*Packaging*	*Net Volume*		*Net Weight*		*Packaging Weight*	
841ER-1.17L	Can	1.17 L	2.47 pt	1.92 kg	4.24 lb	2.74 kg	6.05 lb
841ER-3.25L	Can	3.25 L	6.87 pt	5.34 kg	11.7 lb	6.72 kg	14.8 lb

Thinners & Conductive Coating Removers

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

Technical Support

Contact us regarding any questions, improvement suggestions, or problems with this product. Application notes, instructions, and FAQs are located at www.mgchemicals.com.

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Warranty

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