Total Ground™ Carbon Conductive Coating 838AR Technical Data Sheet

838AR-Aerosol

Description

The 838AR *Total Ground™ Carbon Conductive Coating* is a one-part durable acrylic lacquer pigmented with a highly conductive carbon powder, packaged in convenient aerosol format. 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, good conductivity, excellent low frequency shielding, and strong corrosion resistance, even in marine environments.

Applications & Usages

Total Ground™ is an economical solution for grounding or RFI shielding applications. It may be used in applications such as these:

- Creating a grounded working surface
- Shielding control and pickup cavities on electric guitars and other electronic instruments
- Shielding metal detectors and other devices that malfunction in the presence of metal
- Other low frequency RFI shielding applications
- Acting as a conductive adhesive for electrostatic flocking
- Providing a conductive inner coating in picture tubes
- Acting as a resistor in prototype circuits
- Providing electrical conductivity to almost any surface

Benefits and Features

- **Cost effective conductive coating**
- **Provides >50 dB of RFI shielding at frequencies <1 MHz**
- **Volume resistivity of 0.34 Ω·cm**
- **Smooth, durable, and abrasion resistant**
- **Available in liquid format**
- **Available in convenient pen 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**
- **Strong corrosion resistance, suitable for marine environments**
- **HAP Free; Does not contain toluene or xylene**

ENVIRONMENT
RoHS Compliant
Low-VOC

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Usage Parameters

Properties	*Value*
Recoat Time (liquid)	3 min
Drying Time @25 °C [77 °F]	24 h
Drying Time @65 °C [149 °F]	30 min
Shelf Life	2 y
Theoretical 340G Spray Can Coverage [b]	≤1 560 cm^2 ≤242 in^2 ≤1.68 ft^2

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

Temperature Ranges

Properties	*Value*
Constant Service Temperature	-40 to 120 °C [-40 to 248 °F]
Intermittent Temperature Limits	-50 to 125 °C [-58 to 257 °F]
Storage Temperature Limits [b]	-5 to 40 °C [23 to 104 °F]

b) The product must stay within the storage temperature limits stated. ATTENTION! Aerosol container will be crushed at ≤-26.5 °C [≤15.7 °F].

Principal Components

Name	***CAS Number***
Carbon Black	*1333-86-4*
Acrylic Resin	*25608-33-7*
Acetone	*67-64-1*

Properties of Cured 838AR

Electric & Magnetic Properties	*Method*	*Value*	
Volume Resistivity	Method 5011.5 in MIL-STD-883H	0.34 Ω·cm	2.9 S/cm
Surface Resistance		*Resistance* [a]	*Conductance* [a]
1 coat @0.7 mil	Square probe	120 Ω/sq	0.008 S
2 coats @1.5 mil	Square probe	60 Ω/sq	0.016 S
3 coats @2.0 mil	Square probe	50 Ω/sq	0.019 S
Magnetic Class		Diamagnetic (Non-magnetic)	
Relative Permeability		<1.0	
Shielding Attenuation for 51 μm [2.0 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	

Physical Properties	Method	Value
Paint Type	—	Lacquer (Thermoplastic)
Color	Visual	Black
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	2H, hard
Environmental & Ageing Study	**Method**	**Value**
Salt Fog Test @35 °C [95 °F], 96 h [b)]	ASTM B117-2011	
Resistivity before	"	70 Ω/sq
Resistivity after	"	70 Ω/sq
% Conductivity after	"	100% = No detectible change
Cross-Hatch Adhesion	ASTM D3359-2009	5B
Cracking, unwashed area	ASTM D661-93	None
Visual Color, unwashed area	ASTM D1729-96	No change

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

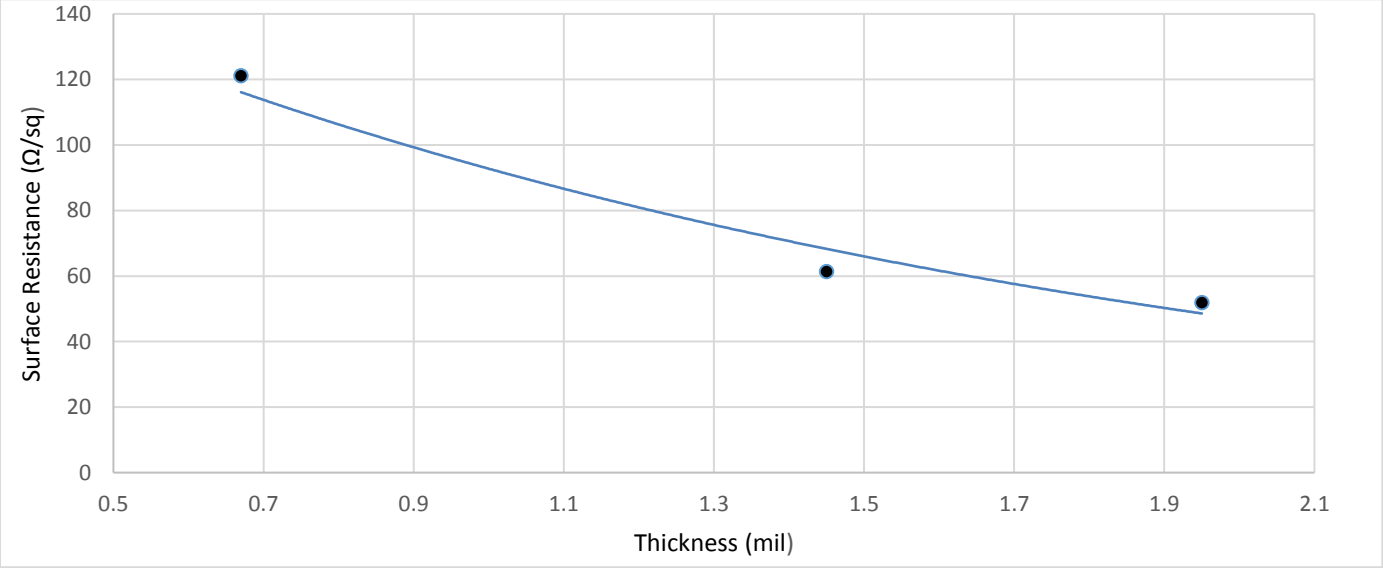


Figure 1. Carbon coating surface resistance at different thicknesses (the dots indicate typical successive coat thicknesses)

Shielding Attenuation

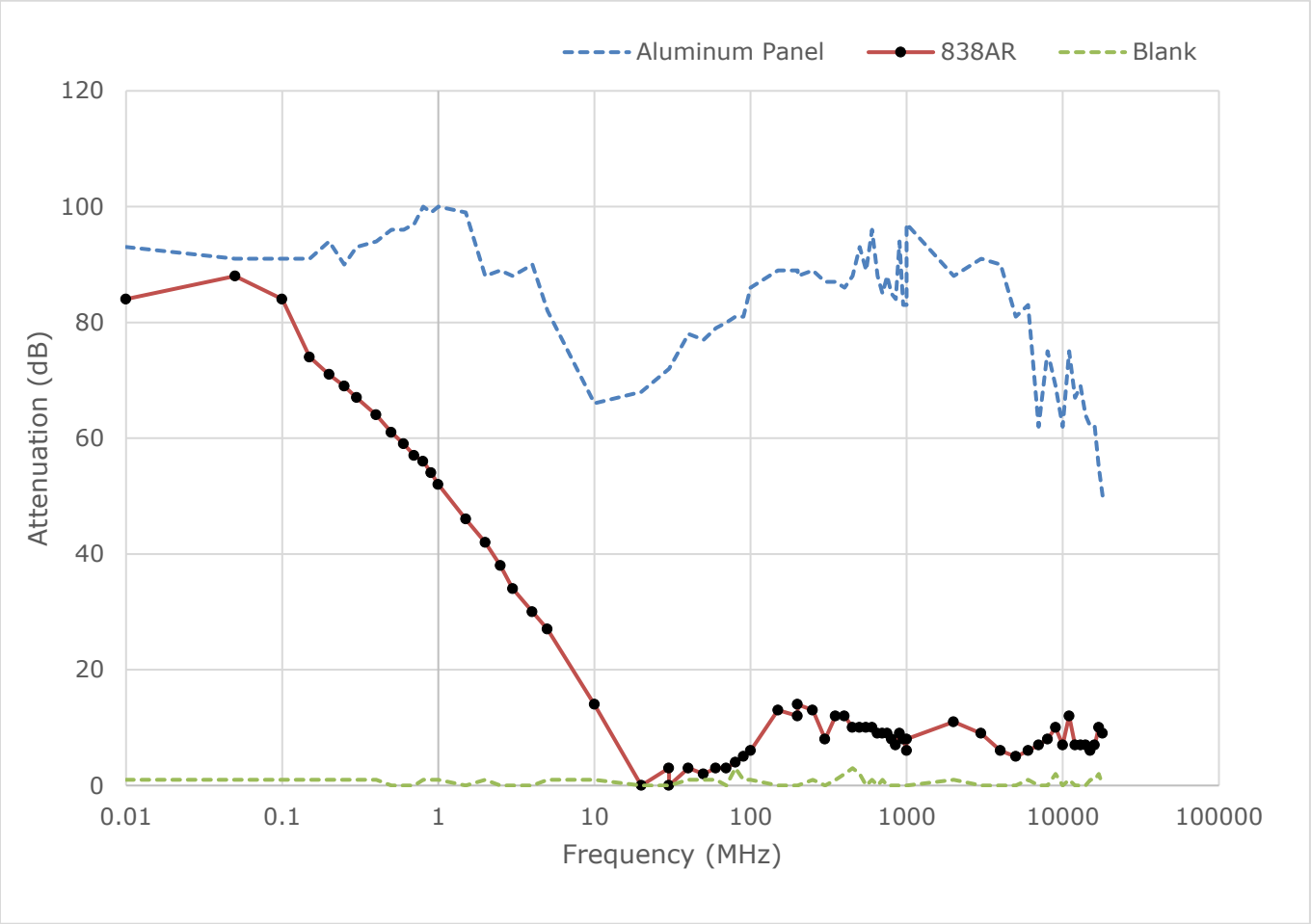


Figure 2. Attenuation of 838AR coating at different frequencies

Properties of Uncured 838AR

Physical Property	***Mixture***
Color	Black
Density @25 °C [77 °F]	0.84 g/mL
Solids Percentage (wt/wt)	12%
Viscosity @25 °C [77 °F] a)	46 cP [55 mm^2/s]
Flash Point	-17 °C [1.4 °F]
Odor	Ethereal

a) Brookfield viscometer at 100 RPM with spindle LVS61

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

Substrate	***Note***
Acrylonitrile Butadiene Styrene (ABS)	Chemically etches [a)] and adheres well to this substrate.
Polybutlylene Terephtalate (PBT)	"
Polycarbonate	"
Polyvinyl Acetate (PVA)	"
Acrylics or Acrylic Paints	Adheres well to clean surface
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.

ATTENTION! Do not use on thin plastics or on plastics where you want to keep original surface intact. The 838AR 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 4351-1L thinner lessens the etching effects for chemically sensitive substrates.

Storage

Store between -5 and 40 °C [23 and 104 °F] in dry area away from sunlight. Temperatures below or above these outer limits will result in the container being crushed and/or ruptured.

Health, Safety, and Environmental Awareness

Please see the 838AR-Aerosol **Safety Data Sheet** (SDS) for greater details on transportation, storage, handling and other security guidelines.

Environmental Impact: The VOC (Volatile Organic Compound) content is 40% (381 g/L) by EPA and WHMIS standards.

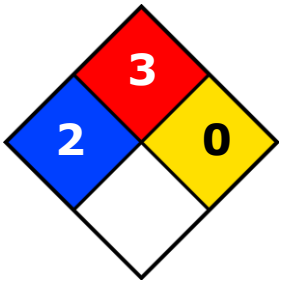
This product meets the European Directive
2011/65/EU Annex II (ROHS);
recasting 2002/95/EC.

Health and Safety: The solvents in 838AR can ignite if exposed to flames or sparks and can cause respiratory track irritation. If ignited, then flame flash back is possible. Use in well-ventilated area. Wear safety glasses or goggles and disposable gloves to avoid exposures.

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)

Aerosol Application Instructions

Follow the procedure below for best results. We recommend a coat with a dry film thickness of roughly 1 mil [25 μm]. For thicker coats, apply many thin coats as opposed to spraying a single thick coat.

Prerequisites

- Ensure surface to be coated is oil free, dust free and clean

Material & Equipment

- Personal protection equipment (See 838AR-Aerosol SDS)

To apply the coating

1. Shake the can vigorously for 2 minutes, and swirl the bead around the bottom to lift settled material back in solution.
2. Spray a test pattern. This step ensures good flow quality and helps establish appropriate distance to avoid runs.
3. At a distance of 20 to 25 cm (8 to 10 inches), spray a thin and even coat onto a vertical surface. 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.
4. Wait 1 minute, shake can, and spray another coat. The delay avoids trapping solvent between coats.
5. Apply additional coats until desired thickness is achieved. (Go to Step 3.)
6. Let dry for 3 minutes (flash off time) at room temperature.

NOTE: Swirling the aerosol can slightly while waiting prevents settling.

ATTENTION!

- Holding the can at a non-vertical angle during the spray application may result in uneven application.
- Coats that are applied too thick cause runs and hamper solvent evaporation.
- Spraying onto horizontal surfaces is not recommended.

After use, clear the nozzle of the aerosol

1. Immediately invert the aerosol can upside down.
2. Press button until clear propellant comes out. The propellant should become clear in a few seconds.
3. Ensure the face of the button is clean of residues by wiping with a cloth or paper towel.

ATTENTION! Failure to clear nozzle can lead to valve being blocked open or closed in a non-noticeable way.

- If blocked closed, the can will not be usable.
- If blocked slightly open, the contents can spill out overnight creating a mess.

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 30 min.

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 and Supporting Products

Cat. No.	Packaging	Net Volume		Net Weight		Packaging Weight	
838AR-340G	Aerosol	360 mL	12.1 fl oz	340 g	12 oz	TBD	TBD
838AR-P	Pen	5 mL	0.16 fl oz	4.21 g	0.14 oz	0.03 kg	0.06 lb
838AR-15ML	Jar	12 mL	0.4 fl oz	10.2 g	0.36 oz	0.07 kg	0.15 lb
838AR-900ML	Can	850 mL	1.79 pt	725 g	1.59 lb	1.10 kg	2.43 lb
838AR-3.78L	Can	3.60 L	3.8 qt	3.07 kg	6.77 lb	3.86 kg	8.51 lb

Note: TBD = To Be Determined

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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