

## Description

The 841AR-P *Nickel Conductive Pen* easily draws and repair conductive traces. It dispenses a conductive paint made of durable acrylic lacquer that is pigmented with highly conductive nickel flakes. The cured traces are durable and corrosion resistant.

This pen works best on smooth, flat, hard surfaces. The valve-tip opens when pressed against the drawing surface, and the flow is controlled by squeezing the barrel.

## Applications & Usages

Use this pen for drawing or repairing highly conductive traces.

It is used for repairing damaged traces on keyboards, game controllers, remote controls, mixing boards, or PCB's.

Also, it is used to create conductive traces on a variety of surfaces for prototyping, hobbies, or maker projects. It is good for making small connections in or between circuits, such as jumpers, through-holes, bridges, and links. It can also be used to increase the surface area of contacts by painting the area around them.

For applications requiring lower resistance, use 842AR-P Silver Conductive Pen.

## Benefits and Features

- **UL Recognized** (File # [E202609](#))
- **Volume resistivity: 0.0068  $\Omega \cdot \text{cm}$**
- **Creates durable, reliable, and highly conductive connections**
- **Typical trace width: 1.0 mm**
- **Dries in minutes at room temperature**
- **Adheres to plastics, epoxy, copper, aluminum, ceramics, wood, and most electronic substrates**
- **Adheres to ABS, PLA, and other 3D printed plastics**
- **Good corrosion resistance**
- **Mild solvent system**
- **Toluene, xylene, and MEK free**



**ENVIRONMENT**  
RoHS Compliant  
Low-VOC

**ATTENTION!** Shake rigorously before use. For best results hold pen at angle, depress pen tip against surface, and draw pen across surface while gently squeezing middle.

### Usage Parameters

| <i>Properties</i>                      | <i>Value</i>                                |
|--|---|
| Handling Time                          | 10 min                                      |
| Drying Time @22 °C [72 °F]             | 24 h  |
| Drying Time @65 °C [149 °F]            | 30 min                                      |
| Shelf Life                             | 2 y   |
| Typical Trace Width                    | 1.0 mm                                      |
| Theoretical Pen Coverage <sup>a)</sup> | ≤225 cm <sup>2</sup><br>≤34 in <sup>2</sup> |

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

### Temperature Ranges

| <i>Properties</i>                        | <i>Value</i>                     |
|--|----------------------------------|
| Constant Service Temperature             | -40 to 120 °C<br>[-40 to 248 °F] |
| Intermittent Temperature Limit           | -50 to 125 °C<br>[-58 to 257 °F] |
| Storage Temperature Limits <sup>b)</sup> | -5 to 40 °C<br>[23 to 104 °F]    |

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

### Principal Components

| <b>Name</b>                | <b>CAS Number</b> |
|----------------------------|-------------------|
| Nickel Flake (high purity) | 7440-02-0         |
| Acrylic Resin              | 25608-33-7        |
| Acetone                    | 67-64-1           |
| Dimethyl carbonate         | 616-38-6          |
| Heptan-2-one               | 110-43-0          |

### Properties of Cured 841AR-P <sup>a)</sup>

| <i>Electrical &amp; Magnetic Properties</i> | <i>Method</i>                    | <i>Value</i>   |
|---|----------------------------------|--|
| Volume Resistivity                          | Method 5011.5<br>in MIL-STD-883H | 0.0068 Ω·cm      147 S/cm  |
| Surface Resistance                          |                                  | <i>Resistance</i> <sup>b)</sup> <i>Conductance</i> <sup>b)</sup> |
| 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   |
| <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  |



ISO 9001 Registered Quality System.  
Burlington, Ontario, Canada QMI File # 004008

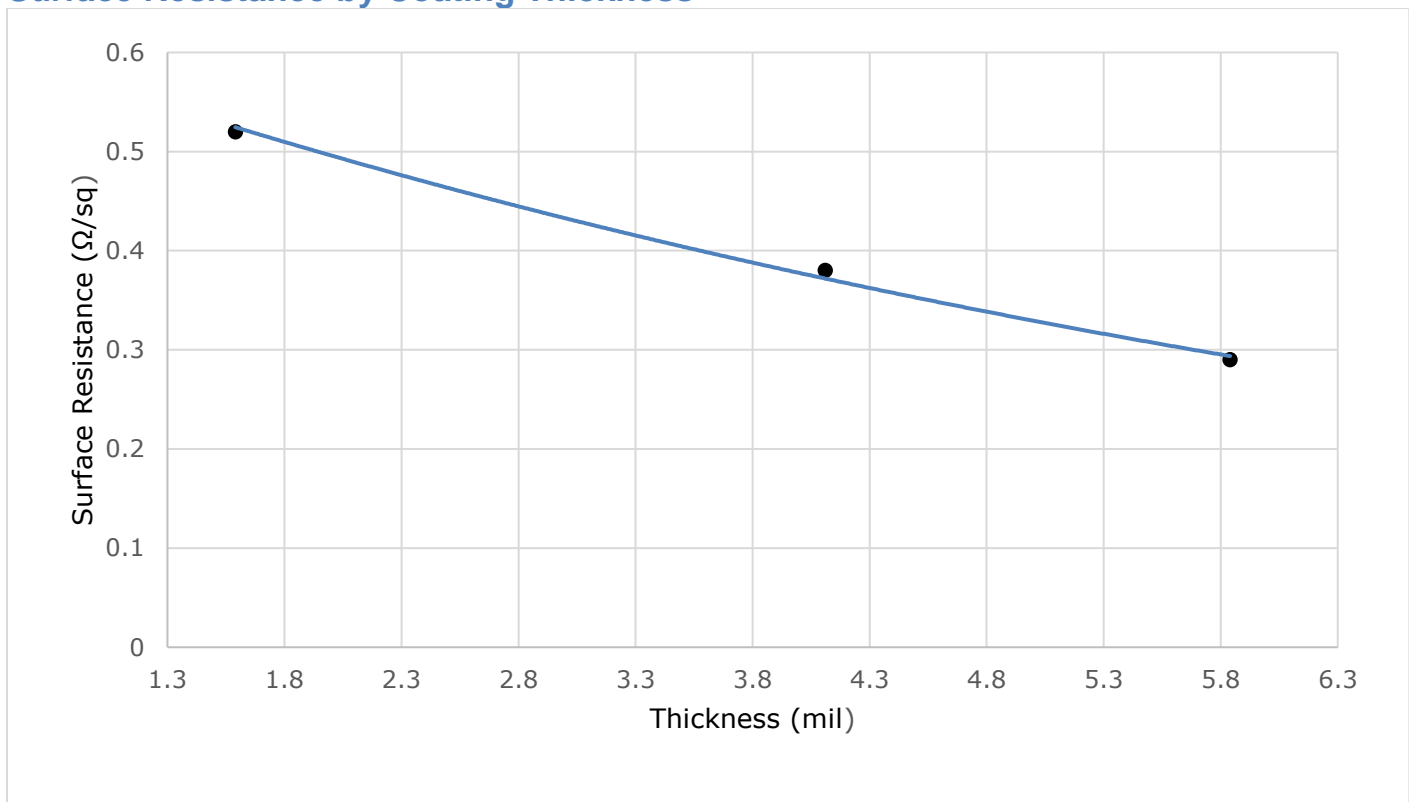
# Nickel Conductive Pen 841AR-P Technical Data Sheet

841AR-Pen

| <i>Mechanical Properties</i>  | <i>Method</i> | <i>Value</i> |
|-------------------------------|---------------|--------------|
| Adhesion <sup>c)</sup>        | ASTM D3359    | 5B           |
| Pencil Hardness <sup>c)</sup> | ASTM D3363    | 3H, Hard     |

- a) Values based on liquid format. Pen format values may vary slightly.
- b) Surface resistance is given in  $\Omega/\text{sq}$  and the corresponding conductance in Siemens ( $S$  or  $\Omega^{-1}$ )
- c) Tested on acrylonitrile butadiene styrene (ABS) material.

## Surface Resistance by Coating Thickness



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

### Properties of Uncured 841AR-P

| <i>Physical Properties</i>             | <i>Mixture</i>                  |
|--|---------------------------------|
| Color                                  | Dark grey                       |
| Density @25 °C [77 °F]                 | 1.51 g/mL                       |
| Solids Percentage (wt/wt)              | 57%                             |
| Viscosity @25 °C [77 °F] <sup>a)</sup> | 161 cP [106 mm <sup>2</sup> /s] |
| Flash Point                            | -17 °C [1.4 °F]                 |
| Odor                                   | Acetone-like                    |

a) Brookfield viscometer at 100 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 841AR-P 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-P 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)               | "   |
| Polyvinyl Chloride (PVC)              | "   |
| 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.

**ATTENTION!** Do not use on thin plastics or on plastics where you want to keep original surface intact. The 841AR-P 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. Store pen with the tip up after use.

### Health, Safety, and Environmental Awareness

Please see the 841AR-P **Safety Data Sheet** (SDS) for greater details on transportation, storage, handling and other security guidelines.

**Environmental Impact:** The VOC (Volatile Organic Compound) content is 14% (236 g/L) by EPA and WHMIS standards.

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

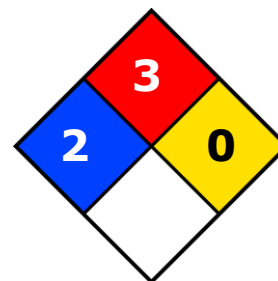
**Health and Safety:** The solvents in 841AR-P can ignite if exposed to flames or sparks and can cause respiratory track irritation. If ignited, then flame flash back is possible. Use in well-ventilated area.

Solvents can cause skin irritation and have some reproductive effects. Wear safety glasses or goggles and disposable gloves to avoid exposures.

### HMIS® RATING

|                             |     |
|-----------------------------|-----|
| <b>HEALTH:</b>              | * 2 |
| <b>FLAMMABILITY:</b>        | 3   |
| <b>PHYSICAL HAZARD:</b>     | 0   |
| <b>PERSONAL PROTECTION:</b> |     |

### NFPA® 704 CODES



*Approximate HMIS and NFPA Risk Ratings Legend:*

0 (Low or none); 1 (Slight); 2 (Moderate); 3 (Serious); 4 (Severe)



## Pen Application Instructions

Follow the procedure below for best results.

### To apply the liquid pen

1. Ensure that the surface to be coated is clean and oil-free.
2. Shake pen vigorously until the ball moves freely inside
3. Hold pen at angle and depress tip against surface
4. Draw pen across surface while gently squeezing barrel
5. Let dry 10 minutes before handling
6. For optimal conductivity, let stand 24 hours or heat cure at 65 °C for 30 minutes
7. Replace cap and store tip up after use

### 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.

**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

| <i>Cat. No.</i>    | <i>Packaging</i> | <i>Net Volume</i> |            | <i>Net Weight</i> |         | <i>Packaging Weight</i> |         |
|--------------------|------------------|-------------------|------------|-------------------|---------|-------------------------|---------|
| <b>841AR-P</b>     | Pen              | 5.0 mL            | 0.16 fl oz | 7.57 g            | 0.26 oz | 0.03 kg                 | 0.07 lb |
| <b>841AR-340G</b>  | Aerosol          | 232 mL            | 7.84 fl oz | 340 g             | 12 oz   | TBD                     | TBD     |
| <b>841AR-15ML</b>  | Jar              | 12 mL             | 0.4 fl oz  | 20.2 g            | 0.71 oz | 0.08 kg                 | 0.17 lb |
| <b>841AR-150ML</b> | Can              | 150 mL            | 5.0 fl oz  | 253 g             | 8.93 oz | 0.30 kg                 | 0.67 lb |
| <b>841AR-900ML</b> | Can              | 850 mL            | 1.79 pt    | 1.43 kg           | 3.16 lb | 1.77 kg                 | 3.90 lb |
| <b>841AR-3.78L</b> | Can              | 3.60 L            | 3.8 qt     | 6.07 kg           | 13.3 lb | 6.80 kg                 | 15.0 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



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## 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](http://www.mgchemicals.com).

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## Warranty

*M.G. Chemicals Ltd.* warranties this product for 12 months from the date of purchase by the end user. *M.G. Chemicals Ltd.* makes no claims as to shelf life of this product for the warranty. The liability of *M.G. Chemicals Ltd.* whether based on its warranty, contracts, or otherwise shall in no case include incidental or consequential damage.

## Disclaimer

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