NOVACENTRIX®

Metalon® Conductive Inks for Printed Electronics

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Metalon® PSI-219 Conductive Screen Print Ink

Product Description

PSI-219 is a water-based, silver nanoparticle screen print ink which is designed to cure at low temperatures. Cured features exhibit high electrical conductivity, low surface roughness, and excellent adhesion on a wide range of substrates. When compared to polymer thick film conductive inks, cured films of PSI-219 achieve equal sheet resistance values at lower thickness. As a result, a noticeable savings in material cost is attained. PSI-219 can be printed on plastics, paper, glass, and transparent conducting oxides (TCO). It is used in printed electronics applications which include flexible solar cells, antenna, RFID, sensors, and heaters.

Key Benefits

- High electrical conductivity at low cured film thickness for material cost savings
- Good printability with low surface roughness
- Low-temperature curing at temperatures as low as 60˚C achievable
- Excellent adhesion on plastics, for example, treated polyester, polyimide, polycarbonate, and polyurethane
- Excellent adhesion on glass and transparent conducting oxide (TCO) surfaces
- Good flexibility and crease resistance on plastics and paper
- Good water and alcohol resistance
- Minimal volatile organic compounds (VOCs)
- Easy clean-up with a solution of particle-free detergent and water

Typical Formulation Properties

Silver content (wt. %)	42 (± 2)
Density (wet)	1.4 - 1.6 g / mL
Viscosity @ $10s^{-1}$	3500 - 6000 cP
Viscosity @ $100s^{-1}$	1500 - 3000 cP
pH	5.80 ± 0.05
Shelf life with refrigeration	> 6 months (will need pH adjustment)

Thermal Processing Conditions and Properties of printed films on selected substrates[1]

	Melinex ST505, a type of treated polyester (PET)			
Cure temperature (˚C)	60	80	100	140
Cure time[2] (min)	60	≥ 15	≥ 5	≥ 5
Weight resistivity[3] (gΩ / m²)	1.09 (6.5x bulk Ag)	0.71 (4.2x bulk Ag)	0.63 (3.8x bulk Ag)	0.52 (3.1x bulk Ag)
Volume resistivity[4] (μΩ cm)	22 (14x bulk Ag)	14 (8.5x bulk Ag)	10 (6.3x bulk Ag)	7.4 (4.6x bulk Ag)
Sheet resistance at 1 mil (mΩ / square)	8.5	5.3	3.9	2.9
Cross-cut tape test (ASTM 3359 method B)	5B	5B	5B	5B

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	Kapton HN, a type of polyimide			
Cure temperature (˚C)	140	200	250	275
Cure time[2] (min)	≥ 5	≥ 5	≥ 5	≥ 5
Weight resistivity[3] (gΩ / m²)	0.39 (2.4x bulk Ag)	0.39 (2.4x bulk Ag)	0.36 (2.1x bulk Ag)	0.28 (1.7x bulk Ag)
Volume resistivity[4] (μΩ cm)	7.7 (4.9x bulk Ag)	7.4 (4.6x bulk Ag)	6.3 (4.0x bulk Ag)	4.9 (3.1x bulk Ag)
Sheet resistance at 1 mil (mΩ / square)	3.0	2.9	2.5	1.9
Cross-cut tape test (ASTM 3359 method B)	5B	5B	5B	5B

	Glass			
Cure temperature (˚C)	100	140	200	250
Cure time[2] (min)	≥ 30	≥ 5	≥ 5	≥ 5
Weight resistivity[3] (gΩ / m²)	0.62 (3.7x bulk Ag)	0.55 (3.3x bulk Ag)	0.52 (3.1x bulk Ag)	0.48 (2.9x bulk Ag)
Volume resistivity[4] (μΩ cm)	11 (6.8x bulk Ag)	8.4 (5.3x bulk Ag)	7.8 (4.9x bulk Ag)	6.5 (4.1x bulk Ag)
Sheet resistance at 1 mil (mΩ / square)	4.3	3.3	3.1	2.5
Cross-cut tape test (ASTM 3359 method B)	5B	5B	5B	5B

	Glass
Cure temperature (˚C)	275
Cure time[2] (min)	≥ 5
Weight resistivity[3] (gΩ / m²)	0.36 (2.2x bulk Ag)
Volume resistivity[4] (μΩ cm)	5.8 (3.6x bulk Ag)
Sheet resistance at 1 mil (mΩ / square)	2.3
Cross-cut tape test (ASTM 3359 method B)	5B

[1]The theoretical wet ink thickness for all prints was 51 μm. All prints were cured in a convection oven.
[2]Most tabulated cure times (for a given cure temperature) are shown as a range of times. This is indicated by the use of the "≥" sign. In this range of cure times, the tabulated values of weight and volume resistivity, sheet resistance at 1 mil, and cross-cut tape test result are the same.
[3]The number in brackets for each entry is the weight resistivity value divided by the weight resistivity of bulk silver (at 20˚C).
[4]The number in brackets for each entry is the volume resistivity value divided by the volume resistivity of bulk silver (at 20˚C).

Some recommended Curing Tools

- Convection ovens
- Forced-air drying ovens
- PulseForge® tools (https://pulseforge.com/)
- Near-IR (infrared) heaters

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General Processing Requirements to achieve consistent printing and Clean-up Solution Composition

- Relative humidity near screen-printing apparatus: > 50 %
- Type of screen-printing mesh: stainless steel and polyester
- Type of screen emulsion: water-compatible
- Clean-up solution is 1 part per volume of a particle-free detergent and 19 to 20 parts per volume of deionized water

For more information about this ink, please contact us at info@novacentrix.com