A FERRO COMPANY

# Precious Metal Electrode Inks

**MRA manufactures RoHS-compliant customized silver-palladium electrode inks to offer customers a complete "dielectric plus electrode" package. These electrode inks are formulated to perfectly match the densification of MRA dielectrics. In addition, MRA has the ability to manufacture customized platinum- and gold-based electrode inks to meet your specific applications.**

| Electrode Inks Product Code | Description | Compatible MRA Dielectrics |
|---|---|---|
| **MRA EI-9505-LOW-K-COG** | 95%Ag/5%Pd electrode for low- and mid-K COG dielectrics | VLF-220Aq3, VLF-220Aq4 |
| **MRA EI-9505-HIGH-K-COG** | 95%Ag/5%Pd electrode for high-K COG dielectrics | VLF-101 |
| **MRA EI-9010-LOW-K-COG** | 90%Ag/10%Pd electrode for low- and mid-K COG dielectrics | VLF-220Aq3, VLF-220Aq4, VLF-440 |
| **MRA EI-9010-HIGH-K-COG** | 90%Ag/10%Pd electrode for high-K COG dielectrics | VLF-101, VLF-101M |
| **MRA EI-8020-X7R** | 80%Ag/20%Pd electrode for X7R dielectrics | LF-222M, LF K3000 X7R/X8R, LF K4000 X7R |
| **MRA EI-7030-LOW-K-COG** | 70%Ag/30%Pd electrode for low- and mid-K COG dielectrics | VLF-220Aq3, VLF-440 |
| **MRA EI-7030-HIGH-K-COG** | 70%Ag/30%Pd electrode for high-K COG dielectrics | LF-085, VLF-101, VLF-101M |
| **MRA EI-7030-HIGH-K-COG-FD** | 70%Ag/30%Pd fast drying electrode for high-K COG dielectrics | LF-085, VLF-101, VLF-101M |
| **MRA EI-7030-X7R** | 70%Ag/30%Pd electrode for X7R dielectrics | LF-451C, LF-222M, LF-262, LF K3000 X7R/X8R, LF K4000 X7R, SF-422 |
| **MRA EI-7030-X7R-FD** | 70%Ag/30%Pd fast drying electrode for X7R dielectrics | LF-451C, LF-222M, LF-262, LF K3000 X7R/X8R, LF K4000 X7R, SF-422 |
| **MRA EI-3070-X7R** | 30%Ag/70%Pd electrode for X7R dielectrics | HF-402 |
| **MRA EI-3070-X7R-FD** | 30%Ag/70%Pd fast drying electrode for X7R dielectrics | HF-402 |
| **MRA EI-100Pd-X7R** | 100%Pd electrode for X7R dielectrics | HF-402 |

**MRA - committed to excellence in multi-layer ceramic device technology.**

ISO 9001:2015 BUREAU VERITAS Certification

# Precious Metal Electrode Inks

A FERRO COMPANY

## Key Features

- RoHS compliant
- Compatible with MRA formulated dielectrics
- Available in fast drying form
- Good print laydown
- Excellent lot to lot uniformity

## Typical electrode ink properties

| Electrode Inks Product Code | Metal Type | Metal Content | Additive Type | Solids Content | Viscosity, cPs * | Drying Rate | Thinner |
|---|---|---|---|---|---|---|---|
| **MRA EI-9505-LOW-K-COG** | 95%Ag/5%Pd | 60 | $TiO_2$-based | 64 | 40,000 | 100-120°C, 6min | MRA-IT-A |
| **MRA EI-9505-HIGH-K-COG** | 95%Ag/5%Pd | 60 | Ternary $TiO_2$-based | 66 | 45,000 | 100-120°C, 6min | MRA-IT-A |
| **MRA EI-9010-LOW-K-COG** | 90%Ag/10%Pd | 60 | $TiO_2$-based | 64 | 43,000 | 100-120°C, 6min | MRA-IT-A |
| **MRA EI-9010-HIGH-K-COG** | 90%Ag/10%Pd | 60 | Ternary $TiO_2$-based | 66 | 47,000 | 100-120°C, 6min | MRA-IT-A |
| **MRA EI-8020-X7R** | 80%Ag/20%Pd | 57 | $BaTiO_3$ | 65 | 50,000 | 100-120°C, 6min | MRA-IT-A |
| **MRA EI-7030-LOW-K-COG** | 70%Ag/30%Pd | 60 | $TiO_2$-based | 64 | 40,000 | 100-120°C, 6min | MRA-IT-A |
| **MRA EI-7030-HIGH-K-COG** | 70%Ag/30%Pd | 53 | Ternary $TiO_2$-based | 56 | 47,000 | 100-120°C, 6min | MRA-IT-A |
| **MRA EI-7030-HIGH-K-COG-FD** | 70%Ag/30%Pd | 53 | Ternary $TiO_2$-based | 56 | 37,000 | 100-120°C, 2min | MRA-IT-B |
| **MRA EI-7030-X7R** | 70%Ag/30%Pd | 51 | $BaTiO_3$ | 60 | 48,000 | 100-120°C, 6min | MRA-IT-A |
| **MRA EI-7030-X7R-FD** | 70%Ag/30%Pd | 51 | $BaTiO_3$ | 60 | 35,000 | 100-120°C, 2min | MRA-IT-B |
| **MRA EI-3070-X7R** | 30A%g/70%Pd | 51 | $BaTiO_3$ | 60 | 36,000 | 100-120°C, 6min | MRA-IT-A |
| **MRA EI-3070-X7R-FD** | 30%Ag/70%Pd | 51 | $BaTiO_3$ | 60 | 30,000 | 100-120°C, 2min | MRA-IT-B |
| **MRA EI-100Pd-X7R** | 100%Pd | 51 | $BaTiO_3$ | 60 | 50,000 | 100-120°C, 6min | MRA-IT-A |

* **Note:** Viscosity is measured using Brookfield HAT with HA-6 spindle @ 10 rpm and 25C.

**MRA - committed to excellence in multi-layer ceramic device technology.**

ISO 9001:2015 BUREAU VERITAS Certification

# Precious Metal Electrode Inks

## Process Recommendations

**The following procedures are recommended for printing internal electrodes on ceramic tapes to make multilayer ceramic capacitors. The listed process parameters are used at MRA, but customers may need to adjust them appropriately to accommodate the specifics of their process.**

**Before use: Slow rolling for 24 hours or milling by hand for 10 minutes. Several prints should be made to "work" the paste prior to production.**

**Thinning: The electrode paste is supplied at design rheology for optimum performance. If thinning is required, depending on the electrode ink composition, either MRA-IT-A or MRA-IT-B ink thinners should be used for best compatibility. Please refer to the "Typical Electrode Ink Properties" table for the correct selection of the electrode ink thinner.**

**Printing: 325 to 400 mesh calendered screens are recommended for uniform deposition. Optimum screen printing parameters should be determined by the customer.**

**Drying: Drying at 100°C – 120°C for 6 minutes under conventional or IR heat. For the fast drying versions of the electrode inks, the drying time can be reduced to 2 minutes at 100°C – 120°C.**

**Firing: Firing in accordance with recommendations for ceramic dielectric compositions.**

**Shelf Life and Storage Conditions: Shelf life of a factory sealed container is one year from date of manufacture when stored at 25°C ±5°C at 45% - 65% RH, not exposed to direct sunlight or temperature extremes. Continuous rolling of container is not required.**

*The data presented is based on our research and is considered to be fair representation of this product.*
*MRA makes no warranties, expressed or implied, as to its accuracy and assumes no liability out of its use by others.*

15 Print Works Drive, Adams, MA, 01220, USA
Tel: (413) 743-3927, Fax: (413) 743-0305, E-mail: mra@mralabs.com, Web: www.mralabs.com