Frequently asked questions

Question:

What electrode types does Meggitt offer?

Answer:

In Ferroperm we use four different processes to deposit an electrode on the surface of the parts. Each of these processes has different characteristics, so the right choice of electrode will depend completely on your application.

Screen-printed electrodes

Process description

An electrode paste containing metal particles, a glass fritt, and organic additives/solvents is deposited on the surface of the ceramic by screen-printing. After drying the electrode paste is heated to 700° C, where the organics burn off, the melted glass fritt reacts with the surface of the ceramic, and the metal particles sinters into a dense metal layer.

Available materials

- Regular Silver for most general applications.
- Low-Glass-Silver for easy soldering (low adhesion strength between electrode and ceramic!).
- Gold-Palladium alloy for parts with operating temperatures above 300° C.

Available thickness

- 4-5 micron layers recommended for parts thinner than 0,5 mm.
- 8-10 micron layers recommended for most other parts.

Strength of screen-printed electrodes

- Cheap and flexible solution used for most piezoelectric parts.
- Low start-up cost.
- Low unit cost.
- Good solderability.
- Excellent adhesion strength when Regular Silver is used.
- Possibilities to produce wrap-around electrodes and special patterns.

Weakness of screen-printed electrodes

- Not possible to use for shear type elements.
- Relative thick electrodes constrain vibration in parts with resonances above 4-5 MHz.

Dipped silver electrodes for tubes

Process description

An electrode dispersion similar to the paste used in regular screen printed silver are homogenised by intensive milling. The tubes are submersed into the silver dispersion. After drying the electrode paste is heated to 700° C, where the organics burn off, the melted glass fritt reacts with the surface of the ceramic, and the metal particles sinters into a dense metal layer.

Available materials

• Regular Silver for normal tubes.
• Gold palladium for high-temperature tubes.

Available thickness

• 8-15 micron layers.

Strength of dipped silver electrodes

• Normal process for PZT tubes.
• Low start-up cost.
• Low unit cost.
• Good solderability.

Weakness of dipped silver electrodes

• Not possible to use for shear type elements.
• Small variations in electrode thickness between the top/bottom and the middle of the tube can sometimes be observed.

Chemically deposited electrodes

Process description

Nano-sized catalytic particles are deposited on the surface of the ceramic. When the parts are submersed in an aqueous solution containing special Nickel complexes, a self containing catalytic reaction will deposit a metallic nickel layer on the ceramic. The top nickel layer is subsequently ion-exchanged with gold.

Available materials

• Nickel-Gold for most parts.
• Pure Nickel in special cases.

Available thickness

• 1,5 – 2 micron Nickel + a few nano meters gold.

Strength of chemically deposited electrodes

- Possible to make shear type parts.
- Good solderability.
- High adhesion strength.
- Possibilities to produce wrap-around electrodes and special patterns.
- Thin electrode does not constrain vibration in thin parts.

Weakness of chemically deposited electrodes

- Relative high start-up cost.
- Not possible to use with Pz35 and Pz46.

Evaporated electrodes

Process description

Parts are mounted in special fixtures and ultrasonically cleaned at very high power. Parts are dried at high temperature and transferred to a vacuum chamber. An evaporation process is performed by electrically melting chromium and noble metals, which diffuse onto the surface of the parts at pressures of approximately 1 nanobar.

Available materials

- Chromium-silver for most parts.
- Chromium-gold for parts with operation temperatures of 300–400° C.
- Pure Chromium layers in special cases.
- Gold flash on top of silver layers available for identification of positive side.

Available thickness

- 1,5 – 2 micron chromium + 0,1 micron silver or gold.
- 4 – 6 micron layer chromium in special cases.

Strength of evaporated electrodes

- Possible to make shear type parts.
- Thin electrode does not constrain vibration in thin parts.

Weakness of evaporated electrodes

- Not possible to produce wrap-around electrodes and special patterns.
- High start-up cost for special fixtures.
- Moderate electrode adhesion.
- Relative difficult to solder.