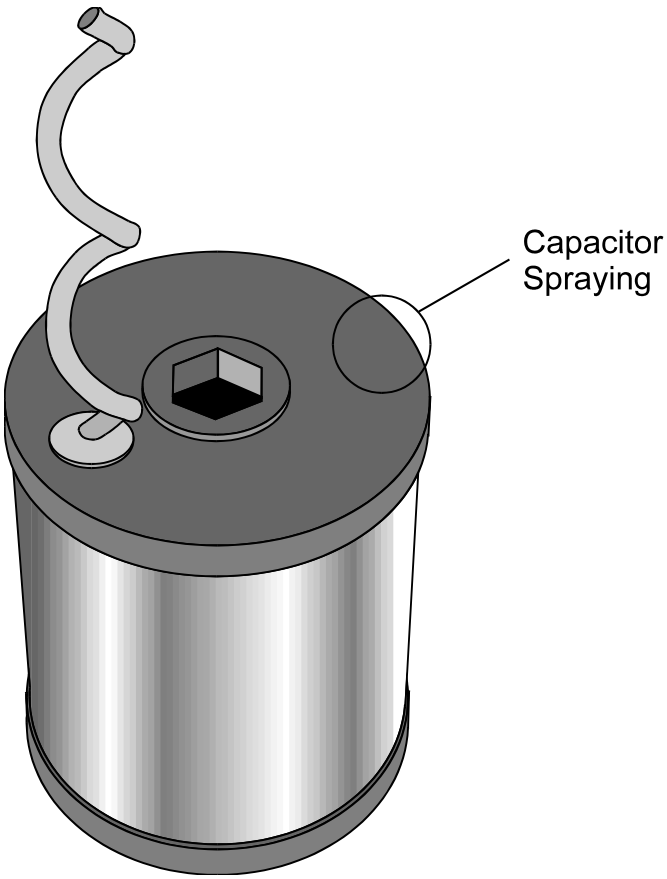
Metallisation
Thermal spray equipment and consumables

Metal Spraying Of Capacitor Ends

Application Data Sheet EL-EP-001



Introduction

The most common type of capacitor in use today is the foil-wound type. A thin film of metal, 1μm, is deposited on one side of a thin, 2.5 - 14 μm, polymer film di-electric leaving one edge uncoated. The film is wound around a central insulating core to form a 'swiss roll' with the uncoated edges staggered to permit the ends to be joined. The ends of the roll are then sprayed with metal to link up the electrodes and provide a surface for attaching the terminals.

Larger, specialist capacitors are also sprayed.

Equipment

Metallisation 528E, 140 or 340 Arcspray Systems

Materials

Metallisation 02E 99.99% purity zinc wire

Metallisation 09E 60/40% purity tin/zinc wire

Many metals may be sprayed on to the ends of capacitors; copper, brass, aluminium, zinc and tin-zinc alloys have been employed. Modern practice favours zinc and tin-zinc, since these materials cause less damage to the capacitor, provide a better surface for attaching and give more consistent results. The sprayed deposits may be either combustion flamesprayed or electric arcsprayed but arcsprayed coatings are most commonly used. Because arcsprayed zinc and tin-zinc give cooler deposits there is less damage to capacitors and the product is more consistent. Arcspraying also offers considerable production engineering and economic benefits.

Manufacture of Capacitors

The rolled capacitors are mounted in a jig. Masking is accomplished either by an extra film winding, which is removed before boxing or encapsulation of the capacitor, or by flattening the capacitors and packing them tightly into the spraying jig. For small quantity production, jigs may be hand sprayed or hand fed to a pistol on a fixed mounting, but, where large quantities (several hundred thousand - several million/week) are required, fully automated plant where both pistol and jig are moved to give a controlled x-y traverse may be supplied. The pistol is usually directed either normal to the capacitor end or up to 15° from the normal. The sprayed coating thickness is determined by the winding quality and is usually 0.014"-0.016" (350μm - 400μm) but for some high class thin film capacitors, coatings may be thinner 0.010"-0.012" (250μm - 300μm). The choice of coating depends on the joining technique; usually the coating is mainly zinc with the final 0.003"-0.004" (75μm - 100μm) being tin-zinc to provide a readily solderable surface. Some applications will just apply only zinc or only tin-zinc to simplify the application process.

It is preferable that metal spraying takes place after heat stabilisation, since this and the consequent shrinkage could cause a previously sprayed end connection to break up. Terminals are usually attached by soldering but in some cases micro-welding techniques may be employed.

	INITIAL DEPOSIT	**FINAL DEPOSIT**
Equipment:	Arcspray 528E (Automatic) Arcspray 140/340 (Automatic or manual)	Arcspray 528E (Automatic) Arcspray 140/34 (Automatic or manual)
Wire Type:	Metallisation 09E Tin/Zinc (60/40) or: Metallisation 02E Zinc	Metallisation 09E Tin/Zinc (60/40) or: Metallisation 02E Zinc
Wire Size:	2.0mm	2.0mm
Spraying Voltage:	18-22V	18-22V
Current:	Sn/Zn:100A, Zn:100A	Sn/Zn:80A
Air Pressure:*	80 psi (5.4 bar)	80 psi (5.4 bar)
Spray Range:*	8-10 ins (20-25 cm)	8-10 ins (20-25 cm)

* Excessive air pressure and spraying ranges will result in serious metal losses. It is usual to experiment with these parameters to determine the minimum values, which will give satisfactory deposits.

Advantages of Arcspraying

- Reduced spraying ranges and higher particle velocities give better penetration of the foil windings.
- The lower heat input to the capacitors gives more consistent products.
- Arcspraying is inherently more consistent in operation.
- Arcspray coatings are denser and contain less oxide.
- The lower heat input to the capacitors gives reduced scrap rates.
- Arcspraying equipment is easily automated.
- Electrical energy costs are cheaper than fuel gas/oxygen.
- No energy is consumed when not spraying.
- Stop-Start operation is easier.
- Electrical supplies are generally more readily available.
- Potentially flammable and explosive gases are not required.

Reference Technical Bulletins:

No. 2.2.2 Metallisation Wire 02E Zinc

No. 2.3.3.1 Metallisation Wire 09E Tin Zinc