



KappAloy™ & Eco-Babbitt Spray Wires in Capacitor Manufacturing

Background Information

KappAloy™ Tin-Zinc & Eco-Babbitt coatings are applied to capacitors to join capacitor layers and terminals, and as a protective coating:

- To shield sensitive electronics against Electromagnetic Interference (EMI) & Radio Frequency Interference (RFI);
- To shield against corrosion;
- To prevent current and charge leakage out of and within the capacitor; and,
- To prevent the development of electron flows within the coating material itself. These currents diminish coating effectiveness, capacitor performance and capacitor life.

Each of these performance characteristics is maximized by the deposition of a consistent thickness and composition coating. The standard formulations of Tin-Zinc and Eco-Babbitt spray wires are shown in the table below, and compared to pure Tin and pure Zinc:

COMPOSITION	MELTING RANGE°F	MELTING RANGE°C
Pure Tin	449	232
KappEco-Babbitt – 90Sn-7Zn-3Cu	392 – 432	200 – 222
KappAloy20 – 80%TIN-20%ZINC	390 – 550	199 – 288
KappAloy30 - 70%TIN-30%ZINC	390 – 600	199 – 316
KappAloy40 - 60%TIN-40%ZINC	390 – 650	199 – 343
Pure Zinc	788	420

The Challenge of Manufacturing Consistent Tin-Zinc & Tin-Zinc-Copper Spray Wire, and Why It Matters

The typical manufacturing method for Tin-Zinc and Tin-Zinc-Copper spray wire alloys is to form billets of the alloy, and then extrude wire from these billets using an extrusion press. Tin-based alloys are typically extruded from 3, 4 or 5 inch diameter billets. The larger the diameter of the billet, the more wires can be extruded at the same time, thus increasing press output, and decreasing costs.

Unfortunately, Tin-Zinc and Tin-Zinc-Copper alloys segregate during billet and wire cooling. Billet segregation is the largest concern - the greater the billet diameter, the greater the segregation of the alloy during cooling. In addition, the greater the Zinc content the greater the segregation in the billet. Segregation in the billet can lead to wire that is substantially off-alloy and inconsistent. This can lead to wire breakage, gun clogging and poor deposition during thermal spraying. In addition, this can result in an uneven bimetallic coating rather than a consistent alloy coating. An inconsistent coating results in diminished performance in all five of the desired characteristics above. The coating designed to shield and protect your expensive part is now part of the problem – generating electron flows which degrade performance and capacitor life.

Billet segregation has led some manufacturers to produce smaller 1 to 2 inch diameter billets for use in extrusion presses designed for these smaller billets. The billets can be cooled more quickly, and thereby component segregation is decreased. The tradeoff is that wire production rates are substantially diminished using smaller billets. In addition, segregation is still a problem in the billet and in the extruded wire as it cools.

Kapp Precision Microcasting™ Solves Your Spray Wire Problems

Kapp Alloy developed the proprietary **Precision Microcasting™** process specifically to address the adverse effects of segregation during billet and wire formation:

1. Excessive spray head wear and clogging,
2. Inconsistent spray gun performance due to inconsistent alloys,
3. Excessive wear of spray gun feed components due to scale and segregation,
4. Excessive wire breakage and feed jams due to inconsistent alloys,
5. Improper coating deposition and inclusions due to inconsistent alloys,
6. Current and charge buildup due to inconsistent alloys, and
7. Corrosion and component failure due to inconsistent spray coatings.

Our proprietary **Precision Microcasting™** process forms the wire directly from the molten alloy. The wire cools extremely quickly, maintaining a precise alloy from edge-to-edge and end-to-end through thousands of pounds of wire. In addition, several production steps are eliminated to increase production efficiency and decrease potential errors and defects.

Precision Microcasting™ avoids the component segregation, brittleness and wire breakage of extruded wires that can bring your spray wire operation to a grinding halt. In our work with capacitor manufacturers, the most critical objectives have been identified as

- maximizing operational productivity, and
- minimizing final product defects.

Kapp Alloy's Precision Microcast™ spray wire ensures you reach your operational objectives.

Whether your process calls for 100 lbs/month or 1000lbs/day, our **Precision Microcasting™** process guarantees superior wire edge-to-edge and end-to-end forever. If you need further information, please do not hesitate to contact us by telephone at 800-327-6533 or by email at jack@kappalloy.com.