Spectra-Mat, Inc.
100 Westgate Drive
Watsonville, CA 95076
phone: 831-722-4116
fax: 831-722-4172
www.spectramat.com

An Employee-Owned Company

TECHNICAL BULLETIN

EMISSION CHARACTERISTICS — DISPENSER CATHODES

The type "M" cathode is an improved version of the familiar tungsten impregnated cathode, employing a coating of an alloy of platinum group metals on the emissive surface to lower the work function of the activated cathode. As a result, this emitter may be operated at lower temperatures than the standard dispenser cathode for the same current density.

Typically, the M-cathode is capable of a zero field emission of 16.5 A/cm^2 (411 M) maximum and 10.0 A/cm^2 (532 M) minimum at 1050^{o}C brightness on the tungsten emitter. It may also be operated as high as 1100^{o}C brightness with an emission density of 24.0 A/cm^2 (411 M) with sacrifice of life. Emission characteristics of the M-cathode family and the tungsten dispenser cathode family are shown on the attached graphs.

The lower operating temperature characteristics of the "M" type cathode, up to 100^{o}C cooler when compared to the dispenser cathode at the same current density, allows a reduction of up to 85% in barium evaporation rate as well as a 35% saving in heater power. Spectra-Mat has confirmed the saturated emission reported in literature[1].. In an in-house study our cathodes were subjected to emission testing as well as scanning electron microscopy and Auger spectroscopy.

Life testing of the M-cathode shows 100,000 hours plus at nominal (2-3 A/cm2) loadings. Higher loadings will affect the overall life, but with a suitable vacuum envelope, an M-cathode will typically exceed the life of the surrounding components – high voltage feedthroughs, for example, have a failure rate far in excess of a properly activated cathode.[2]

M-Cathodes can be reactivated to reach 95%+ of their original emission without adversely affecting life.[3] Although the same steps are followed, re-activation may take longer than the original activation

The type M-cathode is available in 53280,31180, 41180 and 61280 in the same configurations as the standard dispenser cathode and are designated 53280M, 31180M, 41180M and 61280M. 82% dense tungsten is also available in each of these. The designation is an industry standard identifier—532, for example, identifies the molar ratio of the aluminates (BaO.CaO.Al2O3), 80 identifies the matrix density percentage, and M identifies the Os-Ru coating.

---

[1] Representative data taken from Philips-Elmet reviews, April, 1973. Published references include: Phillips Tech Review, No 3/4 1966, Vol 27 pp69 -75, *Osmium Dispenser Cathodes,* P. Zalm & A.J.A. Van Stratum; US Patent 3,373,307, 3/12/1968; JAP Vol 42, No. 11, 10/1971 pp. 4436-37

[2] See Crane NAVSURFWARCEN life test reports, 1998 - or beyond.

[3] Philips-Elmet Bulletin, "Philips Impregnated Cathodes", 06/1973

Spectra-Mat, Inc.
100 Westgate Drive
Watsonville, CA 95076
phone: 831-722-4116
fax: 831-722-4172
www.spectramat.com

An Employee-Owned Company

TECHNICAL BULLETIN

EMISSION AS A FUNCTION OF TEMPERATURE FOR DISPENSER CATHODES