**3M™ Tungsten Dispenser Cathodes**

**Introduction**

3M™ Tungsten Dispenser Cathodes typically consist of a porous tungsten matrix, impregnated with a barium-based emission enhancing material. Depending on the application, this matrix may also be a mixed metal, such as tungsten iridium or tungsten molybdenum (for SEMBO cathodes).

Dispenser cathodes are used in all types of vacuum devices, as well as in inert and reducing atmospheres. The most common applications include TWTs, klystrons, magnetrons and plasma devices.

We are involved at each stage of the cathode manufacturing process, from basic raw materials through the manufacturing of critical components to final assembly. This includes chemical cleaning of the emitting surface to ensure open porosity.

Porosity is verified using scanning electron microscopy. All cathode heater assemblies, if applicable, are tested for proper heater operation. Our quality systems can provide fully qualified cathode assemblies with all required backward and forward material and process traceability.

**3M™ Remote Access Data Acquisition and Recovery System (RADAR)**

The manufacture of quality components for Vacuum Electron Devices (VEDs) used in the communications, space and defense industries requires precisely-controlled and traceable process steps. Based on 60 years of industry experience, we offer customers a proven software solution that can help automate and simplify their data collection, training and documentation requirements through 3M™ Remote Access Data Acquisition and Recovery System (RADAR).

The 3M remote access data acquisition and recovery system is a suite of software communications tools. Its purpose is to establish best practices for controlling the manufacture of cathodes and cathode assemblies, and to provide customers with all required backward and forward material and process traceability. The system acts as a “bridge,” allowing the exchange of data between multiple software platforms.

RADAR provides nearly instantaneous access to any combination of data, including:

- Employee Training and Task Qualification Records
- ISO Procedures and Revision Control System

**Typical Physical Properties**

(Not for specification purposes)

<table>
<thead>
<tr>
<th>Cathode Type</th>
<th>Description</th>
<th>Work Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Porous tungsten impregnated with 5:3:2 BCA</td>
<td>2.1 ev</td>
</tr>
<tr>
<td>S</td>
<td>Porous tungsten impregnated with 4:1:1 BCA</td>
<td>2.1 ev</td>
</tr>
<tr>
<td>M</td>
<td>Porous tungsten iridium impregnated with 4:1:1 BCA or other and sputter coated with Os/Ru</td>
<td>1.8 ev</td>
</tr>
<tr>
<td>MM</td>
<td>Porous tungsten iridium impregnated with 4:1:1 BCA or other</td>
<td>1.8 ev</td>
</tr>
</tbody>
</table>

- **Size Range** 0.010” – 8.00” (0.25 mm – 200 mm)
- **Tungsten Density Range** 74% – 84%
- **Impregnant Types** 4:1:1 (S), 5:3:2 (B), 6:1:2, 3:1:1 or any other required type
- **Sputter Coatings** Osmium Ruthenium (M), Iridium; other coatings possible
- **Materials** Tungsten, molybdenum, molybdenum-rhenium, rhenium, tungsten-rhenium, Kovar®, nickel, stainless steel, Monel® and others
- **Machined Tolerances** To ±0.0002” (=0.005 mm)
- **Brazes** Ranging from molybdenum-rhenium (mp 1980°C) to low temperature alloys such as copper-gold (mp 910°C)
- **Operating Temperature** From 910°C to 1200°C
- **Emission Density** Continuous, as high as 20 A/cm², typically 2 – 5 A/cm²; pulsed, as high as 120 A/cm², typically 30 – 70 A/cm²
- **Life Expectancy** From 3,000 hours to 150,000 hours
3M Technical Ceramics can assist you in meeting your custom design requirements. This includes helping you determine an optimal balance of properties, such as emissions, barium evaporation rate and cathode lifetime.

**Export Control:** The 3M Technical Ceramics product(s) listed here may be controlled commodities under applicable U.S. export control laws and regulations, including, but not limited to, the U.S. International Traffic in Arms Regulations (ITAR) and the Export Administration Regulations (EAR). These laws and regulations may, among other things, prohibit the export and/or reexport of controlled product(s) to any or all locations outside of the United States without prior U.S. Government export authorization, the sharing of export controlled technical data and services with those anywhere who are not U.S. citizens or U.S. permanent residents, dealings with U.S. Government, United Nations and other “Restricted Parties,” and proliferation activities including those that further nuclear, chemical, or biological warfare, missile stockpiling/use, or the use of rockets or unmanned aerial vehicle systems. 3M Technical Ceramics and purchasers or prospective purchasers of the 3M Technical Ceramics product(s) shall comply with all applicable export control laws and regulations, which may require obtaining and maintaining applicable export control authorization or licenses, and understand that the ability of a party to obtain or maintain such authorization or license is not guaranteed. The exporter of record has the sole responsibility to determine whether the export or subsequent reexport of the 3M Technical Ceramics product(s) requires export authorization. An explicit condition to 3M Technical Ceramics selling or making available the 3M Technical Ceramics product(s) is the customer’s agreement to comply with all applicable trade compliance laws and regulations.

---

**Warranty, Limited Remedy, and Disclaimer:** Many factors beyond 3M Technical Ceramics’ control and uniquely within user’s knowledge and control can affect the use and performance of a 3M Technical Ceramics product in a particular application. User is solely responsible for evaluating the 3M Technical Ceramics product and determining whether it is fit for a particular purpose and suitable for user’s method of application. User is solely responsible for evaluating third party intellectual property rights and for ensuring that user’s use of 3M Technical Ceramics product in user’s product or process does not violate any third party intellectual property rights. Unless a different warranty is specifically stated in the applicable product literature or packaging insert, 3M Technical Ceramics warrants that each 3M Technical Ceramics product meets the applicable 3M Technical Ceramics product specification at the time 3M Technical Ceramics ships the product. 3M Technical Ceramics MAKES NO OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OR CONDITION OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY IMPLIED WARRANTY OF NON-INFRINGEMENT OR ANY IMPLIED WARRANTY OR CONDITION ARISING OUT OF A COURSE OF DEALING, CUSTOM OR USAGE OF TRADE. If the 3M Technical Ceramics product does not conform to this warranty, then the sole and exclusive remedy is, at 3M Technical Ceramics’ option, replacement of the 3M Technical Ceramics product or refund of the purchase price.

**Limitation of Liability:** Except where prohibited by law, 3M Technical Ceramics will not be liable for any loss or damages arising from the 3M Technical Ceramics product, whether direct, indirect, special, incidental or consequential, regardless of the legal theory asserted, including warranty, contract, negligence or strict liability.

**Technical Information:** Technical information, recommendations, and other statements contained in this document or provided by 3M Technical Ceramics personnel are based on tests or experience that 3M Technical Ceramics believes are reliable, but the accuracy or completeness of such information is not guaranteed. Such information is intended for persons with knowledge and technical skills sufficient to assess and apply their own informed judgment to the information. No license under any 3M Technical Ceramics or third party intellectual property rights is granted or implied with this information.

---

**3M Technical Ceramics, Inc.**
695 Laco Drive
Lexington, Kentucky 40510
Phone 895-255-3664
Web www.3M.com/cathodes

Monel is a registered trademark of Special Metals Corporation. Kovar is a registered trademark of Carpenter Technology Corporation.

3M is a trademark of 3M Company. Used under license by 3M subsidiaries and affiliates.

Please recycle. Printed in USA © 3M 2020. All rights reserved. Issued: 12/20 16581HB 98-0050-0302-9 Rev. C