

## Brief description on Thermionic Dispenser Cathodes

Dispenser cathodes are the source of electron beam for various vacuum electron devices such as Travelling Wave Tubes, Klystrons, Magnetrons and Backward Wave Oscillators etc. The basic requirements of a conventional dispenser cathodes are uniform emission over the surface, Low barium evaporation rate, higher zero field emission density ( $>15 \text{ A/cm}^2$  at  $1050^\circ\text{C}$ ) and long life. The size, shape and the zero field emission density requirement varies depending on the application. Ruggedness towards various levels of vibration plays major role in deciding the life of the vacuum devices in which the dispenser cathodes are being used. These cathodes are indirectly heated cathodes and hence optimized heater design and heater potting is also critical. Vacuum grade refractory materials like Molybdenum, porous Tungsten, Tungsten-Rhenium alloy material for heater wire and Moly-Rhenium foils are some of the materials used for developing the cathode. Dimensional tolerances, cleanliness during the development also plays major role in the performance of the cathode.

MTRDC has successfully established the M-type dispenser cathode technology and developed cathodes of various sizes ranging from 1.4 mm diameter to 30 mm diameter. More than  $15 \text{ A/cm}^2$  current density was achieved at operating temperature of  $1050^\circ\text{C}$ . The life test for more than 70,000 Hrs has been carried out for M-type dispenser cathodes without any measurable performance degradation. These cathodes has been incorporated in various electron guns and microwave tubes.



**Figure:** Photo of dispenser cathodes developed at MTRDC. Cathode diameter ranging from 1.4 mm to 30 mm, for various vacuum microwave devices.