

## **HIGH CURRENT DENSITY – LONG LIFE CATHODES**

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Creek Research, Inc. (CCR) is continuing development of higher current density cathodes using sintered tungsten wire technology [1]. The goal is cathodes capable of operating at 50 A/cm<sup>2</sup> or more for many thousands of hours. The sintered wire technology provides a simple process for fabricating reservoir cathodes with controlled porosity. Control of the porosity allows the designer to tailor the barium diffusion rate based on the current density requirement. This minimizes spurious barium diffusion and maximizes lifetime. An additional benefit is extremely uniform coverage of barium on the emitting surface, resulting in very low emission spread.

Test results will be presented indicating the performance exceeds that of sintered powder dispenser cathodes in terms of emission spread and work function. The reservoir configuration provides long life, because far more barium is available than in impregnated cathodes. Calculated life of test cathodes operating at 50 A/cm<sup>2</sup> exceeds 50,000 hours.

Successful development of high current density, long life cathodes could have significant implications for high frequency RF sources currently under development. High current density cathodes would reduce or eliminate requirements for beam compression, greatly facilitating both the design and fabrication of electron guns.

High current density and long life result in the reservoir configuration and the control porosity features of the sintered wire material. The same geometries, tolerances, and machining operations applicable to conventional porous tungsten cathodes are compatible with tungsten wire cathodes. Wire cathodes are currently being implemented into an electron gun for a Ka-Band TWT and a W-Band backward wave oscillator. Tungsten wire reservoir cathodes can be built as drop-in replacements for many existing electron guns, offering improved performance and significantly longer lifetimes.

1. [1] R.L. Ives et al. "Controlled Porosity Cathodes from Sintered Tungsten Wires, IEEE Trans. On Electron Devices, Vol. 52, No. 12, pp. 2800-2805 (December 2005).

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\* This research was supported by U.S. Department of Energy Grant DE-FG02-04ER83918