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Repetitively Pulsed Cold Cathode Research in the NRL Plasma Physics Division

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A large selection of materials have been investigated as electron beam producing repetitively pulsed cold cathodes. The cathodes were tested at 200 kV to 500 kV, 100 A to 110 kA, with cathode cross-sections ranging from 5 cm² to 3000 cm², and pulse widths from 50 ns to 300 ns. Cathode turn-on time and emission uniformity were measured, and cathode longevity was estimated for the following materials: solid carbon, carbon fiber flock with and without cesium iodide (CsI) coating, velvet with different fiber lengths and fiber densities, glass fiber, carbon fiber cloth, bundles of carbon fibers, carbon foam, ceramic honeycomb, ceramic/metal configurations, silicon carbide, and diamond-like carbon.

This paper provides a summary of two decades of cold cathode research, discusses the advantages and limitations of each cathode material, and it covers other topics relevant for rep-rated operation, such as cathode holding structures and vacuum chamber pressure considerations.

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