

Laser Heated LaB6 Thermionic Cathode on a MV Electron Beam Accelerator *

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One of the major problems in high voltage/ current and long pulse e-beam generation is plasma diode closure. LaB6 thermionic cathodes can eliminate plasma and are more robust from poisoning than oxide cathodes. To heat the LaB6 disk on the MELBA cathode stalk at -1 MV we employ a 100-650 W CW Nd:YAG laser. Depending upon the LaB6 disk diameter (1.3 cm or 2.2 cm), temperature, and cathode shape, preliminary analysis of experiments suggests three e-beam modes:

- 1) Thermionic mode at electron beam current density up to 90 A/cm², with current shape which matches the voltage flatness,
- 2) Plasma mode in which 2-6 kA of current is drawn with rapid current ramping, and
- 3) Combined thermionic and plasma mode with initial thermionic current turnon which is later overtaken by plasma current.

It is believed that the plasma modes may involve explosive edge emission or outgassing from a graphite cathode mounting structure.

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