Electron-beam diodes using ferroelectric cathodes

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(Received 3 August 1992; accepted for publication 1 December 1992)

A new high-current density electron source is described. The source consists of a polarized ferroelectric ceramic disk with silver electrodes coated on both faces. The front electrode consists of a periodic silver grid alternating with exposed ceramic. A rapid change in the polarization state of the ceramic results in the emission of a high-density electron cloud into a 1–10-mm accelerating diode gap. The anode potential is maintained by a charged transmission line. Some of the emitted electrons traverse the gap and an electron current flows. The emitted electron current has been measured as a function of the gap spacing and the anode potential. Current densities in excess of 70 A/cm^2 have been measured. The current is found to vary linearly with the anode voltage for gaps < 10 mm, and typically exceeds the Child–Langmuir current density by at least two orders of magnitude. The experimental data is compared with predictions from a model in which the electrons emitted from the ferroelectric reflex in the diode gap.