

DPP08-2008-000021

Abstract for an Invited Paper
for the DPP08 Meeting of
the American Physical Society

Pulsed Plasma Electron Sources

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Pulsed ($\sim 10^{-7}$ s) electron beams with high current density ($> 10^2$ A/cm²) are generated in diodes with electric field of $E > 10^6$ V/cm. The source of electrons in these diodes is explosive emission plasma, which limits pulse duration; in the case $E < 10^5$ V/cm this plasma is not uniform and there is a time delay in its formation. Thus, there is a continuous interest in research of electron sources which can be used for generation of uniform electron beams produced at $E \leq 10^5$ V/cm. In the present report, several types of plasma electron source (PES) will be considered. The first type of PES is fiber-based cathodes, with and without CsI coating. The operation of these cathodes is governed by the formation of the flashover plasma¹ which serves as a source of electrons. The second type of PES is the ferroelectric plasma source (FPS).² The operation of FPS, characterized by the formation of dense surface flashover plasma is accompanied also by the generation of fast microparticles and energetic neutrals.³ The latter was explained by Coulomb micro-explosions of the ferroelectric surface due to an large time-varying electric field at the front of the expanding plasma. A short review of recent achievements in the operation of a multi-FPS-assisted hollow anode to generate a large area electron beam will be presented as well. Finally, parameters of the plasma produced by a multi-capillary cathode with FPS and velvet igniters⁴ will be discussed.

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