

# **DEVELOPMENT OF THE PSEUDOSPARK-SOURCE ELECTRON GUN AND A SLOW WAVE STRUCTURE FOR A MILLIMETER-BAND BACKWARD-WAVE OSCILLATOR**

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## **ABSTRACT**

One of the promising trends in the development of a high-power vacuum and plasma sources of sub-THz radiation is utilizing a pseudospark discharge based hollow cathode electron gun. In comparison with thermionic cathodes, a pseudospark discharge based hollow cathode electron gun has a much higher beam current density and eliminates the need for a guiding magnetic field for electron beam propagation due to ion focusing mechanism.

We consider the design and development of the pseudospark discharge based electron gun and the slow-wave structure for a V-band backward-wave oscillator (BWO). The BWO is driven with a 30-40 kV, 10-20 A sheet electron beam with 50-100 ns pulse duration. The simulations as per the different beam parameters for the pseudospark-based electron gun has been performed using COMSOL Multiphysics simulation software. The components like hollow cathode, planar anode and multi-gap have been developed. Also, the sine-waveguide slow-wave structure (SWS) is also designed and simulated by using COMSOL Multiphysics package. For fabrication of the SWS we use the CNC micro-milling machine [2]. Dimensions of the fabricated SWS are controlled by SEM and optical study. Experimental cold-test S-parameters are measured utilizing PNA N5227A vector network analyzer and compared with the simulated ones. Output power and oscillation frequency are calculated by using 3-D PIC simulation. BWO with a pseudospark discharge based electron gun can be used in various applications including non-destructive evaluation, spectroscopy and material science, high-data-rate communications, and etc.

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## **References**

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