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Experimental Studies on Cathode Material Dependence of Mirowave Power in Axially-Extracted Vircator with Resonance Cavity

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High power microwave sources play a significant role in a variety of applications such as accelerators, basic physics, astronomy, high power radar, thermonuclear fusion, and various industrial applications. The virtual cathode oscillator (vircator) is one of the most promising high-power microwave sources among several types of pulsed high power microwave generators. The vircator is considered to be very attractive due to its conceptual simplicity, output power capability, and frequency tenability. However, the efficiency of converting an electron beam to microwave is still several percent and does not reach sufficient levels. Recent research efforts and experimental studies on vircators have been concentrated on the efficiency improvement and oscillation frequency control.
High power microwaves generated in an axially extracted vircator have been studied experimentally in our laboratory. The vircator is driven by a Marx generator and pulse forming line (400 kV, 50 ns, 3 Ω). To improve the efficiency, we installed a resonator in vircator since the narrowing of the output microwave frequency leads to the improvement of the efficiency. The disc resonator with a center hole was placed at the distance x away from an anode with anode-cathode gap of 8 mm. The power of output microwaves were measured varying the distance x to analyze the resonator effect. In addition, the characteristics of high power microwaves depend sensitively on the electrode material and the anode-cathode (AK) gap distance. In this paper, We report the experimental studies on the output characteristics of high power microwaves from the axial vircator with resonance cavity for various anode-cathode (AK) gaps using different materials as a cathode material.

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