Experimental Study of Oversized Backward Wave Oscillator with Coaxial Slow-Wave Structure

H. Yoshimura, K. Ogura, K. Bansho, H. Iiduka, M. Takahashi, A. Sugawara

Graduate School of Science and Technology, Niigata University, Niigata 950-2181, Japan

e-mail address : f09e105b@mail.cc.niigata-u.ac.jp

Microwaves at moderate-power level or high-power level are demanded for widespread applications including plasma heating, plasma diagnostics and radar systems. Slow-wave microwave devices such as backward wave oscillators (BWOs) have been studied extensively as a candidate for high or moderate power microwave sources. In the slow-wave devices, slow-wave structure (SWS) is used to reduce the phase velocity of electromagnetic wave to the beam velocity. In order to increase the operation frequency and the power handling capability, oversized devices are used successfully. K and Q band oversized BWOs operating in the weakly relativistic region less than 100kV are reported in Ref. [1] and their improved performances in Ref. [2]. SWSs used in these experiments are a hollow waveguide having a periodical corrugation on the wall like Fig.1(a). With the hollow SWS, the higher the operation frequency is, the more difficult the manufacture of corrugation becomes.

Introduction of inner conductor is expected to increase the operation frequency and stabilize the electron beam propagation. In this work, we investigate coaxial oversized BWO operations. The coaxial SWS are composed of oversized hollow waveguide and inner conductor. The corrugated hollow waveguide and corrugated inner conductor are shown in Fig.1(a) and (b), respectively. The corrugations have a rectangular shape with parameters for K band BWO [3]. There are three kinds of coaxial structure; (1) corrugated waveguide and straight inner conductor, (2) straight waveguide and corrugated inner conductor and (3) corrugated waveguide and corrugated inner conductor. Performances of these coaxial BWOs are examined experimentally. And the inner conductor's effects on the oversized BWO are studied.

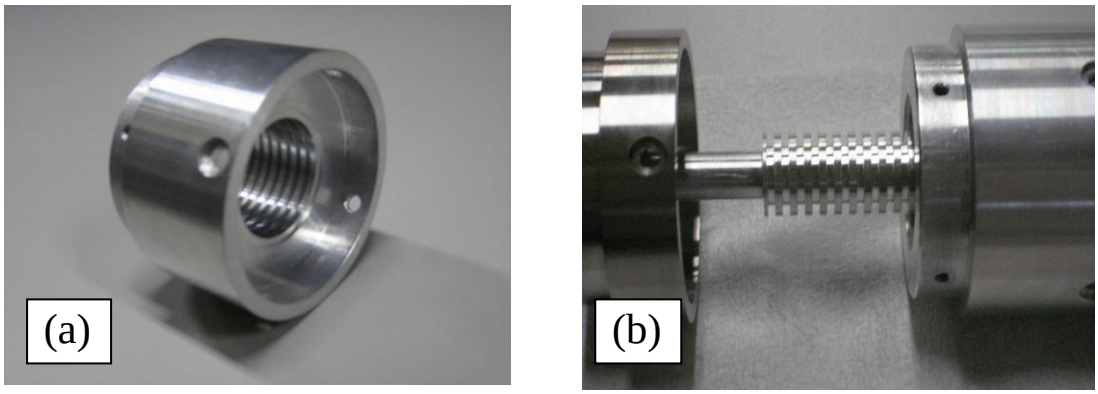

Fig.1 Periodically corrugated slow wave structure; (a) corrugated hollow waveguide and (b) corrugated inner conductor

[1] K. Ogura et al., IEEJ Trans. FM, **125** (2005) 733.
[2] S. Aoyama et al., Trans. Fusion Sci. Tech. **51** (2007) 325.
[3] K. Ogura et al., IEEJ Trans. FM, **127** (2007) 681.