High output powers of structure-simplified RTD oscillators with offset-fed slot and coplanar stripline antennas

Tokyo Inst. of Technology, (D) Mai Van Ta, (M2) Yusei Suzuki, Xiongbin Yu, Safumi Suzuki and Masahiro Asada

E-mail: mai.v.aa@m.titech.ac.jp

RTD oscillators have emerged as a promising candidate for THz sources owing to compact size, high oscillation frequency, and room temperature operation. Recently, we proposed and demonstrated structure-simplified RTD oscillators without using MIM capacitors. Such RTD oscillators have a big advantage for short fabrication process compared to that of conventional RTD oscillators [1]. However, the output power of these simple RTD oscillators was relatively low at ~ 10 μW. Although an offset-fed slot antenna structure, which is usually employed in conventional RTD oscillators, is effective for high output power due to high radiation efficiency [2], it has not been applied to the simple RTD oscillators. Besides, adding external antennas is also effective for increasing radiation efficiency and we recently demonstrated RTD oscillators with coplanar stripline (CPS) antennas [3]. In this work, we proposed and fabricated simple RTD oscillators with offset-fed slot and CPS antennas that exhibited high output powers.

Fig. 1 shows the micrograph of a fabricated device. An RTD mesa was located in the slot antenna with an offset of 48 μm from the center. Stabilization resistors, which suppress parasitic oscillations in lower frequency, were formed at both ends of the slot. In addition to the offset structure, we added CPS antennas to both external sides of the stabilization resistors for further increase in radiation efficiency. Fig. 2 shows output power as a function of oscillation frequency. The tendency of experiments was roughly agreed with the theoretical curve. There is a frequency gap between ~350 and 500 GHz because of the interaction between the resonance frequencies of the antennas. We obtained the highest output power of ~300 μW at oscillation frequency of 500 GHz.

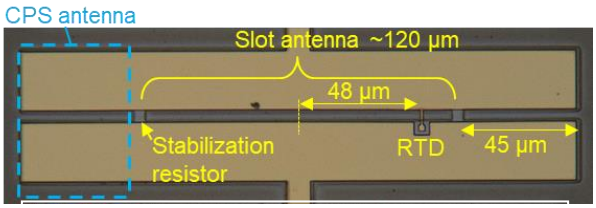

Fig. 1 Microphotograph of fabricated device

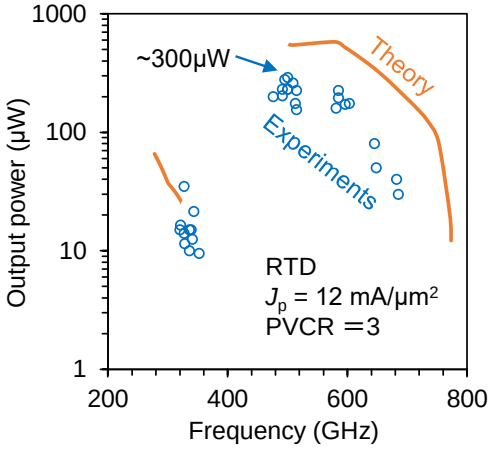

Fig. 2 Output power as a function of oscillation frequency

[1] T. V. Mai, *et al.*, J. Infrared Milli. Terahz. Waves, 41, 1498, 2020.

[2] S. Suzuki, *et al.*, IEEE J. Sel. Topics Quantum Electron., 19, 8500108, 2013.

[3] X. Yu, *et al.*, IEEE Electron Device Lett., published online, 10.1109/LED.2021.3082577.

© 2021年 応用物理学会