

77 K 動作 THz-QCL の高出力化の試み

THz quantum cascade lasers toward high output power operation

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THz quantum cascade lasers (QCLs) [1,2] are a promising high output-power semiconductor THz sources with narrow bandwidth. Based on the long time bottom neck of limited operation temperature below 200 K, it is still quite limited the compact size THz applications cause by the large cooling system. On the other hand, devices output is also one of the critical parameters to realize the applications. Here we demonstrate the recent our fabricated high temperature operation QCLs devices combined with the 77 K liquid nitrogen Dewar condenser as a real useful relative compact size THz source unit. Then improve the output power from the active region, waveguide, and device fabrication designs from recent toward high operation temperature THz QCLs in order to suit with and exhibit the best performance of the compact 77 K Dewar system.

Figure (a) and (b) shows the diagram and photographs of our recently fabricated toward high temperature operation metal-metal waveguide (MMW) modulation active structure design THz QCLs and Dewar construction with a inside focusing parabolic mirror and hemisphere Si lens; gives the maximum peak power 3.1 mW and average output power 6.2 μ W in 77 K Dewar system which plotted in Figure (c). Based on this results, we improve the devices by change the active region design, semi-insulator surface plasma (SI-SP) waveguide, increase the active region with thicker crystal growth and large size device fabrication with large size contact for high duty cycle operation in order to toward the further robust portable compact size continuous wave operation average output power mW order THz source unit by QCLs.

[1] J. Faist *et al.*, Science **264** (1994) 553. [2] R. Köhler *et al.*, Nature **417** (2002) 156.

