Investigation of Double Metal THz Quantum Cascade Lasers by Terahertz Time-Domain Spectroscopy

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The study of terahertz quantum cascade lasers (THz QCL) employing a single plasmon waveguide by broadband Terahertz pulses has gained a lot of physical insight [1]. In comparison to the single plasmon waveguide the double plasmon or metal-metal waveguide QCL uses a metal/semiconductor/metal structure. The generation of broadband THz radiation at the facet of a gallium arsenide filled waveguide was reported [2] recently.

We fabricated THz-QCLs in a geometry that allows the generation of broadband THz pulses in the first section of the waveguide and lasing operation within the second section. The THz transient generation on the QCL facet was investigated first. Further the coupling of the broadband THz pulses to the active QCL ridge was studied in experiment and by finite element simulation. The cavity of the emitter section and QCL section were proved to be coupled by FTIR measurements.

The coupled cavity configuration enabled the bias dependent measurement of gain and loss of the THz QCL [3]. The gain and loss processes can be explained by comparison with the calculated bandstructure.

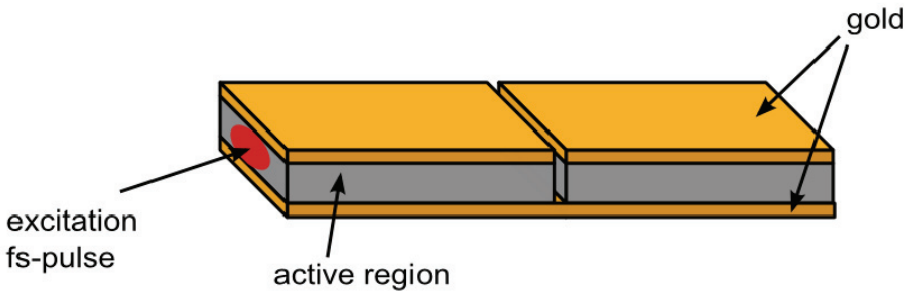

Fig. 1: Geometry used for coupling of broadband THz pulses into a double-metal.

References

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