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noch einfallen lassen

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Contents

1 Goal

The goal of this lab-course is to acquire knowlege about terahertz spectroscopy and its aplications. This protocoll will treat fundamental physical properties of matter, such as the refractive index, conductivity and resistivity. Also this protocoll treats 2D-pump-and-probe spectroscopy and non-linear processes of matter.

2 Theoretical Introduction

I am not sure if I will write one, but if i have the time and know all the topics treated in this protocoll i might aswell do.

3 Experimental Execution

In this chapter i might give some informaiton about the setup, how it works and general information about the experiment so the reader could understand what i am working with.

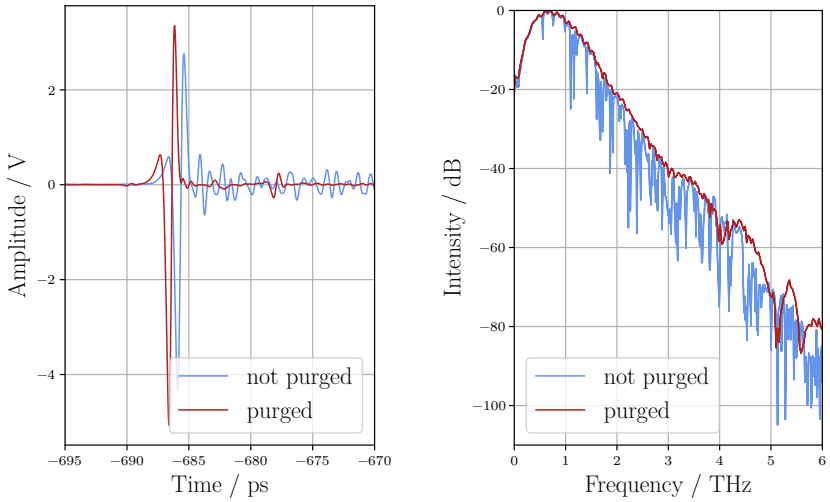
definitly a picture of the setup in this chapter

4 Analysis

After the setup was adjusted the first measurement is taken. In this measurement only atmospheric air is inside the beam path. The data shown in figure 4.1a. The maximal amplitude of the reference measurement is −4.3 V. To extract frequency information a fast fourier transformation (FFT) of the data is performed. The frequency domain is plotted in figure 4.1b In the frequency domain, the data shows many drops in the spectrum. The spectral width of the setup lies around 5 THz - 6 THz.

4.1 Air Humidity in the Laboratory

As mentioned before the spectrum shown in figure 4.1 is measured with atmosheric air. The absorption peaks in the spectrum result from the air humidity. Water has many different and strong absorption peaks in the terahertz range. [1] This can lead to low field ampitudes inside possible samples at a resonant frequency and can therefore interfere with the measurement To enable qualitative measurements this factor needs to be solved. By purging the system, which means to envelop the entire beam path in nitrogen gas. Nitrogen does not have any absorption lines inside the terahertz spectrum.



(a) Time Domain **(b)** Frequency Domain

Figure 4.1: (a) Measured time domain data of atmospheric air (blue) and nitrogen gas (red). (b) Frequency domain data of atmospheric air (blue) and nitrogen gas (red). This is the Fourier transform of the time domain data expressed in the unit dB. The normalization for this unit was the maximum of the Fourier transformation.

A reference measurement of the purged system is shown in figure 4.1. The resulting amplitude with purging rises up to −5.07 V. Also the noise is reduced. The frequency domain shows a very clear spectrum up to 5 THz. However, at around 4 THz occurs a broad absorption line. The upcomming of this absorption line us not yet determind. Therefore measurements with expected phenomena at 4 THz are harder to measure. Nevertheless, does figure 4.1 show a qualitative spectrum for broad band terahertz spectroscopy.

4.2 Silicon Wafer

5 Discussion

In this chapter i will discuss and evaluate the personal success for this course and the experiments within.

Bibliography

[1] Tao Yuan et al. *Terahertz time-domain spectroscopy of atmosphere with different humidity.* (2003).

Appendix