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Solid State Optics

Lukas Hein, Elias Schwarzkopf

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Versuchsdurchführung: ?? . ?.????

Protokollabgabe: ?? ??

1 Introduction

Fourier Transform Infrared (FTIR) spectroscopy is a powerful method for determining the electronic properties of metals and semiconductors. The FTIR technique is based on the interaction of infrared light with the material. Reflection and transmission are used to determine important electronic properties. Especially for semiconductors, the FTIR method is particularly useful because it helps to adjust parameters such as the doping concentration or the bandgap. For building applications like LEDs, transistors, or solar cells, precise knowledge of the bandgap and doping concentrations is required. In contrast to other common methods, such as spectroscopy with a monochromator, the FTIR method is much faster and more precise. Instead of varying the wavelength through multiple measurements, the FTIR method can measure the entire spectrum at once due to the use of a Michelson interferometer, which enables the interference of light. After Fourier transformation, the complete spectrum is obtained in a single step.

Firstly, the theoretical basics of light-matter interaction and some important formulas regarding reflection and transmission will be discussed. Following this theoretical introduction, the experimental setup will be described. The final part of this paper will focus on data evaluation, starting with the gas absorption of air. The second part of the data evaluation will involve determining the signal-to-noise ratio. The last part will address the determination of several previously mentioned electronic and optical properties, such as the refractive index, extinction coefficient, absorption coefficient, bandgap, and pulse matrix element for all given semiconductor samples.

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2 Introduction

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3 theory

3.1 Plane parallel layer

The investigated semiconductor samples can in first approximation be described as a plane parallel layer with a thickness d and refractive index N_2 which acts like a fabry-perot interferometer.

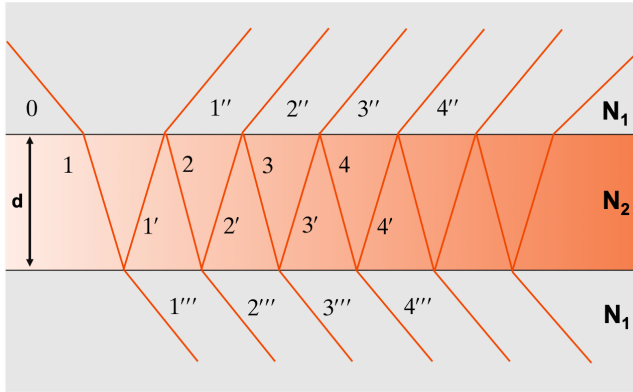


Abbildung 1: Simplified illustration of the measured samples as a plane parallel plate with thickness d and refractive index N_2 . The surrounding air is described with a refractive index $N_1 \approx 1$ [1]

4 Set-Up

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5 Bibliography

Literatur

- [1] Meschede D., *Gerthsen Physik*, Springer Verlag, 25th Edition, 2018. Modified by Lukas Hein and Elias Schwarzkopf.

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