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Waveguides and Splitters for Terahertz (THz) Frequencies

ABSTRACT - Masterthesis

The successful development of THz time domain spectroscopy (THz-TDS) marks a breakthrough record in the research of THz field. It serves as an important tool to reveal the hidden characteristics of different materials in the THz frequencies. With the assistance of THz spectroscopy, the absorption of different materials in THz frequencies is no longer a secret; instead, it serves as a background knowledge for the search of suitable material which could be used for THz waveguiding.

The state-of-the-art THz-TDS deals with materials characteristic through free space propagating wave. To further expand the capability of THz applications, the need of guided wave propagation of THz signal and the associated coupling between guided and freely propagating wave has arisen. THz waveguide which aims to guide THz wave along the waveguide is highly desirable for this purpose. With the understanding of materials classification obtained from THz spectroscopy, the fingerprints of several materials in THz frequencies which give low absorption loss are marked.

Among this, absorption coefficients of various polymer materials investigated in classifies basic polymer into two groups, i.e. polymer with low and high absorption. Given this pre-knowledge, this thesis carries on further by proposing suitable geometry and dimension for THz wave guiding and the corresponding waveguide is further characterized at various THz frequencies. To further explore the potential of such waveguide, the second part of this thesis is to look into the development of THz power splitter based on the same materials. Power splitter built based an 3 different approaches, namely the fiber based power splitter, multimode interference (MMI) power splitter based an self imaging principle and radiative power splitter based an Fourier optics are investigated.

This thesis is carried out completely at Institute für Hochfrequenztechnik TU-Braunchweig, under the research group of THz-Systemtechnik.