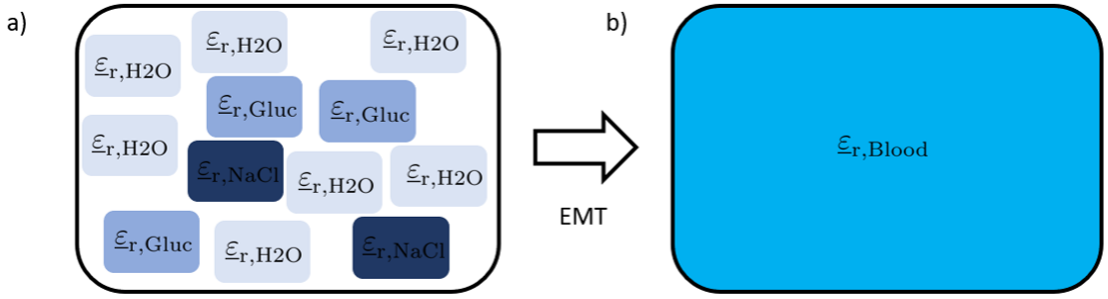
Master Thesis

Research-related and Interesting

Determination of Blood Permittivity and Conductivity in THz Regime based on Glucose Concentration Variation



The electrical properties of blood (i.e. permittivity and conductivity) are influenced by changes in glucose content. Especially the relationship between glucose level and the electrical conductivity is still not quantified. Obviously blood is of vital importance for the human body. However, its composition is complex and thus measurements on blood samples are partly meaningful owing to lack of knowledge how each component is contributing for the effective blood parameters. In general, variations in material properties have a direct impact on the reflected power from a layered structure, including a layer with high blood content. Consequently, the reflected power demonstrates corresponding changes in response to glucose variations. However, as the dispersive conductivity of blood plays a determining role in the reflected power spectra and its variation seems to behave in a non-deterministic manner. Therefore, the blood glucose content detection through THz (0.1 THz-2 THz) reflectometry requires the understanding of the blood composition and the influence of blood components on the electrical parameters, whereas focussing mainly on the glucose concentration

The current master project will deal with the investigation of state of the art blood phantoms. Given complexity of the blood composition the blood may be represented by destilled water with different glucose for estimating the influence of the glucose content itself. This setup can be enhanced by water containing ions or gases (i.e NaCl, CO2 etc.) until the development of ”artificial blood”. The measurements will be employed using the SWISSto 12 transmission measurement setup and for obtaining a holistic study this measurement results should be compared with a suitable simulation tool (COMSOL, Feko,...). The empirical derived electrical parameters should be compared with methods of the effective medium theory to support the goal to derive a model, which described the influence of glucose concentration on permittivity and conductivity. Furthermore, the effect of different sugar types (i.e. glucose or fructose) should be investigated and be compared with respect to the variation of electrical properties.

Got curious? simply contact us for an informal meeting discussing the topic or send a thesis request per email to us.

Requirements:	Knowledge of electromagnetic field theory, interest in THz technology, material characterization and bioengineering
Character of the project:	20% Theory / 40% Experiment / 40% Simulation
We offer:	An interesting master project at the edge of science in a friendly research environment.
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