# Separation of absorption and scattering contributions to the extinction coefficient of scattering samples in THz-TDS experiments

M. Bernier[1], F. Garet[1], and J.-L. Coutaz[1]
[1] *IMEP-LAHC, UMR CNRS 5130, University of Savoie – 73 376 – LE BOURGET DU LAC*

***Context***: For experimental reason, some materials have to be diluted in a transparent hosting matrix (e.g. Polyethylene) to be characterized by terahertz time domain spectroscopy (THz-TDS). Therefore, the sample to be measured is a non-homogeneous pellet constituted of grains whose diameters $\Phi$ could be as large as the THz wavelengths, leading to scattered transmitted THz waveform. In such condition, the extracted complex refractive index of powder materials in the THz range using THz-TDS suffers from both i) an overestimation of the absorption $\alpha_{TDS}$ and a distortion of the spectral resonance peaks of the powder material [1], together with ii) a frequency-dependent distortion of the refractive index $n_{TDS}$. Previous works [2] have pointed out and verified the scattering-induced distortion of both refractive index and absorption coefficient, according to exact Mie theory [3]. Some of them proposed numerical [4] and experimental [5] solutions to get rid of these scattering-induced effects in order to obtain the actual values of refractive index and absorption coefficient of the scattering sample. In this work, we propose a technique, which retrieves the actual optical constants ($n_0$ and $\alpha_0$) of a scattering sample by applying Kramers-Kronig transforms (KKT) to erroneous ones ($n_{TDS}$ and $\alpha_{TDS}$).

***Principle & preliminary results***: Since the $n_{TDS}$ and $\alpha_{TDS}$ of pellet-like samples are not impacted in the same manner by the presence of scatterers, the imaginary and real parts of the complex refractive index are not causally linked, as it should be. This results in a break of self-consistency of Kramers-Kronig relations. Nevertheless, by calculating $n_{KK}$ and $\alpha_{KK}$ from KKT of $\alpha_{TDS}$ and $n_{TDS}$, respectively, and by comparing each other, we show that the so-calculated optical constants are closer to the actual values. By repeating this process, $n_{KK}$ and $\alpha_{KK}$ converge to $n_0$ and $\alpha_0$, respectively. During the conference, authors will detail the technique and present works in progress.

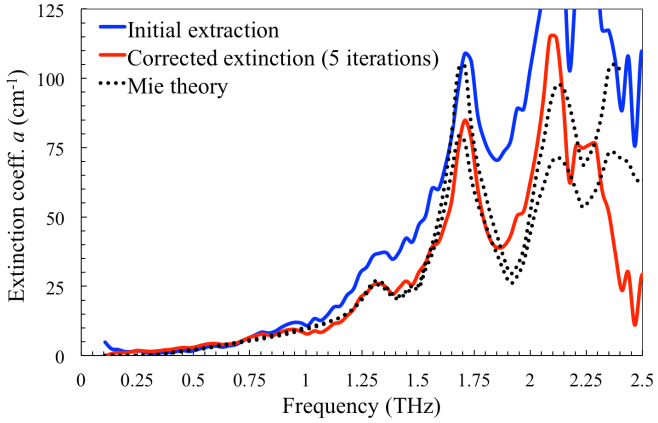


*Fig.1. Extinction coefficient of fructose (blue curve) extracted from THz-TDS measurement of a 510-µm thick pellet constituted of fructose/HDPE mixture (70% mass concentration) having grain size 150µm<Φ<200µm. The extinction coefficient corrected by our technique (red curve) tends to the theoretical values (dashed lines) predicted by Mie theory after 5 iterations.*

**References**

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