Absorption and polarization effects of terahertz waves on clinochlore

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I. Introduction

The use of Terahertz Time-Domain Spectroscopy (THz-TDS) technique has proven to be essential for studying the collective vibrations of the crystalline lattice in solids in the THz range. On the other hand, the study of minerals with the ability to be exfoliated, such as clinochlore, is highlighted as a low-cost source of two-dimensional material. In this work, the properties of clinochlore in the THz region were investigated using the THz-TDS technique.

II. Terahertz Time-Domain Spectroscopy

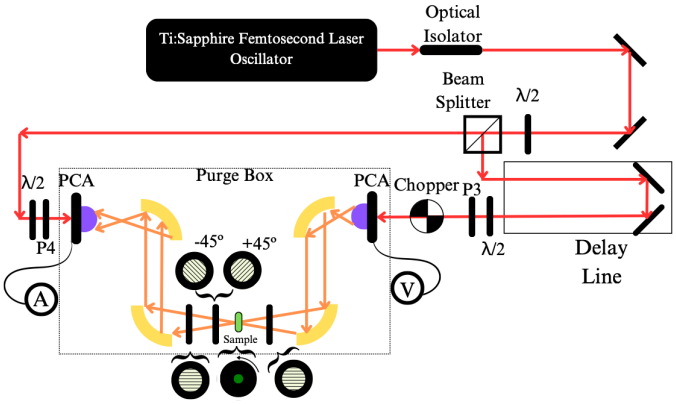

Fig. 1 - Optical setup for a Terahertz time-domain spectroscopy.

III. THz Transmission

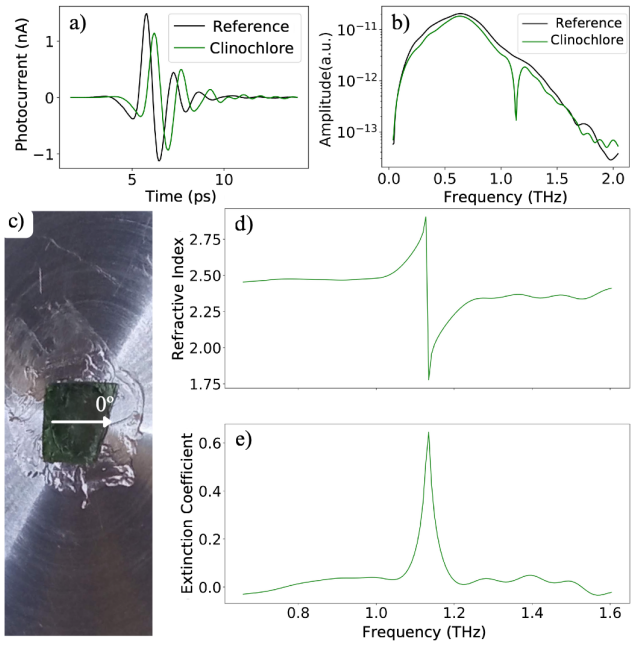

Fig. 2 - (a) Measured THz pulse. (b) Amplitude calculated by Fourier transform. (c) Clinochlore. d) Refractive index of the clinochlore. e) Extinction coefficient of the sample.

IV. What if we rotate the sample?

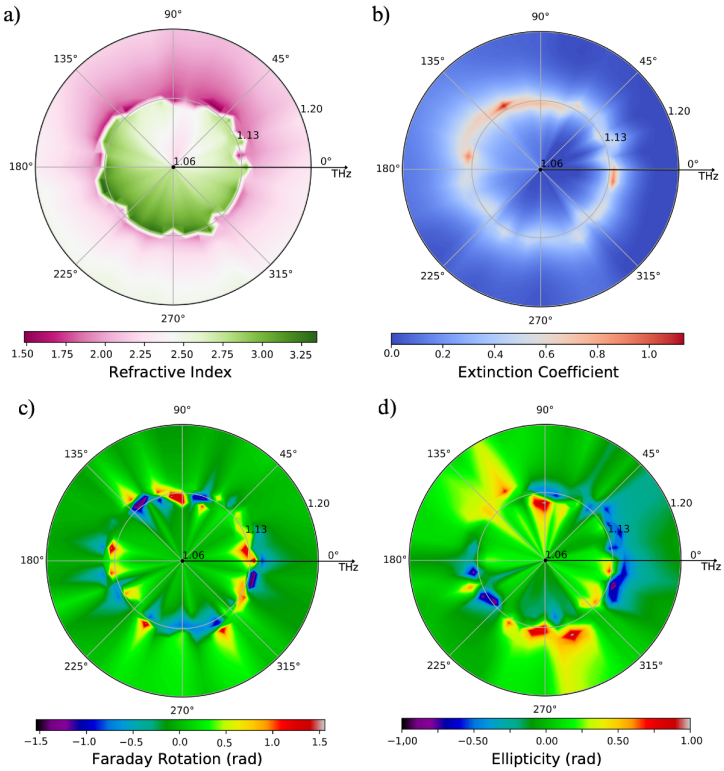

Fig. 3 - Polar plots of (a) refractive index, (b) extinction coefficient, (c) rotation of the polarization plane and (d) ellipticity of the electric field. The angle varied is the angle between the polarization of the THz beam and the axis shown in Fig. 2(c).

V. Conclusion

It is rare to find absorption lines in solid-state materials in the THz region, allowing future applications of the clinochlore. It was observed that the rotation of the plane of polarization and ellipticity varies with the azimuthal angle of the sample, suggesting a chiral behavior of the phonons. This property can be related to the presence of impurities and defects that changes the symmetry of its crystalline structure and induce the phonons to become circularly polarized.

VI. References

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