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Verification of L-alanine single-crystallinity for anisotropic synchrotron terahertz measurements

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One way to probe the molecular interactions of a material is by using terahertz (THz) spectroscopy, which has been used to study L-alanine in detail [1]. However, isotropic THz spectroscopy has limitations in identifying the origin of vibrational modes since the direction of the associated dipole moment is random in an isotropic THz measurement. Therefore, there is a benefit to performing anisotropic (polarised) THz measurements. This work represents the first anisotropic measurements performed on L-alanine, the simplest chiral amino acid, and one of the earliest amino acids fundamental to early life on Earth [2].

An appropriate sample for anisotropic measurements must be highly single-crystalline. This presentation describes a method to prepare and test a sample for anisotropic THz measurements. Samples have been grown at the University of Wollongong, and sample verification has been done at ACNS's Taipan triple-axis spectrometer. Using Taipan, a narrow mosaic spread of ~0.8° was determined, and single, well-fitted Gaussian peaks were observed in both sample rotation and Q-space scans, suggesting high single-crystallinity in our L-alanine samples. Additionally, the Taipan measurements were able to verify the orientation of the L-alanine single crystals with respect to their crystallographic axes.

Anisotropic THz measurements were taken on the THz – Far Infrared beamline at the Australian Synchrotron using a wire-grid polariser. Distinct absorption bands were observed for different crystal orientations, further confirming single-crystallinity, and identifying the dipole moment directions for the observed modes. We thus demonstrate a method of performing anisotropic THz measurements.

[1] T. J. Sanders et al., J. Chem. Phys., 154, 244311 (2021)
[2] V. Kubyshkin and N. Budisa, Int. J. Mol. Sci., 20, 5507 (2019)

Level of Expertise

Student

Presenter Gender

Man

Pronouns

He/Him

Which facility did you use for your research

Australian Synchrotron

Students Only - Are you interested in AINSE student funding

Yes

Do you wish to take part in the Student Poster Slam

No

Condition of submission

Yes

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