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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 $\sim 0.8^\circ$ 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)

Presenter Gender

Man

Do you wish to take part in the Student Poster Slam

No

Condition of submission

Yes

Students Only - Are you interested in AINSE student funding

Yes

Level of Expertise

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Which facility did you use for your research

Australian Synchrotron

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