Experiment Brief

Metro counting camera

Title

Enhancing MicroED/3DED analysis with direct detection electron counting cameras

Gatan instrument used

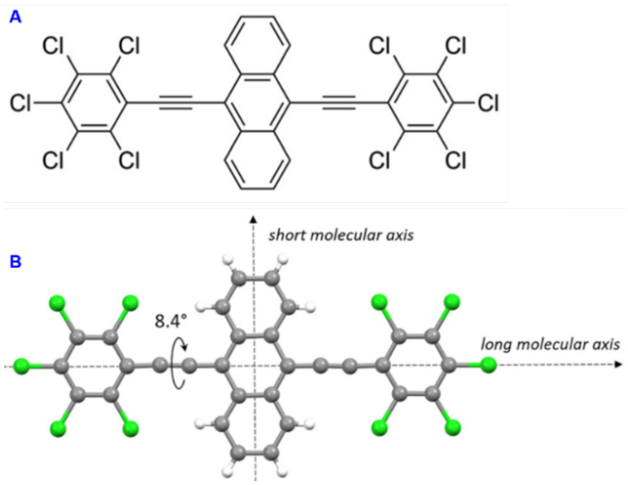
The Metro® camera enables low-dose imaging and **diffraction** via **real-time electron counting** with a simple user interface.

Background

PPEA, a semiconducting molecule, exhibits a high affinity to graphene surfaces. The PPEA molecule forms very small, needle-like crystals that measure several micrometers in length and have a width ranging from 100 to 200 nm. Due to their size, these crystals are too small for analysis using single-crystal x-ray structure techniques. Moreover, the beam-sensitive nature of PPEA requires low-dose techniques in the transmission electron microscope (TEM) to avoid damaging the crystallites, making continuous diffraction tomography (MicroED/3DED) the method of choice for structure determination.

Materials and methods

PPEA crystals were grown and prepared for TEM using the methods described in Reference 1. Data was acquired at 200 kV with a Metro camera. A continuous tilt series from -30° to 30° was collected using a tilt speed of ~1 °/s tilt and a dose rate of 0.0311 $e^-/Å^2/s$ to ensure a total dose of <2 $e^-/Å^2$ for the tilt series acquisition.



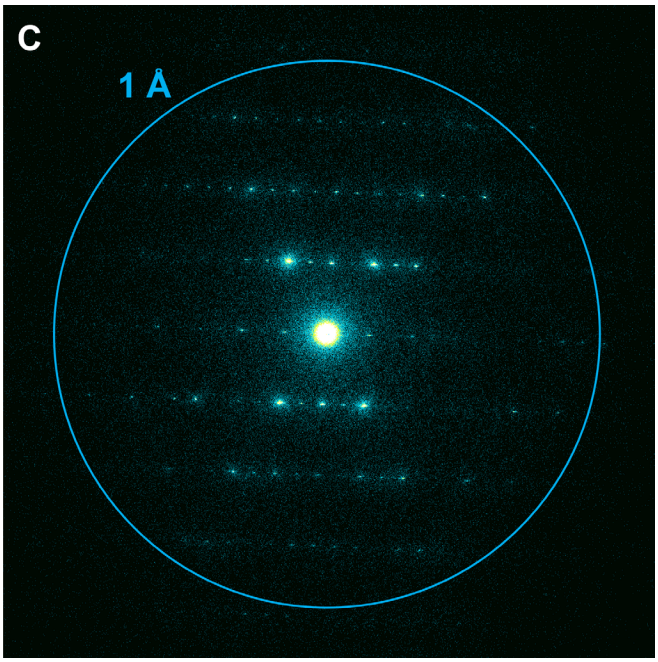


Figure A: Molecular structure and **B:** Conformation within the crystal structure of the 9,10-bis-((perchloro-phenyl)-ethynyl)anthracene (PPEA). **Figure C**: Single frame from a continuous diffraction tomography dataset showcasing higher order reflections with resolutions exceeding 1 Å. The full dataset video is available at https://youtu.be/Nr3v4vTa_IY.

Summary

This study highlights the effectiveness of the Metro electron counting camera for MicroED/3DED experiments without needing a beam stop. A key achievement here is maintaining a low electron dose rate during full tomogram data collection, which is crucial for studying sensitive materials such as PPEA without altering their natural state. Further work could leverage the Latitude® D software for high-throughput automated data collection of continuous diffraction tomography datasets.

Reference

1) Gorelik, T.E., Ulmer, A., Schleper, A.L., Kuehne, A.J.C., Crystal Structure of 9,10-bis-((perchloro-phenyl)-ethynyl)anthracene Determined from Three-Dimensional Electron Diffraction Data, Z. Kristallogr. (2023), https://doi.org/10.1515/zkri-2023-0009

Credit(s)

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