OPEN ACCESS Freely available online

Journal of Physical Chemistry & Biophysics

Commentary

Applications Employed in X-ray Crystallography

Chung Pessoa*

Department of Chemistry, University of Zurich, Zürich, Switzerland

DESCRIPTION

X-ray crystallography is an analytical technique used by the crystallographers to determine the atomic and molecular structure of the samples. This technique is only applicable to crystals. A powerful monochromatic x-ray beam, often produced by a synchrotron, is directed at a crystal and diffracts in many directions. The intensities and angles of the diffracted x-rays are measured by sensors. Hundreds of two-dimensional x-ray diffraction patterns are converted into a three-dimensional map of electron density by the crystallographer using special computer software. Finally, the crystallographer, like a jigsaw puzzle, fits each atom into the three-dimensional electron density map.

It turns out that x-rays are simply a type of electromagnetic radiation. They are simply a different type of light. X-rays, like light, are made up of particles called photons but have wave-like properties. Beyond visible light, in decreasing wavelength order, are ultraviolet light, x-rays, and finally gamma rays.

X-rays scatter when they interact with electrons. For the most part, x-rays scatter randomly and experience destructive interference, which means that the waves cancel each other out. In the case of a diffraction grating, however, some of the waves experience constructive interference, which causes the waves to become stronger. The wavelength of the waves must be similar in size to the distance between the grooves in the diffraction grating for this to work. Crystals, it turns out, behave similarly to diffraction gratings. Furthermore, the wavelengths of x-rays are on the order of angstroms, which is the same as the distance between atoms in a crystal.

X-ray crystallography is used in a wide range of scientific disciplines. When it first became known as a method of study, it was primarily used in basic science applications for measuring the dimensions of atoms, the lengths and types of chemical bonds, the arrangement of atoms in materials, the differences between the materials on an atomic level, as well as the thickness of films, grain size, and the roughness of interfaces between minerals and alloys.

Since the beginning of time, science has made significant progress, and while these areas remain important in the study of new materials, it is now commonly used to analyse the structure of many biological materials, vitamins, drug molecules, thin-film substances, and multi-layered substances. Because of its non-destructive properties and excellent accuracy and precision, it is now one of the primary methods for analyzing a material when the structure is unknown in the environmental, geological and chemical, material science, and pharmaceutical industries (among many others).

This method is also employed in forensics. It has been used to characterize a wide range of substances and is typically nondestructive in nature. Among the various techniques, X-ray powder diffraction is relatively simple and is commonly used for the analysis of powder samples; however, due to the form and size of most crime samples, the limited amount of material, and sample preservation requirements, this technique has rarely been used for the analysis of non-powder samples. The technique was used to characterize the constituent fibres.

Correspondence to: Chung Pessoa, Department of Chemistry, University of Zurich, Zürich, Switzerland, E-mail: pessoach@edu.ch

Received: 10-Mar-2023, Manuscript No. JPCB-23-21961; **Editor assigned:** 13-Mar-2023, PreQC No. JPCB-23-21961 (PQ); **Reviewed:** 27-Mar-2023, QC No. JPCB-23-21961; **Revised:** 03-Apr-2022, Manuscript No. JPCB-23-21961 (R); **Published:** 10-Apr-2023, DOI: 10.35248/2161-0398-23.13.347

Citation: Pessoa C (2023) Applications Employed in X-ray Crystallography. J Phys Chem Biophys. 13:347.