

A Short Note on Crystallography

Dr. Armin Khan*

Department of Environment Science and climate change, University of EDC Science and technology, Ethiopia

Abstract

The study of the structure and properties of crystals, which are solids with highly ordered arrangements of atoms, ions, or molecules, is known as crystallography. Physics, chemistry, materials science, biology, and other disciplines are all involved in this multidisciplinary field. Earth science is one of the fields in which crystallography plays a crucial role. The study of our planet's physical and chemical processes, as well as its structure, composition, and history, is known as earth science. Geology, geophysics, geochemistry, and mineralogy are just a few of the many subdisciplines that make up this vast and intricate field. Because it enables researchers to ascertain the atomic structure of minerals, rocks, and other Earth-based materials, crystallography is an indispensable tool for many of these sub-disciplines. The study of crystals, including their structure, properties, and formation, is the focus of the science known as crystallography. Crystals are solid materials with a repeating pattern of atoms or molecules arranged in a particular way, either naturally occurring or manufactured. Crystals are characterized by their distinctive shape, symmetry, and unique physical properties due to this arrangement of atoms and molecules.

Keywords: Crystallography; Symmetry; Materials science; Chemistry; Earth science

Introduction

Crystallography is the study of various methods for figuring out the structure and properties of crystals. X-ray crystallography, electron diffraction, neutron diffraction, and a variety of spectroscopic techniques are among these strategies. The most common method for examining a material's crystal structure is X-ray crystallography.

Using X-rays, the three-dimensional structure of a crystal is determined in X-ray crystallography. A type of electromagnetic radiation with a wavelength shorter than that of visible light are X-rays. A diffraction pattern is produced when X-rays pass through a crystal because they are diffracted by the atoms or molecules in the crystal's lattice. The atoms or molecules' positions in the crystal lattice can be determined using this diffraction pattern. There are a number of steps involved in X-ray crystallography. Preparing a crystal of the material to be studied is the first step [1]. It is necessary for the crystal to be of high quality and free of imperfections or impurities. After that, a goniometer is used to mount the crystal, allowing it to be rotated in various directions. A detector is used to record the diffraction pattern after X-rays are passed through the crystal. Mathematical algorithms are used to look at the diffraction pattern and figure out where the atoms or molecules are in the crystal lattice. A three-dimensional model of the crystal structure is made with this information. Similar to X-ray diffraction, neutron diffraction makes use of neutrons rather than X-rays. Particles with no electric charge are neutrons, which are dispersed by the atomic nuclei in the crystal lattice. Neutron diffraction is especially valuable for concentrating on the places of light particles like hydrogen. Crystallography also employs electron diffraction. The crystal's structure is determined by utilizing an electron beam. A diffraction pattern that can be used to determine the crystal structure is produced when the electrons are diffracted by the atoms or molecules that make up the crystal lattice [2]. The sciences of chemistry, physics, materials science, and biology all make use of crystallography. Crystallography is a technique used in chemistry to figure out how molecules are made and how they interact with one another. Crystallography is a technique used in physics to investigate the electronic and magnetic properties of materials. Crystallography is a technique used in materials science to investigate the structure and properties of materials like polymers, ceramics, and metals. Crystallography is a technique in biology that

is used to figure out the three-dimensional structure of proteins and other biomolecules. This is important for knowing how they work and making drugs that target them [3].

The study of minerals is one of the primary applications of crystallography in Earth science. Minerals are solids that are found in nature and have crystal structures and a well-defined chemical composition. Over 5,000 minerals have been identified, each with its own set of characteristics and properties [6]. Scientists are able to comprehend the physical and chemical properties of minerals and their atomic arrangement by utilizing crystallography methods like X-ray diffraction and electron microscopy [7]. Crystallography, for instance, has been crucial in identifying and characterizing minerals like olivine, pyroxene, and feldspar that make up the Earth's crust and mantle. Scientists can gain a deeper comprehension of the processes that shape the Earth's surface and form rocks by studying these minerals' crystal structures [8].

The study of the behavior of materials under extreme conditions, such as high pressure and temperature, is another area in Earth science where crystallography plays an important role. Crystallography, for instance, has been used to investigate how minerals and other Earth materials behave in the extreme pressure and temperature environments of the Earth's core and mantle [9]. Scientists can gain a deeper comprehension of the physical and chemical processes that drive plate tectonics, volcanism, and other geologic phenomena by comprehending how materials behave under these conditions. Crystallography has also been used to investigate the properties of

***Corresponding author:** Dr. Armin Khan, Department of Environment Science and climate change, University of EDC Science and technology, Ethiopia, E-mail: armin.khan@gmail.com

Received: 03-Apr-2023, Manuscript No: jesc-23-91820; **Editor assigned:** 05-Apr-2023, PreQC No: jesc-23-91820 (PQ); **Reviewed:** 19-Apr-2023, QC No: jesc-23-91820; **Revised:** 21-Apr-2023, Manuscript No: jesc-23-91820 (R); **Published:** 28-Apr-2023, DOI: 10.4172/2157-7617.1000674

Citation: Khan A (2023) A Short Note on Crystallography. J Earth Sci Clim Change, 14: 674.

Copyright: © 2023 Khan A. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

minerals and other Earth materials that play a crucial role in industrial and technological processes, such as ceramics, semiconductors, and catalytic materials. Scientists can create new materials with improved properties and performance by comprehending these materials' crystal structures and properties [10].

Conclusion

Crystallography is a significant area of science that has added to how we might interpret the construction and properties of materials. It has revolutionized our comprehension of the molecular and atomic structures of complex materials and has applications in a variety of scientific fields. Crystallography will continue to play a crucial role in the creation of new materials and the expansion of scientific knowledge as technology develops. For Earth scientists to comprehend the structure, properties, and behavior of minerals, rocks, and other Earth materials, crystallography is an essential tool. It gives researchers a powerful way to look into the fundamental processes that shape our planet and create new technologies and materials that are good for society. In the years to come, we can anticipate even more exciting discoveries in the field of earth science as our comprehension of crystallography and its applications grows.

References

1. Dixon J, Gulliver A, Gibbon D (2001) Farming Systems and Poverty: Improving Farmers' Livelihoods in a Changing World. FAO Rome.
2. Viste E, Korecha D, Sorteberg A (2013) recent drought and precipitation tendencies in Ethiopia. *Theor Appl Climatol* 112: 535-551.
3. Omondi P, Awange J L, Ogallo LA, Okoola RA, Forootan E, et al. (2012) Decadal rainfall variability modes in observed rainfall records over East Africa and their relations to historical sea surface temperature changes. *J Hydrol* 464-465.
4. Hastenrath S, Polzin D, Mutai C (2010) Diagnosing the Droughts and Floods in Equatorial East Africa during Boreal Autumn 2005-08. *J Clim* 23: 813-817.
5. Alexander L, Hope P, Collins D, Trewin B, Lynch A, et al. (2007) Trends in Australia's climate means and extremes: A global context. *Aust Meteorol Mag* 56: 1-18.
6. Williams CJR, Kniveton DR, Layberry R (2010) Assessment of a climate model to reproduce rainfall variability and extremes over Southern Africa. *Theor Appl Climatol* 99: 9-27.
7. Bono A De, Giuliani G, Kluster S, Peduzzi P (2004) Impacts of summer 2003 heat wave in Europe. *Environ Alert Bull UNEP* 4.
8. Bell Elizabeth A, Boehnke Patrick, Harrison T (2015) potentially biogenic carbon preserved in a 4.1 billion-year-old zircon. *Proc Natl Acad Sci USA* 112: 14518-21.
9. Dodd Matthew S, Papineau Dominic, Grenne Tor, Slack John F, Rittner Martin, et al. (2017) Evidence for early life in Earth's oldest hydrothermal vent precipitates. *Nature* 343: 60-64.
10. Indexed at Google Scholar CrossRef
11. Zhang K, Bieger-Dose R, Dillmann M, A Klein, H Meinert, et al. (1995) ERA-experiment space biochemistry. *Advances in Space Research* 16: 119-129.