

Principles and applications of X-ray powder diffraction in the Earth Science

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Credits: 1 CFU (8 hours)
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Theoretical lesson: fundamentals of crystallography, introduction to X-ray diffraction, experimental techniques, overview of X-ray data collection.

Practice: instrument description, sample preparation, X-ray data collection

Theoretical lesson: overview of X-ray data reduction. Practice: X-ray data reduction

1. Introduction

The X-ray powder diffraction is a powerful technique for materials characterization, providing qualitative and quantitative analysis of phases in a crystalline powder as well as structural information even when the crystallite size is too small for single crystal X-ray diffraction methods. The technique is also useful for processes characterization such as phase transition or kinetics of reactions. There has been a significant increase in the application of powder diffraction in recent years, both in research and manufacturing, fuelled by improved instrumentation, data processing and awareness of the information that can be obtained. Powder diffraction allows for rapid, non-destructive analysis of multi-component mixtures without the need for extensive sample preparation. This gives laboratories the ability to quickly analyse unknown materials and perform materials characterization in such fields as geology, mineralogy, chemistry, materials science, forensics, archaeology, and the biological and pharmaceutical sciences.

2. The course consists of theoretical and practical sessions aimed to highlight the versatility and potentiality of the X-ray powder diffraction in Geosciences. In detail, the course will provide an introduction to modern powder diffraction methods with particular emphasis on practical aspects. It is organized in a form approachable by those with an undergraduate degree. The aim is to gain a rapid overview of what they can do with the X-ray powder diffraction.