Modern X-ray Diffraction Techniques for Exploration and Analysis of Ore Bodies

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ABSTRACT

A quantitative phase analysis method based on Rietveld analysis of X-ray diffraction analysis was performed on a variety of bauxite, iron-ore, and copper-ore samples from mineralogy and ore deposits. The Rietveld method was used for determining the mineral phases present, their abundance, and any preferred orientation. The results are compared with other methods, including optical microscopy, chemical analysis, and other X-ray diffraction methods. The Rietveld method is found to be more accurate and has a faster analysis time than other methods. A case study is presented to demonstrate the method.

Case Study 1: Iron Ore Analysis

An iron ore sample supplied to a steel production plant was analyzed by Rietveld analysis to determine the phases present and their abundance. The iron ore sample was found to be composed of magnetite, hematite, and quartz. The method was also able to identify any preferred orientation present in the sample. This information is crucial for determining the mining and processing techniques to be used for the iron ore.

Case Study 2: Cluster analysis of bauxite

A cluster analysis of bauxite samples was performed using the Rietveld method. The results were compared with other methods, including optical microscopy and chemical analysis. The Rietveld method was found to be more accurate and faster than other methods. The results also showed that the bauxite samples contained a variety of minerals, including hematite, quartz, and mullite.

Case Study 3: Rietveld analysis of hexagonal vs. monoclinic pyrrhotite ratios

Rietveld analysis was used to determine the ratio of hexagonal to monoclinic pyrrhotite in a variety of iron-ore samples. The results were compared with other methods, including optical microscopy and chemical analysis. The Rietveld method was found to be more accurate and faster than other methods. The results also showed that the iron-ore samples contained a variety of minerals, including magnetite, hematite, and quartz.

Modern X-ray diffraction is a powerful technique for the analysis of minerals and ore deposits. It can provide quantitative data on the composition of minerals, their abundance, and any preferred orientation present in the sample. This information is crucial for determining the mining and processing techniques to be used for the ore.

Keywords: Rietveld analysis, X-ray diffraction, iron ore, bauxite, copper ore, mineralogy, ore deposits.