

USE OF NEAR INFRARED FOR THE QUANTITATIVE ANALYSIS OF BAUXITE

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Quantitative analysis is an important requirement in exploration, mining and processing of minerals. There is an increasing need for the use of quantitative mineralogical data to assist with bore hole logging, deposit delineation, grade control, feed to processing plants and monitoring of solid process residues. Quantitative analysis using X-Ray Powder Diffraction (XRD) requires fine grinding and the addition of a reference material, or the application of Rietveld analysis to XRD patterns to provide accurate analysis of the suite of minerals present. Whilst accurate quantitative data can be obtained in this manner, the method is time consuming and limited to the laboratory.

Mid infrared when combined with multivariate analysis has also been used for quantitative analysis. However, factors such as the absorption coefficients and refractive index of the minerals requires special sample preparation and dilution in a dispersive medium, such as KBr to minimise distortion of spectral features. In contrast, the lower intensity of the overtones and combinations of the fundamental vibrations in the near infrared allow direct measurement of virtually any solid without special sample preparation or dilution.

Thus Near Infrared Spectroscopy (NIR) has found application for quantitative on-line/in line analysis and control in a range of processing applications which include, moisture control in clay and textile processing, fermentation processes, wheat analysis, gasoline analysis and chemicals and polymers¹.

It is developing rapidly in the mineral exploration industry and has been underpinned by the development of portable NIR spectrometers^{2,3} and spectral libraries of a wide range of minerals⁴. For example, iron ores have been identified and characterised in terms of the individual mineral components using field spectrometers^{5,6}. Data acquisition time of NIR field instruments is of the order of seconds and sample preparation is minimal. Consequently these types of spectrometers have great potential for in-line or on-line application in the minerals industry.

To demonstrate the applicability of NIR field spectroscopy for quantitative analysis of minerals, a specific example on the quantification of lateritic bauxites will be presented. It has been shown that the application of Partial Least Squares regression analysis (PLS) to the NIR spectra can be used to quantify chemistry and mineralogy in a range of lateritic bauxites. Important issues such as sampling, precision, repeatability, and replication which influence the results will be discussed.