

Analysis of Magnesium rich ores using Unisantis XMD-300 X-ray Diffractometer with X-Ray Polycapillary Optics technology

Abstract

Rapid XRD mineralogical phase analysis is critical to the evaluation of ore quality during any geological, mineralogical or mine exploration work.

This study illustrates quick data acquisition and analysis of one unknown geological exploration sample supplied by a customer using the Unisantis XMD-300 Polycapillary Optic Parallel Beam X-ray Diffractometer.

The complete analysis and evaluation of the sample could be carried out successfully in less than 10 minutes.



Introduction

X-ray diffraction is a unique tool for the identification and quantification of crystalline and amorphous phases present in any unknown sample. The peak/ line positions and relative intensities of the diffractogram are compared with reference 'fingerprint' patterns of known compounds available in the ICDD PDF database and the phases identified.

The demand for rapid analysis of geological exploration samples on-site has necessitated development of compact and easily transportable XRD's with small footprint and low installation requirements. Use of low power X-ray tubes and Position Sensitive Detectors (PSD's) has reduced the analysis time to a few minutes.

Low beam intensities from low wattage X-ray tubes however produce low quality diffractograms that adversely affects the outcome in applications like phase identification/ quantification, unit cell indexing and crystallite size analysis.

The high intensity resulting from the use of polycapillary collimating lens in the XMD-300 X-ray Diffractometer and high speed of data collection due to the Linear Position Sensitive Detector yield good quality diffraction data rapidly with a high signal to noise ratio which makes phase identification easy.

Table 1. System Configuration	
Unisantis XMD-300 Diffractometer	
X-Ray Tube	50 W; Air cooled; Cu anode
Incident Beam Optics	Polycapillary collimating lens
Tube Voltage	45 kV
Tube Current	0.8 mA
Detector	Position Sensitive Detector
Sample Stage	Standard sample stage with laser alignment

The complete scan was recorded by measuring 8 times a 10° interval during 60 seconds, which corresponds to the active length of the PSD. These measurements were subsequently concatenated.

The diffractogram for this sample was obtained using the above instrumental configuration and is shown in Fig.1.

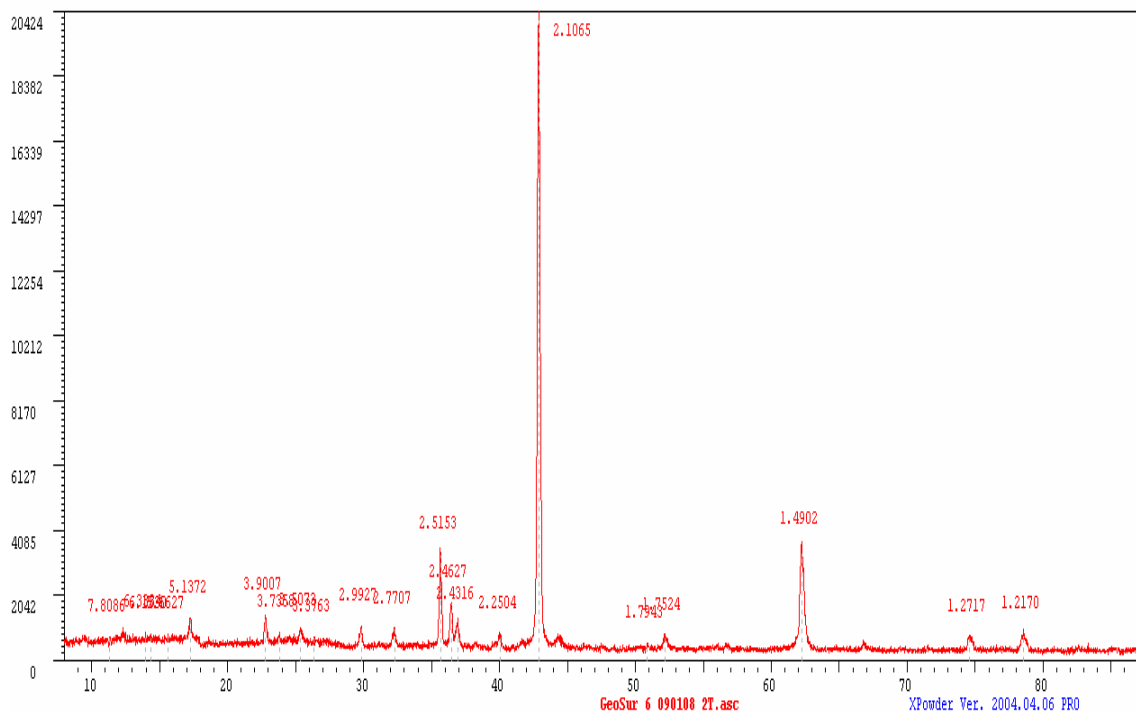


Fig.1. X-ray diffraction pattern for the sample obtained from Unisantis XMD-300

Search-match was conducted on the diffractogram obtained for this sample followed by quantitative phase analysis using the RIR (Reference Intensity Ratio) method. The result is given in Fig.2.

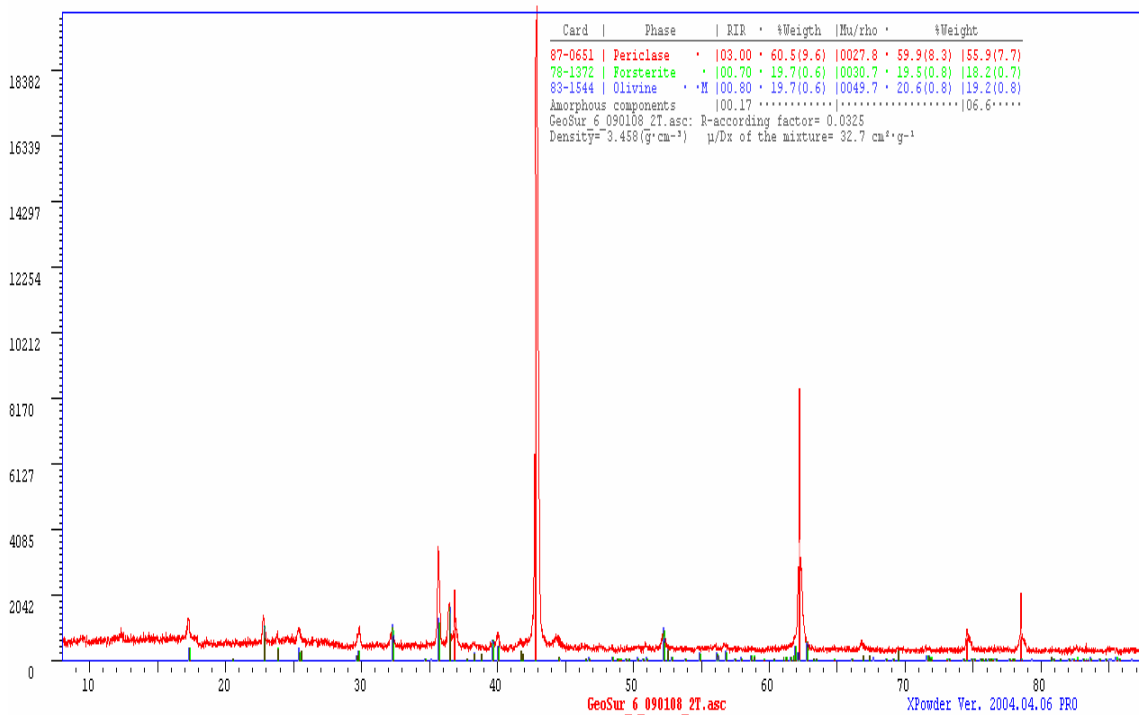


Fig.2. Mineral phases identified in the sample and Quantitative analysis results

Results

Analysis was carried out on the raw diffraction pattern obtained for this sample.

The best search-match hit was found to be Periclase. Two other phases were also present in substantial quantity and identified as Forsterite and Olivine. The ICDD PDF stick patterns for the best search-match results are shown along with the quantitative analysis results.

The analytical results and all graphics can be integrated into WINDOWS™ and MSOFFICE based packages for reporting and documentation.

It may be noted that the XRD data for each sample, covering the entire 2Theta range, was collected in only 8 minutes with high intensity and excellent signal to noise ratio.

Conclusions

The present study demonstrates that Unisantis XMD 300 Polycapillary Optic X-ray Diffractometer provides rapid and reliable data that is highly suitable for all X-ray diffraction studies such as phase identification, phase quantification, crystallite size measurement and unit cell indexing.

The quality of diffraction data obtained using a low power tube is exceptionally good considering the fact that the data has not been corrected for any of the errors known to be generally associated with powder diffraction experiments

It may be noted that due to its parallel beam geometry the data provided by XMD is without any instrumental errors known to be associated with conventional powder diffractometers such as sample displacement error, sample transparency errors, etc.

Company profile

Unisantis Europe GmbH is a global leader in development and manufacturing of innovative X-Ray analytical instrumentation, complete solutions and software for structure and elemental analysis using proprietary Polycapillary optics known for best beam collimation. Success in research has enabled Unisantis Europe GmbH to develop new cutting-edge X-ray technology, applications and products for the market. Our products have particular applications in material characterization, life science and industrial analysis.

Unisantis instruments incorporate a new range of user benefits, including transportability and multi-functionality all comprised in compact, bench top, user friendly, environmentally safe and low energy consumption equipment.

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