Evaluation of Unisantis XMD 300 Polycapillary Optic Parallel Beam Diffractometer using NIST Instrument Sensitivity Standard (SRM 1976)

Abstract

The instrument sensitivity of a X-Ray Diffractometer is very critical to any powder diffraction experiment.

In the present study, an evaluation of the sensitivity of Unisantis XMD 300 polycapillary optic parallel beam diffracto-meter was carried out using the NIST SRM 1976.

The results obtained indicate the high sensitivity of the instrument

Introduction

Qualitative and Quantitative phase analysis are important techniques in many industrial and mineral processing applications.

Precise Peak positions and proper peak intensities are very critical for qualitative and quantitative phase analysis. While precise peak positions facilitate a proper identification of the phase constituents, relative intensity of the peaks enable a reliable quantitative phase analysis.

The ability of Unisantis XMD 300 to provide precise line position data was reported in Unisantis Analytical Report- XRD 101.

National Institute of Standards have developed a Standard Reference Material exclusively for testing the instrument sensitivity of a powder diffractometer.

NIST SRM 1976 consists of a sintered alumina plate intended for calibration of powder X-Ray equipment for diffraction intensity as a function of 2θ angle.

In this study, NIST SRM 1976 is used to test the instrument sensitivity of Unisantis XMD 300.

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

The diffractogram obtained for NIST SRM 1976 using the above instrumental configuration is given in Fig.1.

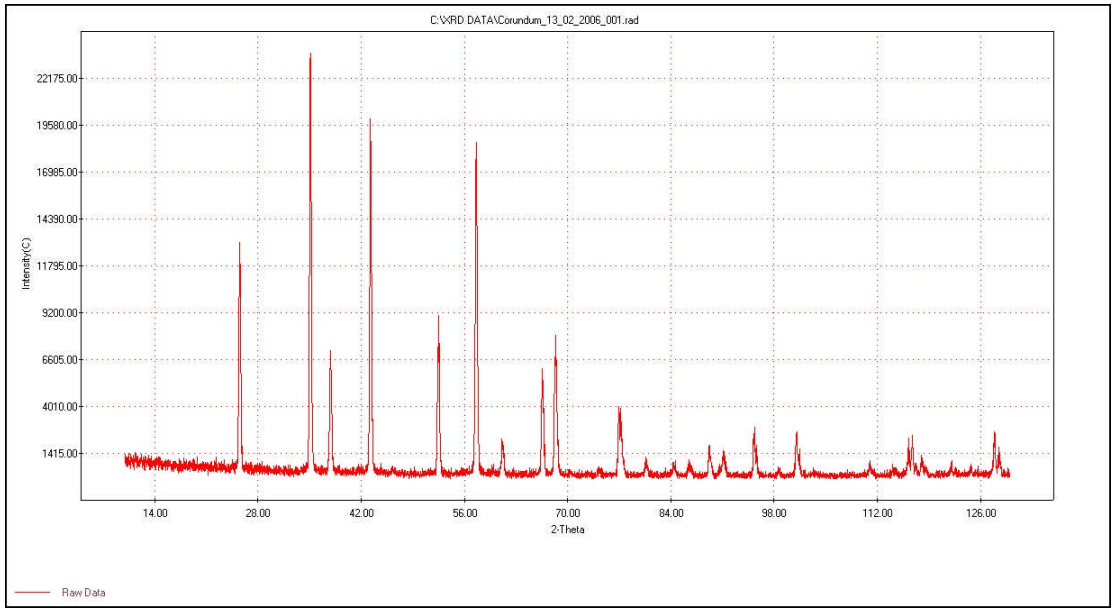

Fig 1. XRD Pattern of NIST SRM 1976 obtained from Unisantis XMD300

Results

The intensity values of 12 selected lines from the alpha alumina standard (NIST SRM 1976) were plotted as ratios of measured relative line intensities (strongest line = 100) to the certified values. The average ratio value was also estimated. This plot is given in Fig 2.

Several round-robin tests have shown that specific models of powder diffracto-meters may exhibit a 5-15% intensity variation across the 2θ range.

The data obtained from Unisantis XMD 300 shows an average value of 0.94 which means that the intensity variation across the 2 theta range is very nominal.

The largest deviation was found to be 0.01045°. This difference very well agrees with the value suggested in literature.

The quality of this data is excellent considering the fact that the data has not been corrected for any of the errors known to be generally associated with powder diffraction experiments

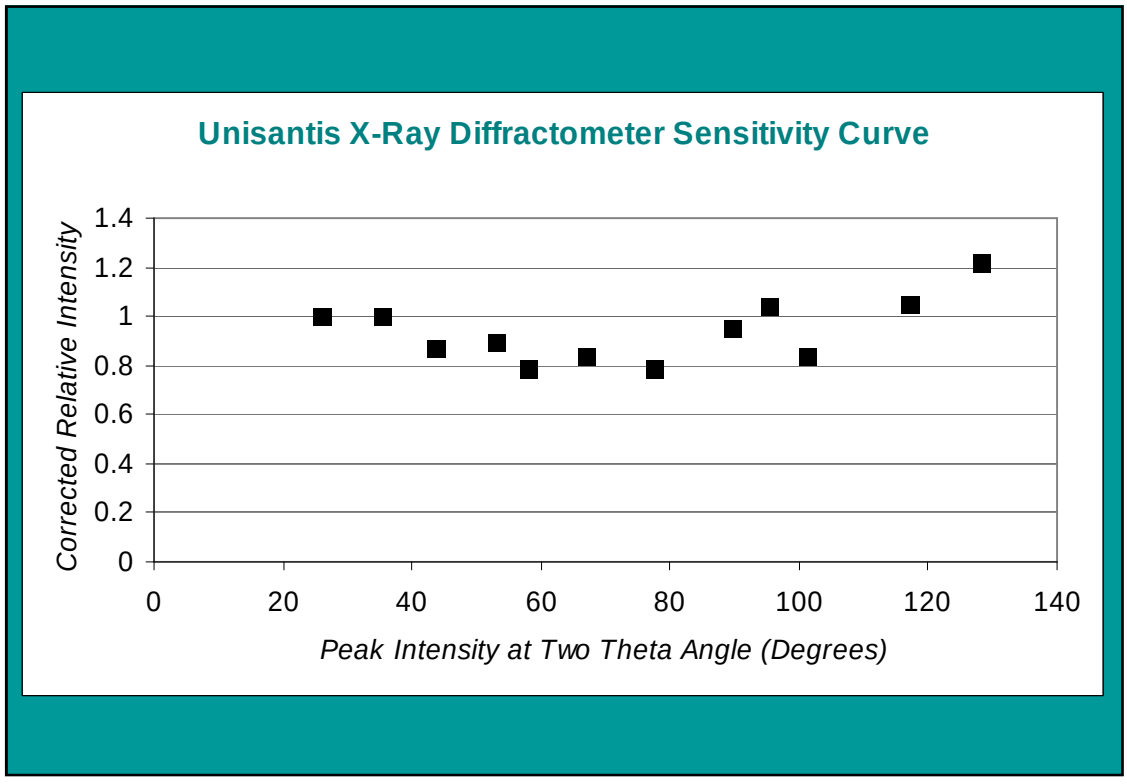

Figure 2. Diffractometer Sensitive Curve of Unisantis XMD 300

Conclusions

The present study demonstrates that Unisantis XMD 300 Polycapillary Optic Parallel Beam Diffractometer makes a precise and reliable measurement of peak intensity over the entire two-theta range

Thus, the intensity data provided by Unisantis XMD 300 is highly suitable for X-ray diffraction studies such as phase identification and quantitative analysis.

The quality of diffraction data obtained using a low power tube is exceptionally good.

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 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 multifunctionality all comprised in compact, bench top, user friendly, environmentally safe and low energy consumption equipment.

Unisantis Headquarter

Unisantis Europe GmbH
Werner-von-Siemens-Strasse 31
49124 Georgsmarienhütte
Germany

Tel: + 49 5401 3681 40
Fax: + 49 5401 3681 50
E: sales@unisantis.com

Unisantis FZE
P.O Box: 17667
Dubai, United Arab Emirates
Tel: + 971 4 808 44 44
Fax: + 971 4 881 98 98
E: info-me@unisantis.com

sales@unisantis.com
www.unisantis.com