

XMF 104 X-ray Micro Analyser

X-ray Spectrum of Monazite Mineral Grains

Introduction

This application notes highlights the utility of micro-beam x-ray characterization in the fields of geology, ore mineralogy and mineral processing. In this study, micro beam x-ray elemental analysis has been carried out on separated monazite mineral grains.



Such a study was possible due to the high resolution of Unisantis XMF-104 X-ray Micro Analyser which allows precise characterization of various elemental components of mineral grains of very small size.

Unisantis XMF-104 X-Ray Micro Analyser

Application Note: 601

In association with Institute for Roentgen Optics, Moscow

Application Background

In many geological applications, it is required to qualitatively and quantitatively determine the elemental composition of separated mineral grains. Normally, electron microprobe is preferred for such applications for various reasons. Conventional XRF is usually preferred only for bulk analysis of materials and cannot cater to the analytical needs of small grains. Moreover, the huge dimensions of the XRF instrument and high cost of analysis also are disadvantageous to such analytical needs.

However, using Unisantis XMF–104 Micronalyser, equipped with Kumakhov's Polycapillary Optics, it is possible to precisely analyse such materials. The Unisantis XMF 104 micro X-Ray fluorescence spectrometer produces a small beam spot due to x-ray lens. This makes the XMF 104 eminently suitable to analyse specific areas of interest in non-homogeneous ores and minerals. A quick quantitative assessment of the mineral quality for geological and geochemical prospecting is possible with Unisantis XMF –104.



Instrumentation

Measurements were performed using a Unisantis XMF-104 X-Ray Micro Analyser, equipped with a 50 W Molybdenum tube and a high resolution two-stage Peltier cooled, compact Si-PIN detector.

This reduces the dimensions of the instrument significantly and also eliminates the need for cooling of the detector with liquid nitrogen.

The XMF uses a Polycapillary focusing lens which provides the analyst an intensely focused x-ray beam of very small diameter. Typical dimensions of the focal spot at the exit of the lens vary between 50 and 250 microns. The optical layout of the equipment is given in Fig 1.

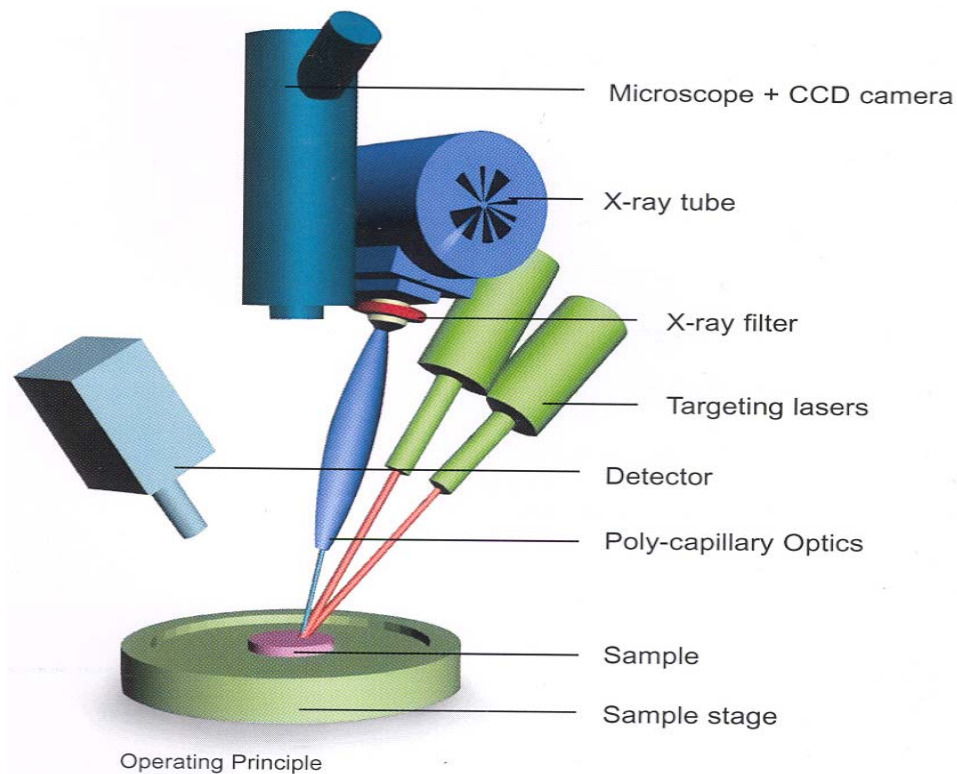


Fig 1. Optical lay out of Unisantix XMF–104 Micro Analyser

A digital photo of part of the surface of the film with separated monazite grains of 50 – 100 micron in size placed thereon taken at 60x magnification is given in Fig 2.

The micro EDXRF spectrum obtained from the above sample is illustrated in Fig 3. The measurement conditions are listed in Table-1.



Fig 2. Photo record of the sample of separated Monazite mineral grains

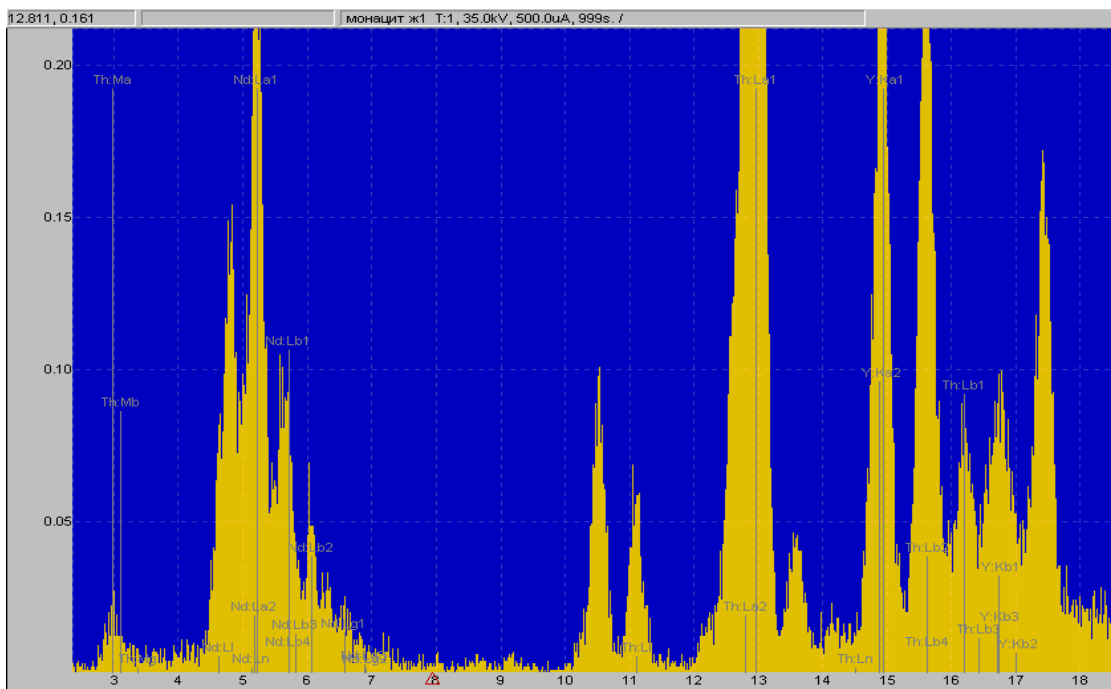


Fig 3. Micro EDXRF spectrum obtained from Monazite mineral grains

Tube	Voltage	Current	Filter	Measuring time
Molybdenum	35 kV	500 μ A	None	999 s

Table 1. Measurement Conditions

Results and Discussion

The x-ray spectrum of monazite grains given above shows the $L\alpha$ lines of Cerium (4.84 keV), Neodmium (5.23 keV), Samarium (6.64 keV), Lead (10.55 keV) alongwith a family of lines of Thorium Yttrium and uranium (13.61 keV).

Monazite samples were provided and analysis was done by a member of the Chair for Rock Age Studies, Kiev State University.

Unisantis S.A. is a global leader in the development and manufacture of innovative X-Ray analytical instrumentation, complete solutions and software for structure and elemental analysis using proprietary Kumakhov’s optics best known for accurate beam collimation. Success in research has enabled Unisantis S.A. 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.



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