

**XMF 104 X-ray Micro Analyser**

# X-ray Spectrum of Precious Metals

## *Introduction*

*This application notes highlights the utility of Unisantis XMF–104 X-Ray Microanalyser in the application areas of geology, ore mineralogy and mineral processing. In this study, micro beam x-ray elemental analysis has been carried out on separated mineral grains of precious metal ores like chalcopyrite. This study stresses the ease, cost effectiveness and high utility of such X-ray Microanalysis studies.*

*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. In addition, XMF-104 uses a Polycapillary focusing lens which provides the analyst an intensely focused x-ray beam of very small diameter which is very essential for such geo-prospecting studies.*



*Unisantis XMF-104 X-Ray Micro Analyser*

## **Application Note: 602**

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 micro areas such as inclusions, intrusions and impurities. Generally, electron microprobe is preferred for such studies due to huge dimensions of the conventional XRF instrument and high cost of such elemental analysis.

However, using Unisantis XMF–104 Microanalyser equipped with Kumakhov's Polycapillary Optics, it is possible to precisely analyse such materials qualitatively as well as quantitatively. The other advantages are usage of low power tube and micro focussing using polycapillary lens.

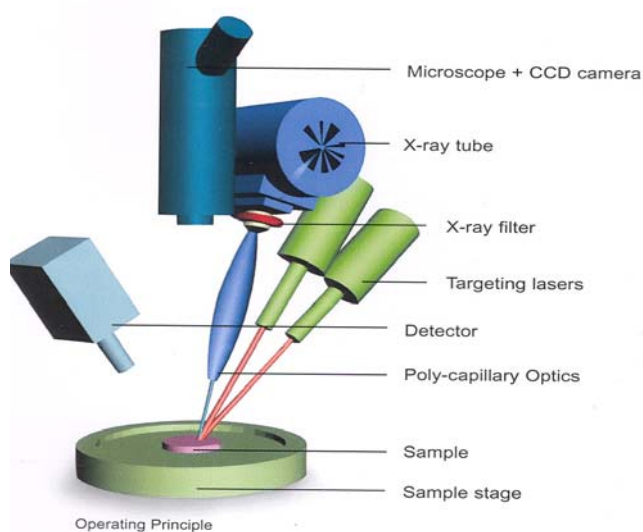


Fig 1. Optical lay out of Unisantis XMF–104 Micro Analyser



## 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 lay out of the equipment is given in Fig 1.

### **Sample Details**

The sample used for this study is chalcopyrite ore from Talnakh field area. The main objective of the study was to quantitatively estimate the precious metal grain inclusions in the ore. Ore sample was provided by the Polar Branch of Norilsk Nickel OJSC. The analysis was performed at the Institute for Roentgen Optics by V.A. Mikhin.

The digital pictures of the sample at two different magnifications are given in Figs 2 and 3. X-ray spectrum of precious metal grain inclusions in chalcopyrite / pyrrhotine ore is given in Fig 4. The measurement conditions for this study are given in Table 1.

<b>Tube</b>	<b>Voltage</b>	<b>Current</b>	<b>Filter</b>	<b>Measuring time</b>
Molybdenum	30 kV	30 $\mu$ A	None	100 s

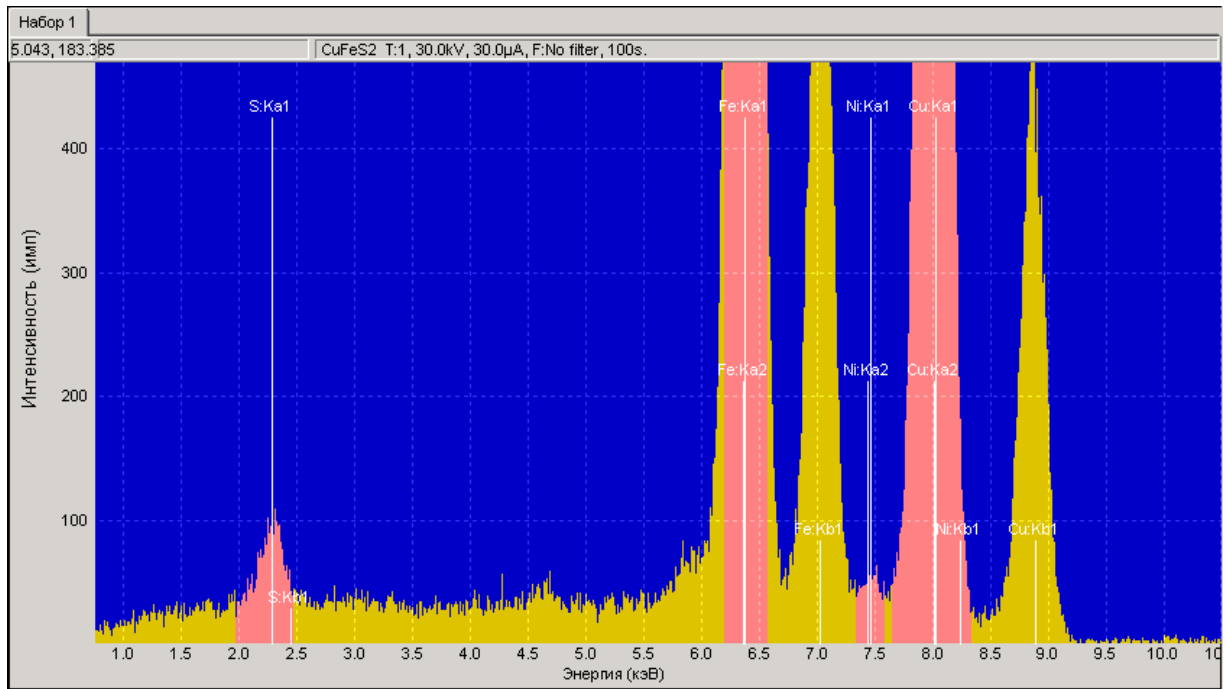
**Table 1. Measurement Conditions**



**Fig 2. Digital Picture of Chalcopyrite sample at 15X magnification**



**Fig 3. Digital Picture of Chalcopyrite sample at 60X magnification**



*Fig 4. Micro EDXRF spectrum of the chalcopyrite sample*

### *Results and Discussion*

*The elements present in the sample were quantitatively determined using Fundamental Parameters approach. The elements identified in the sample are listed below:*

<b>Pd</b>	<b>Pt</b>	<b>Sn</b>	<b>Ni</b>	<b>Fe</b>	<b>Cu</b>
<b>63.8%</b>	<b>12.42 %</b> ,	<b>21.73 %</b> ,	<b>0.39%</b>	<b>1.68%</b>	<b>0.02%</b>

*The above study amply illustrates the utility of Unisantis XMF –104 such precise studies on micro samples which is very essential in geological prospecting.*

*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 optics known for best 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.*

**Unisantis S.A.**

**Avenue des Morgines 12**

**1213 Geneva, Switzerland**

**Tel.: +41 22 879 11 70. Fax: +41 22 792 60 11**

**sales@unisantis.com**

**www.unisantis.com**