

TIMA-X TESCAN

Enhancing SGS' Automated Mineralogy with TIMA-X Technology

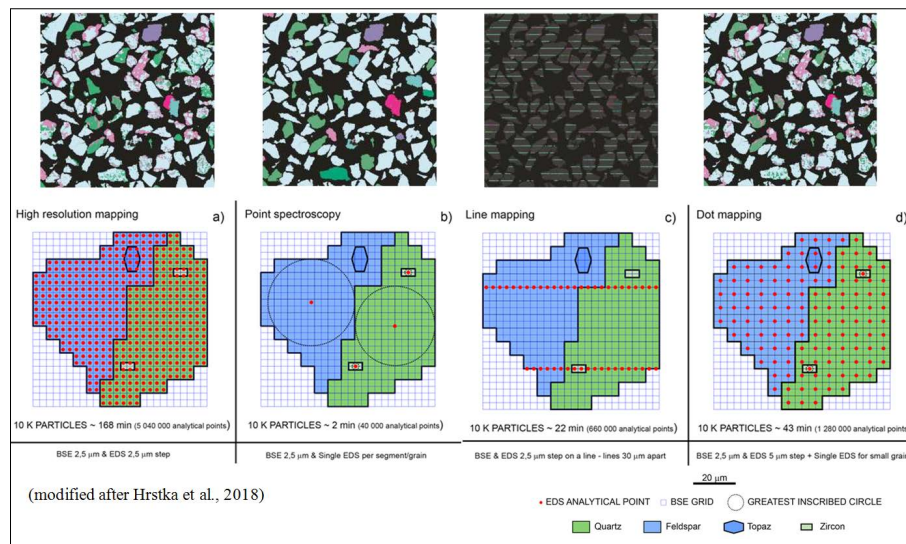
SGS has been providing the mining industry in Canada and worldwide with trusted cutting-edge automated mineralogy. Our team of mineralogical experts ensures a quality product, and offers a significant interpretive value addition at every stage of a project. Detailed mineralogical interpretations provide significant input into strategic decisions, and the competitive advantage for our clients. The detection limits and fine textural data collection and interpretation are currently greatly improved using new advancements in automated mineralogy technology. The recent addition of the Tescan Integrated Mineral Analyser (TIMA-X) in our services extends our capabilities in automated mineralogy, coupled with our in-depth experience for a variety of ores (strategic metals, base and precious metals, industrial minerals and others), and other analytical techniques.

TIMA-X is one of the newest and most versatile automated mineralogy systems to provide rapid quantitative analysis of samples including:

- Ores
- Concentrates
- Rocks
- Tailings
- Leach Residues
- Smelter Products

The TIMA-X configuration uses four Energy Dispersive X-Ray (EDX) silicon drift detectors (SDD) attached to a TESCAN MIRA (field-emission gun – FEG) platform, which also includes backscattered electron (BSE) and secondary electron (SE) detectors. The full integration of hardware and software significantly enhances performance and reliability.

The TIMA-X system combines both the EDX and BSE signals to identify minerals at each measurement point (or each homogeneous



segment of a grain, depending upon the analysis mode). The EDX spectra (and BSE data) are compared to entries in a mineral library on a first match principle to identify the mineral phase. Therefore, directly acquired chemical compositions of each phase, collected during the measurements, can be used for mineral assay reconciliation to ensure best in class mineral to assay data validation. The SGS configuration of the TIMA-X software applications allows for determination of mineral concentrations, elemental distributions and mineral textural properties such as:

- Grain size
- Liberation and locking parameters
- Association and exposure
- Mineral release and predictive grade-recovery response

TIMA-X introduces a number of novel approaches in the search for minerals of interest (bright phases search) including gold, silver, rare earths, platinum, and it is optimized to detect sub-micron inclusions and rapidly acquired low-count spectra.

TIMA-X MODES OF ANALYSIS

TIMA-X has four X-ray analysis scanning modes to identify mineral/compounds which can be further optimized for different analysis types including:

High-Resolution Mapping (THRM)

The THRM collects simultaneously BSE signals and EDX data at a set resolution by the user to map the particles and/or fields (i.e., intact drill core samples). The THRM is used to collect modal and textural information like liberation or exposure data.

Point Spectrometry (TPS)

The TPS examines individual image segments which are determined using the BSE mode. Thus, when homogeneous regions of similar BSE brightness are identified, then an X-ray analysis point is taken at the center of each of these regions.



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Line Mapping (TLM)

In the line mapping mode (TLM), each field is covered by equidistant horizontal lines using a specified line spacing, which is user dependent. At a set pixel spacing on each line an X-ray analysis point is taken. This analysis mode is ideal for fast modal mineralogy and grain size information.

Dot Mapping (TDM)

The TDM analysis mode uses a BSE grid at a specific pixel spacing to segment areas of homogeneous BSE intensities and identifies the center of the greatest inscribed circle (similar to the point spectroscopy). A grid for the X-ray acquisition with specified resolution is then set. The X-ray data from zones of similar BSE and EDS signals are quantified to produce single high-quality spectra for each final segment for proper mineral identification. The combination of high resolution BSE and lower resolution EDS provides an excellent combination between speed and analysis detail. This analysis mode is robust for modal mineralogy, grain size and liberation analysis.

KEY FEATURES

- Comprehensive offline mineral reclassification, investigation, image processing, reporting and interpretation functions
- Greater flexibility in reporting (extensive query language for analysis and modeling of mineral particle behavior)
- Extremely fast system (up to 4 EDS detectors which are fully integrated)
- Superior resolution of the Field Emission Gun (FEG) electron source
- Silicon nitride (Si₃N₄) detector window – (optimize for light element analysis)
- Fully integrated quantitative EDX analysis of measured X-ray spectra
- Superior quantitative data for analyzed minerals (uses proprietary spectral segmentation to produce high quality spectra)
- Analysis optimization of variable size mineral particles (seamless data stitching and utilization of hybrid analytical modes for fast and detailed data acquisition)



MINERAL APPLICATIONS

Plant Support Mineralogy

Automated mineralogy including TIMA-X technology can be used as a production improvement tool for metallurgists at mines and plants.

SGS' plant support mineralogy provides detailed quantitative mineralogical analysis of the feed and various metallurgical products, which are typically carried out at weekly, monthly or quarterly intervals to ensure ongoing efficiency, while quality control is monitored and benchmarked over time. Plant support mineralogy can be used to assess, and trouble-shoot mineral and metal recovery, and provide solutions to improve the flowsheet, depending on the current and future feed to the plant.

The SGS team of process mineralogists and metallurgists can help drive metallurgical results in real time and optimize operating conditions.

Plant support mineralogy assists with:

- Ore variability
- Adaptability of your flowsheet based on ore variability changes (i.e., alteration zones, hardness, textures)
- Ability to understand and communicate in real time to adjust operating conditions
- Increase overall efficiency, recovery and profit
- Benchmarking and monitoring of plant operations over time
- Troubleshooting plant processes

Gold Characterization

Gold recovery is one of the most complex tasks in mineral processing. The TIMA-X can determine and quantify the microscopic chemical forms of gold in exploration and metallurgical samples, concentrates, tailings, residues, and slags. TIMA-X can measure the grain size, liberation and association, and surface exposure of the gold minerals. It also excels in the detection of ultrafine gold particles. The analysis, coupled with decades of SGS experience, provides solutions to understand gold recovery, and help to prevent and minimize gold losses.

IN SUMMARY

Our trusted automated mineralogy and team of professionals provides significant input required for informed strategic decisions. Adding TESCAN's TIMA-X technology enhances our current suite of SGS' automated mineralogy capabilities that have been offering across Canada and worldwide for decades. Better detection limits, superior imaging and faster turn around times, and results, coupled with advanced interpretations, yield a holistic solution. Contact us anytime to learn how incorporating our automated mineralogy services can help your projects today!

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WHEN YOU NEED TO BE SURE