FIRST Newsletter

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Where a Single PPM Counts for Millions of Dollars

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Introduction

Mining is one of the most profitable businesses due to the increasing worldwide demand, but calling at the same time for huge investments in remote territories or low grade resources. From the very beginning, decisions must be made in seconds in every step of the mining process – waste rock or valuable ore! Every truckload containing more than 300 tons of rocks must be sorted; the parameters for the mineral processing must be set quickly, the final grade of the material must be determined accurately before shipping. Determining the ore concentration accurately, increasing the mine efficiency, improving the analytical accuracy by a single ppm, reducing the concentration of hazardous elements by a ppm –this all sums up to millions of dollars of returns.

But the process and grade control of mined materials has become a challenging task in mining operations today. Low-grade ores with frequent changes in mineralogy will be the future source for the metal industry. This makes the setup and maintenance of analytical strategies in the mining lab is difficult. New environmental regulations are enforcing the control of hazardous elements in final products. Therefore, early knowledge of contaminations from ores helps producers to avoid hazardous element, such as Cd or Pb, contaminations in the final metal alloys. These new requirements enforce a higher degree of analytical flexibility, which cannot be fulfilled with traditional setups in mining labs.

Simultaneous wavelength-dispersive XRF instruments deliver accuracy paired with precision in the shortest possible measurement time. These instruments are configured with fixed wavelength-dispersive element channels for a selection of elements of special interest. This makes them an indispensable tool for process control in metals and

*Figure 1: **S8 DRAGON** simultaneous XRF spectrometer*

mining. By achieving high analytical speed, a maximum sample throughput in the mining lab is ensured. Traditional WDXRF units, however, are configured for a fixed application; any additional demand for analytical flexibility slows down the analytical speed when changing from the simultaneous to the sequential mode.

The new instrument design of the **S8 DRAGON** combines the analytical performance and speed of a conventional configuration with fixed single-

element channels (SEC) with a simultaneous Multi Element Channel (MEC) in order to achieve high analytical speed, precision, and accuracy in combination with analytical flexibility. At the same time, while the elements of interests are counted with the SECs, the MEC records the complete spectrum of the sample (Figure 2). This "snapshot" of the elemental composition enables monitoring of all elements present in the sample, but doesn't add additional measurement time.

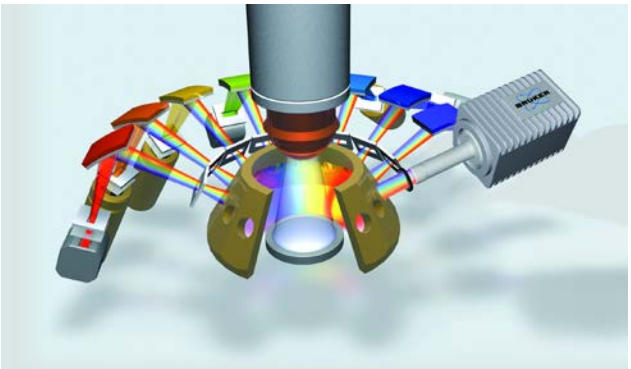

*Figure 2: Beam path of the **S8 DRAGON***

On the Top for Process Control

For the efficient control of mineral processing steps in the mine, samples must be analyzed quickly for fast adaption of the process parameters. Samples from the various steps (crushing, milling, flotation or leaching) are dried and prepared as pressed pellets. A few minutes after the samples are received, they are analyzed in the **S8 DRAGON** (Table 1).

The **S8 DRAGON** applies up to 4 kW power to excite samples with X-rays, ensuring maximum intensity for each element. Due to the compact coupling between X-ray tube anode, sample surface and the X-ray detector, distances are minimized and the highest possible count rate is attained. Each important element is measured by a separate SEC, designed and optimized to achieve optimal results for that element. At the same time, the MEC records the whole spectrum of the sample, revealing contaminations of hazardous trace elements that occur occasionally. The results for essential elements can be checked at any time using the MEC as a second information source. This is a unique advantage, making sure decisions for mining process control are always based on compositional data.

Table 1: Analytical precision for iron ores, prepared as pressed pellets, control the mineral processing step at the mine site (measurement time 60 s).

Sample	Average (%)	Abs. Std. Dev. (%)	Rel. Std. Dev. (%)
Fe (%)	66.698	0.020	0.029
SiO2 (%)	0.829	0.003	0.312
P (%)	0.040	0.000	0.368
Al2O3 (%)	0.902	0.004	0.422
Mn (%)	0.673	0.014	2.026
CaO (%)	0.013	0.001	4.003
MgO (%)	0.032	0.000	1.351
TiO2 (%)	0.053	0.001	2.319
K2O (%)	0.017	0.000	0.833

The **S8 DRAGON** is built to maintain its solid performance in the long run (Figure 3). The detection channels are mounted outside the spectrometer chamber. Therefore, all components are easily accessible for a quick adjustment or repair. By arranging the X-ray tube and the element channels above the sample, the risk of

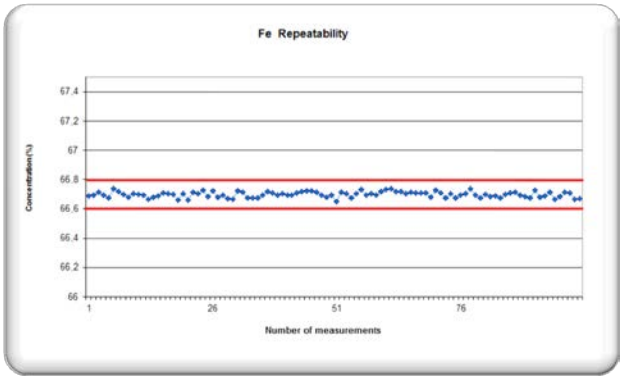

Figure 3: Long term repeatability for iron in pressed ore samples

contamination is eliminated – even by dust or broken pieces of the sample material. This guarantees flawless operation, without any elaborate or expensive maintenance and service, even in a dusty environment.

Accuracy at Its Best for Grade Control

When it comes to the determination of the final grade, every single ppm counts because the total concentration of valuable metal determines the ore's commercial value. Hazardous elements reduce commercial value, however, as they cause problems in metal processing later on. To enable accurate determination of different ore grades, the preparation of fused bead is the worldwide accepted procedure (Table 2). Along the supply chain the grades are evaluated according to international standards such as ISO 9516. Any reported difference will lead to financial loss. But lab managers in shipping stations, customs and service labs or at metal production sites can rely on the **S8 DRAGON** delivering unequaled analytical accuracy and precision.

Table 2: The analytical precision derived from 200 measurements of a low-grade iron ore, prepared as fused bead to evaluate the ore grade (measurement time 60 s).

Sample	Average (%)	Abs. Std. Dev. (%)	Rel. Std. Dev. (%)
Fe (%)	47.065	0.013	0.028
SiO2 (%)	0.673	0.006	0.869
P (%)	0.031	0.001	0.746
Al2O3 (%)	4.081	0.014	0.334
Mn (%)	15.348	0.016	0.102
CaO (%)	0.032	0.001	1.867
MgO (%)	0.032	0.002	5.401
TiO2 (%)	0.023	0.003	11.705
K2O (%)	0.160	0.001	0.484

Ease of Use and Reliability

The **S8 DRAGON** utilizes TouchControl™ for ease of use and reliability. TouchControl™ enables multilingual (English, Chinese, Portuguese, Russian, Spanish, etc.), simple and fail-safe operation via an integrated touch screen, thus requiring minimal user training (Figure 4).

*Figure 4: Simple operation of the **S8 DRAGON**, quick loading and intuitive operation with TouchControl*

Summary

The **S8 DRAGON** delivers analytical performance combined with instrument uptime and easy operation, making it the ideal choice for service and process labs in mining, especially in remote places. Detailed, accurate analysis of different ore grades with maximum precision means the ideal information source for quick decisions – information you can rely on for process and quality control. In addition, the **S8 DRAGON**'s unique multi-element channel provides the analytical flexibility to spot contamination or new elements in the mined materials; it acts as an integrated backup for the single-element channels, the backup for essential elements. Users in mining can be sure that their analytical tool gives the best possible result every time.

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