



FIRST Newsletter
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S2 KODIAK – the Perfect Fit for Base Metal Ore Mining

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The S2 KODIAK is perfectly suited for online process control in mining operations. By measuring the exact material composition at any time, hydro- or pyro-metallurgical processes can be optimized to increase output and enhance separation efficiency. Real-time control of the blending step ensures a constant concentrate composition in support of later refining steps. The S2 KODIAK not only analyzes major and minor elements, it also delivers information about hazardous trace elements, such as As or Pb. Low-quality material can simply be excluded from further processing. The S2 KODIAK works for base metal ores, such as iron, nickel, copper, chromium, molybdenum, titanium, tungsten and delivers immediate results for all of them.



Figure 1: Iron ore blending and shipping.



Figure 2: S2 KODIAK online XRF spectrometer on top of conveyed material.

Typically in mining operations, only a few samples are analyzed in a central lab and the results are seen as representative for the entire ship load. But the ore keeps changing, leading to higher variation, and huge differences between the analyzed material and the ore concentration on the vessel are common. When analyzing the material directly during loading with the S2 KODIAK, the exact amounts of base metals in the shipped material is known. This is a source for high savings in shipping costs.

The entire ship load under control – instantly, at any time, with the performance you need – thanks to S2 KODIAK

Current and future demands for online analysis in the shipping terminal, during loading of iron ore onto vessels and trucks, are answered by the XRF spectrometer S2 KODIAK. Based on energy-dispersive X-ray fluorescence technology, the S2 KODIAK is the ideal choice to act as an element sensor for iron ore mining, blending and shipping.

The spectrometer provides real-time information about major, minor and trace element concentrations from 100% down to a few ppm. The material stream when blending and loading onto ships can be closely monitored in real time based on the S2 KODIAK's results. A typical absolute deviation of less than 0.5% for iron allows perfect blending to match guaranteed element concentration of the ore. Due to the nature of online XRF, there is no need for additional sample preparation equipment, and integration into the loading or shipping process is mechanically simple.

The S2 KODIAK is mounted above the conveyor belt. Large lumps from 30 cm down to fines – grain size < 5 mm – are continuously analyzed. The X-ray tube excites the elements in the material and the fluorescence radiation from the elements present is detected with an energy-dispersive silicon drift detector. Today these detectors operate maintenance-free, requiring only electrical Peltier cooling. The energy resolution is in the range of 160 eV at 100,000 cps, which allows separation of neighboring spectral lines. The complete

spectrometer is mounted in an entirely closed stainless steel box for X-ray safety.

The material on the conveyor belt is constantly analyzed. A typical spectrum of iron ore recorded with the S2 KODIAK is shown in Figure 3. Neighboring element lines, such as Mn and Fe, are resolved, and even trace elements such as Pb and As are analyzed

Low-grade material was analyzed with the S2 KODIAK in order to evaluate its end value and do a real-time sorting. With a single calibration, the S2 KODIAK handles wide concentration ranges covering the entire material, from waste rock to low-grade ore.

With an absolute analytical standard deviation of less than 0.1 %, the S2 KODIAK shows its impressive analytical precision. The instrument handles wide material ranges and particle sizes from fines up to bigger lumps, all that the same time. In addition, humidity is automatically taken into account since this can vary in wider ranges.

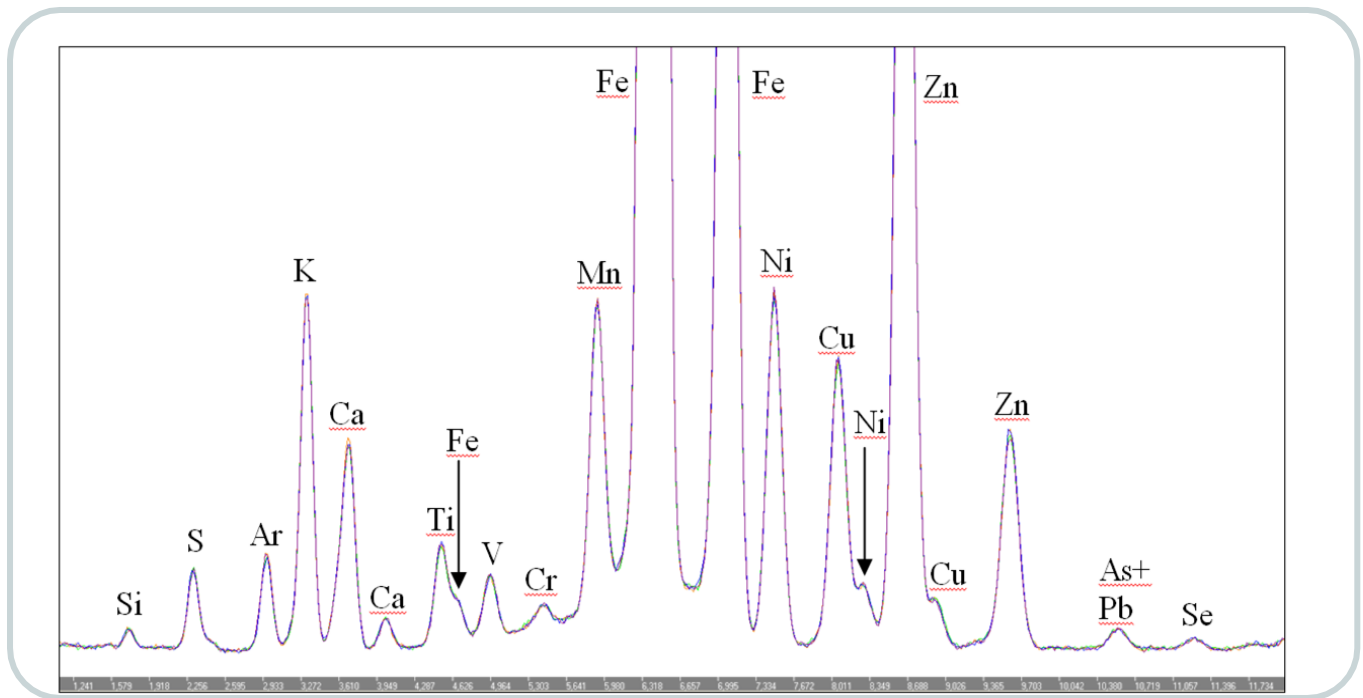


Figure 3: Iron ore spectrum recorded with the S2 KODIAK. With high resolution, neighboring elements (Mn, Fe) are clearly identified, and with high sensitivity, trace elements (Pb, As) are easily analyzed.

Table 1: Analytical results of low-grade iron ore

	SiO ₂	S	K ₂ O	CaO	TiO ₂	Fe ₂ O ₃	NiO	CuO	ZnO
Abs. Std. Dev. [%]	1.87	0.36	0.11	0.13	0.012	0.24	0.010	0.010	0.04
Average Conc. [%]	47.09	7.17	4.03	2.84	0.52	11.25	0.19	0.12	0.44
Rel. Std. Dev. [%]	4.0	5.0	2.7	4.5	2.3	2.1	5.1	8.7	9.4
Difference between Min. and Max. Conc. [%]	27.05	11.99	2.20	2.34	0.28	10.88	0.48	0.30	1.09

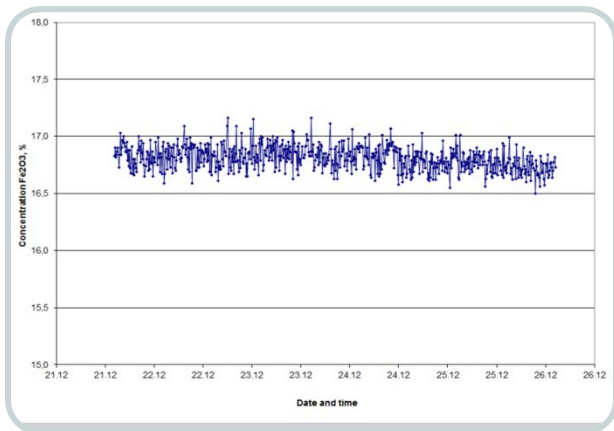


Figure 4: The precision test: S2 KODIAK measurements of iron ore on five consecutive days.

Safety First: No radioactive targets, integrated safety and more than 98 % uptime – in short: S2 KODIAK

The S2 KODIAK comes with a complete safety circuit that ensures the unit is completely X-ray safe at all times. Most importantly, in contrast to other techniques, the S2 KODIAK operates without radioactive targets. Installation, setup, approval from authorities, and maintenance are easy to do. An integrated camera allows checking the material flow below the analyzer, or visually inspecting the tube and detector shielding.