PULSED NEUTRON TECHNOLOGY: EXPLORING NEW DIMENSIONS

FASTGRADE™
LOGGING NEUTRON TOOL

SODERN
NEUTRON TECHNOLOGY
FastGrade™ is an opportunity for the mining sector to rethink and optimize, in real time, its production cycle based on the ore grade.

Assays from cored boreholes, reverse circulating (RC) boreholes or blast hole samples, do not always provide truly representative analyses and are very expensive. However, borehole logging provides in situ elemental analysis, making the use of altered samples no longer necessary. Used for many years in the oil service industry, the technology is based on a neutron analytical technic called Pulsed Fast & Thermal Neutron Activation (PFTNA). This technology explores new dimensions and might be a game changer for the mining industry.

**FastGrade™ 100: Making your exploration program more informative for less**

The FG100 tool was created to help improve and streamline exploration programs and resource management.

It is controlled from a truck, and produces a complete borehole logging of up to 400 meters deep with a resolution of around 30cm.

Thanks to a great deal of accurate data, which enhance 3D resource modeling, the FG 100 Tool can significantly reduce the number of cored boreholes and reverse circulation drilling (according to the nature of the deposit and the frequency of assays required).

**FastGrade™ 170: Differential blasting as a grade engineering lever**

The FG170 tool is to be basically used in blast holes. Here, the log obtained by the FG 170, in real time, makes the optimization of explosive charging holes possible. The creation of a particle-sized separation of ore, based on its grade, makes it easy to extract low-grade material through the processing cycle.

It is controlled by a single operator from a specific vehicle or could be paired with the drilling rig. Its logging time is 10 minutes per hole, thanks to a large high-resolution LaBr3 gamma ray detector that is linked to a very fast electronic data acquisition system (2,500,000 counts/second).

Sodern leads pulsed neutron technology today

Thanks to over 50 years of experience in neutron technology, Sodern pulsed neutron tubes have been used for a wide range of industrial applications at a low cost of ownership.

The tube lifetime and reliability have been significantly enhanced through a unique combination of ceramic technology and a unique hydrogen isotopes loading process.
Neutrons emitted by the pulsed neutron generator penetrate the surrounding rock and lose their energy when colliding with nuclei. As they penetrate, they initiate different interactions, as fast inelastic collisions or neutron captors that results, nearly instantaneously, in the emission of gamma photons. Each element produces a set of characteristic energies, which is the key to identifying and quantifying them. A high resolution, scintillating material coupled with a photomultiplier converts the photons into electrical pulses and a fast processing, specialized circuit digitizer sorts and counts them to build their spectrum.

At this point a computer can unfold element footprints out of the spectrum to reveal the chemistry of the formation.
- The sensor delivers a set of spectra at regular intervals (20 cm) as it rises.

- The raw data acquisition set is represented in the form of an image (rainplot) where each line results in the color intensity of the spectrum.

- The emission rays then appear in the form of vertical traces, more or less marked by the presence of the elements they characterize.

- Digital processing makes it possible to isolate specific information about each element and thereby compensate for possible artifacts of measurement.

- Information in mass fraction of the elements, eliminates any subjective interpretation.
Knowledge

In a borehole logging configuration, the gammas signal collected by the FastGrade™ tool, and the derived elemental composition, is representative of a much larger volume of surrounding material than the delimited volume of the core material that is traditionally used to provide chemical assays.

Then, the main benefits are a better sampling statistics and reliability in resource estimation, especially when heterogeneous deposits are explored.

Resources stewardship

The FastGrade™ tool is an essential link in the natural resources optimization program.

Thanks to this tool, it is possible to sort only the high-grade and rich materials for the energy demanding transformation process, thus limiting the negative impact on the environment.

Safety

Contrary to the radioactive chemical tools, FastGrade™ is equipped with an electric neutron tube that can be turned off (Zero Neutron) during surface handling operations and in cases of accidental blockage of tools in a borehole.

Moreover, by removing the need for manual samples taken on site, the FastGrade™ tool also limits the exposure of workers to the often hostile environment of the mine.

Savings

The nature of information provided by FastGrade™, tool brings with it tangible economic resources.

• Less energy spent needlessly, during low-grade material beneficiation operations
• Less samples collected and analyzed
• Less “core-boreholes” which can be substituted by cheaper drilling technics.
In May 2009, BHP Billiton, the CSIRO and Sodern decided to jointly develop a new PFTNA logging tool, especially designed to meet current operating procedures, field conditions and borehole characteristics common to ore extraction sites.

The first units operated in the Pilbara iron ore-mining district, in 2012, when BHP Billiton started PFTNA tool experience with model FastGrade™ 100.

This tool is primarily aimed at measuring boreholes drilled for exploration and resource estimations. It is expected to log more than 100 kilometers a year by measuring the numerous 140 mm diameter holes commonly drilled on sites, using reverse circulation drilling. Operators quickly promoted the tool and its immediate benefits.

The FastGrade™ Logging Tool can be customized for various ore chemistry and different logging vehicles. For further information, feel free to contact SODERN customer support.

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