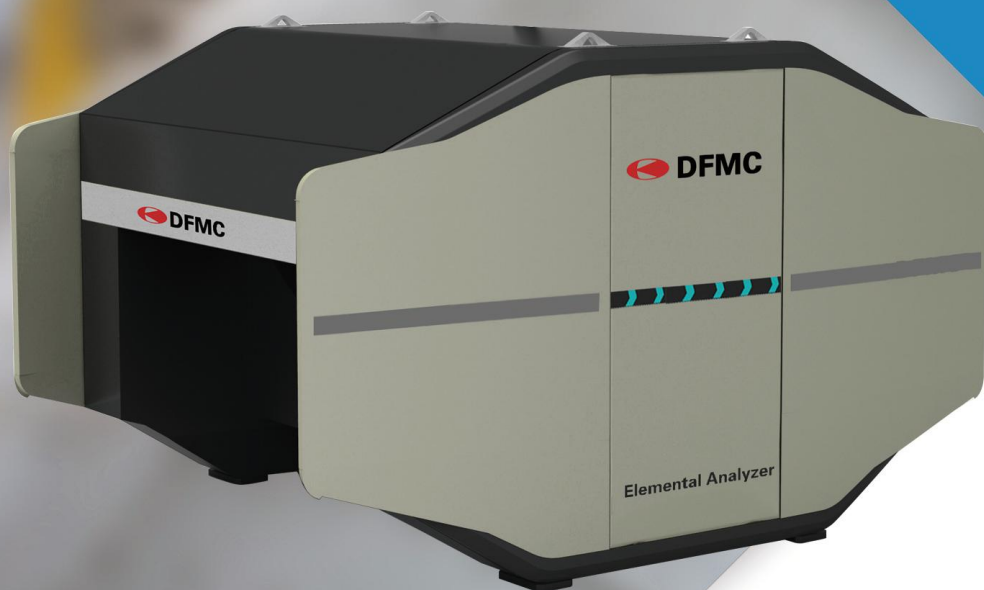




EA

Elemental Analyzer

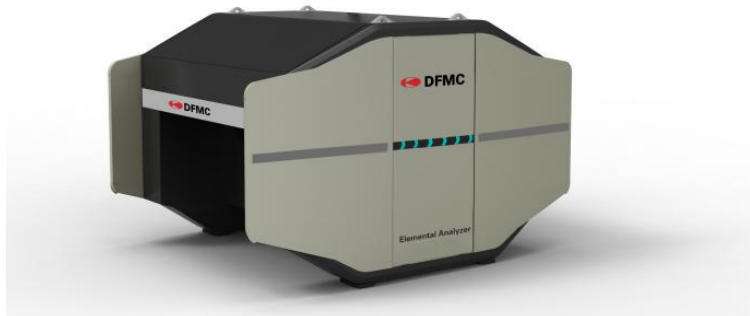


Elemental Analyzer (EA)

I. Product Overview

Elemental Analyzer (EA) features one cross-belt type online detecting device for cement materials. It is mainly used for online detection of element (compositions) contents during limestone batching, raw mix. EA is a modular structure and can be installed around a belt without the necessity to cut it. When EA operates, the belt slides through the internal supporting tank of the measuring unit and then EA measures all the materials passing by. During the whole detection process, no material is contacted and there is no influence on belt operation.

When using EA, the measuring results are given once every minute, with the contents of each element and related quality control parameters being analyzed accurately. Effective control over the production process can be made according to the real-time detecting information from the analyzer to improve the production process, reduce the production cost and improve the product quality.



II. Operating Principle

EA adopts prompt gamma neutron activation analysis (PGNAA) technology. A fast neutron with an average energy of 2.35MeV is released from a neutron source. The fast neutron is moderated into thermal neutron by the measuring device, and the thermal neutron irradiates the material and occurs thermal neutron capture reaction with all elements in the material, emitting different gamma rays with different energy and intensity. By testing the energy in characteristic gamma rays, the element categories in the materials can be distinguished, and by testing the intensity of gamma rays with specific energy, the content of elements can be got.

When the detector receives gamma rays, pulsed light will occur, which will generate electric pulse

after entering into the photoelectric multiplier. The electric pulse is magnified by electronic signal processing parts and converted through ADC, and then recombined gamma ray energy spectrum is generated. Afterwards, the element (components) of such energy spectrum can be disclosed by microprocessor and advanced analysis software.

III. Product Composition

EA consists of such five parts as measuring unit, neutron source, detector, signal processing cabinet and host computer.

1. Measuring unit

Measuring unit is of modular frame structure, including key parts supporting the prompt gamma neutron activation (PGNA) reaction during the measuring process. At the same time, it forms radiation protection against rays, so that the surrounding radiation dose meets the safety standards in GSR Part 3 which stipulated by IAEA, ensures the health and safety of working personnel.

2. Neutron source

Adopt ^{252}Cf neutron source as excitation source. Radioactive material is totally sealed within SS enclosure. The source is put into the sealed source housing from sideway and is locked outside to keep it safe. The half-life of ^{252}Cf is 2.6 years. After the half-life, new neutron source core should be supplemented to reach initial source intensity.

3. Detector

Detector is used to receive characteristic gamma rays emitted from materials and turned it into electric signal. The signal is transmitted to signal processing cabinet through cable.

4. Signal processing cabinet

Signal processing cabinet adopts SS leak-proof structure to protect in-house facilities, it is dust-proof, moisture-proof and water-proof.

The signal processing cabinet contains peripheral equipment and detector signal receiving equipment that ensure the stable operation of the detector. And then the received analog signals is converted into digital signals and uploads them to the host.

Cable is used to connect signal processing cabinet and detector, optical fiber is used to connect signal processing cabinet and host computer.

5. Host computer

Host computer consists of hardware and software, mainly acquires and analyzes digital signals from signal processing cabinet, calculates the contents of element and related quality control parameters, so as to direct and control cement production.

The hardware is a computer and the computer is equipped with data transmission interfaces. One interface exchanges data with the factory control system via OPC communication, and the other interface provides remote technical services via the Internet (provided by the factory).

By using optimized analysis algorithm, the software can analyze complicated gamma energy spectrum, it presents the measuring results once every minute, real-time display and provide multiple ways to query historical data.

IV. Performance Parameters

Application conveyor (mm)	650	800	1000	1200	1400	1600
Analyzer length (mm) *	2200	2200	2200	2200	2200	2200
Analyzer width (mm) *	1700	1700	1700	2250	2250	2450
Analyzer height (mm) *	1500	1500	1500	1700	1700	1700
Weight (kg) *	2600	2600	2600	2900	3000	3300
Angle of support groove	25°~45°					
Neutron source	15~60μg Cf-252					
Signal processing cabinet	Protection class: IP66 Dimension: 1100×770×300mm					
Working temperature	-30°C~50°C					
Power supply	~230V±10%, 50Hz/60Hz, 6.5A, 3-wire (L、N、PE)					

Measuring principle	Prompt gamma neutron activation analysis (PGNAA) technology
Analysis time	The shortest time is 1 minute, the user can set
Analysis element	Si, Al, Fe, Ca, Mg, K, Na, S, Cl, Mn, P, Zn, N, V, Cu, Ni, Ti, Cr, Ag, Hg, As and etc.
Calculate quality parameters	LSF, KH, SM, IM, C ₃ S, C ₂ S, C ₃ A, C ₄ AF, Alkalinity and etc.

*Size and weight should be determined according to the application site.

V. Product Characteristics

Comprehensiveness: Measuring all the materials passing by, with strong representativeness;

Fastness: Giving composition data once per minute;

Effectiveness: Providing key parameter data for production, so as to make effective control;

Stability: Complete hardware and software safeguard measures ensure stable operation of instrument;

Being compared with same kind products, EA's advantages lies in

Strength

- DFMC undertakes national scientific development project for neutron activation instruments
- DMFC has independent intellectual property rights, is capable for continuous upgrading of research and development
- DFMC has a technical service team with 300 people. This team can provide constant services from designing, installing and commissioning to performance tracking

Hardware:

- All components that determine the performance of EA are selected from top-level professional international manufacturers

Software:

- Optimized software algorithm is more adaptable to the field and easier for quality control and central control personnel to operate and manage

Radiation safety:

- Radiation protection of the device is designed in strict accordance with the relevant standards.

The material has strong ability to absorb the rays, the protective body is thick, and it is safer and more reliable

- DFMC has nearly twenty years of experiences in industrial nuclear instruments development and radiation protection

VI. Product Applications

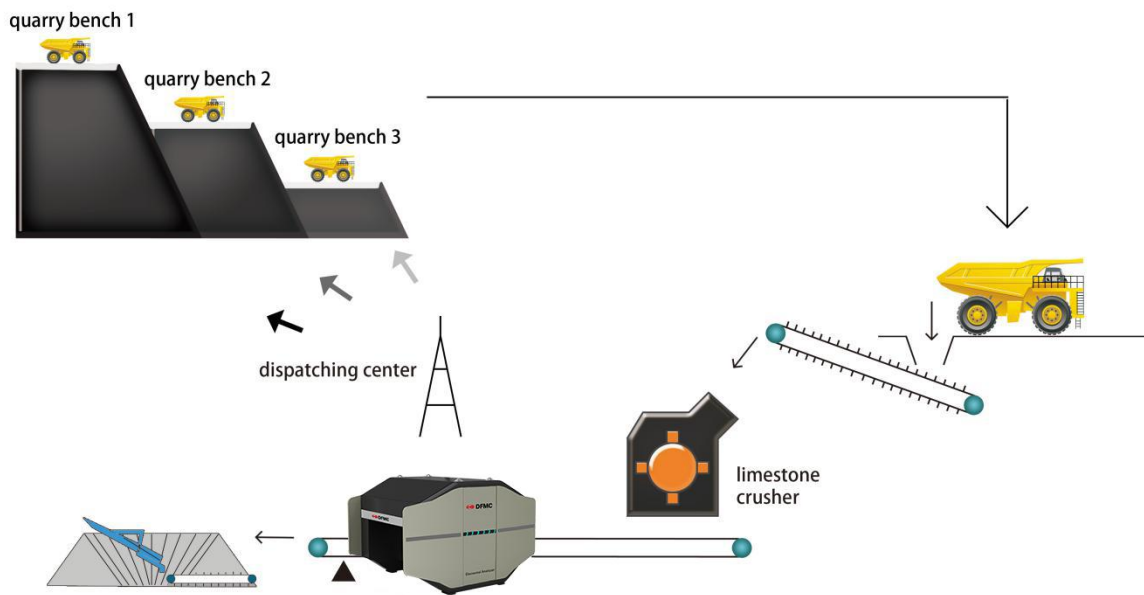
EA is mainly used for limestone batching and raw mix in cement plants. According to real-time raw materials information detected by the analyzer, quarry optimal dispatching control and statistics on quality and ingredients, the limestone batching can be achieved. While the raw mix control is realized by controlling the feeding volume of various raw meals. In addition, it can be used in the additives component detection and cement proportioning.

1. Limestone batching

EA can be used to direct production by real-time detection of the chemical compositions of limestone, and conduct batching in conjunction with the process control software. Manual mode, automatic mode or fine batching mode can be adopted during operation.

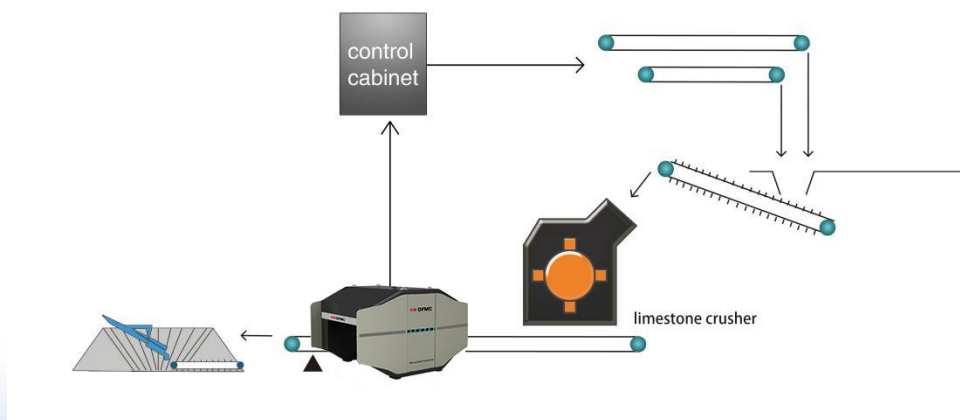
Manual mode

According to the results measured by the analyzer, the quality control personnel can dispatch the quarry operation, match different grades of limestone together to meet the quality control requirements of the pile homogenization.



Automatic mode

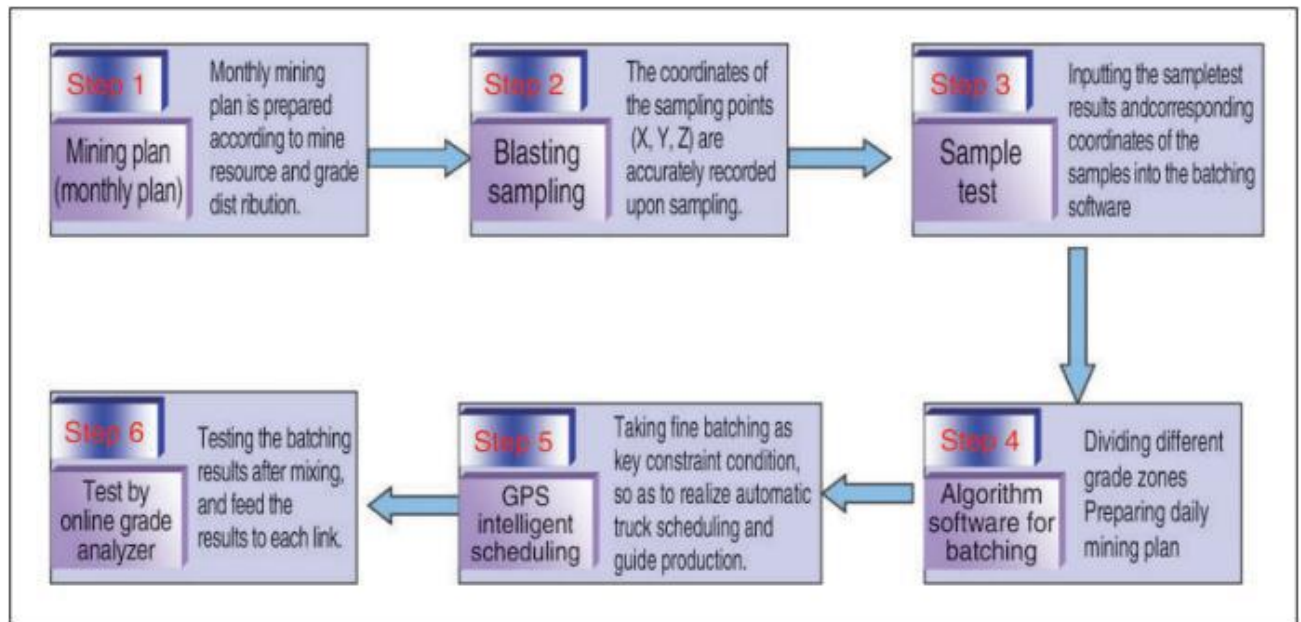
Automatic mode is available under the circumstance that raw materials are stored in different storages (there are automatic feeders after storages). Automatically control the matching ratio of materials through control system to meet the quality requirements of the pre-mix pile.



Fine batching mode

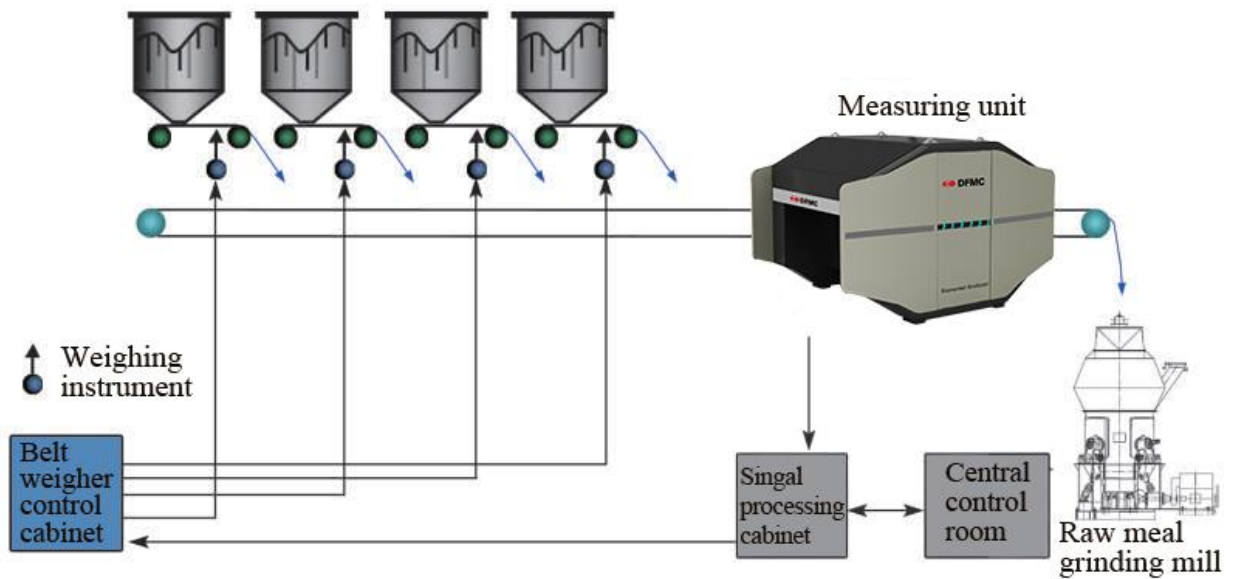
Realize the dispatching management of mine production and equipment by utilizing GPS/BeiDou positioning and navigation technology. According to the batching target requirements, in

combination with the production plan and by automatic directing and dispatching of operating equipment in mine, the grade of raw ore is strictly controlled at crushing station; EA is used to make real-time monitoring on the batching results, and the results are fed back to the production dispatching and directing level, thus realizing accurate control on the grade of raw ores at crushing station.



2. Raw mix

Used in conjunction with automatic batching software, EA can conduct process control on raw mix. EA sends current analysis result to batching software. Batching software controls feeding amount of all the raw material feeders based on target values of quality control parameters (LSF, KH, SM, IM, etc.) set by the user to make batching result meets the quality control requirements.



Advantages of raw mix control

- Reduce fluctuation in raw meal
- Reduce the operating cost of homogenization storage
- Stabilize thermal regulation of kiln, reduce kiln operation and increase machine-hour output
- Reduce fuel consumption
- Extend service life of refractory materials
- Improve the quality of clinker
- Increase the mixing amount of admixture



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