X-RAY FLUORESCENCE

True Grade Control of Limestone with S8 TIGER Series 3 based on GEO-QUANT Basic

Application Report 3

The grade control of limestone is essential for later use in cement, minerals, chemistry and metallurgical industries. Major elements, such as Ca, are as well important as traces, depending on the later usage. As pigments, fillers in polymers and pharmaceuticals traces, such as Fe and Mn, are determining the commercial value.

The S8 TIGER Series 3 WDXRF spectrometer offers a robust and precise solution for this task, combining high analytical performance with operational efficiency. With its advanced XRF technology, intuitive user interface, and high sample throughput, the S8 TIGER ensures reliable results to define later use of the mined material.

This report demonstrates the capabilities of the S8 TIGER Series 3 in analyzing major and minor elements in limestone, including Ca, Mg, Si, Fe, Al, and trace components. It highlights the instrument's accuracy, repeatability, and suitability for routine laboratory workflows, making it an ideal choice for elemental characterization of geological materials.

True concentrations for industrial minerals with predefined solutions GEO-QUANT Basic and Advanced

The analysis of industrial minerals, such as limestone, dolomite, quartz, gypsum, as fused beads using the S8 TIGER Series 3 WDXRF delivers highly accurate and reproducible results for both major and minor elements. Combined with the pre-defined solutions GEO-QUANT Basic and Advanced packages, the start of the grade control becomes quick, easy and accurate. GEO-QUANT enables fast quantification of key components such as CaO, SiO_2, Al_2O_3, and Fe_2O_3, ideal for routine quality control. GEO-QUANT Advanced extends the analytical range to trace elements and provides enhanced calibration flexibility, supporting more complex material matrices.

The fused bead technique ensures excellent sample homogeneity and minimizes matrix effects, while the S8 TIGER's high-resolution optics and stability guarantee reliable performance across industrial and geological applications.

To analyze the elemental composition of limestone a S8 TIGER Series 3 spectrometer was configured with 3 or 4 kW excitation power, including two collimators (0.46° and 0.23°), three analyzer crystals (XS-55 for Na, and Mg, PET for Al – Cl and the LiF200 for K to U).

For the detection of light elements the proportional flow counter is used, In addition the patented signal processing software SensorBoost can be applied to enhance the analysis of major concentrations of e.g. Si in quartz, Al, Mg and Ca in limestone, dolomite or clay minerals. For heavy elements either the scintillation counter or the HighSense XE is used,

To achieve higher intensity for the traces instead of the LiF200 the special optics XS-400 can be used providing an intensity plus of about 35%

Typical measurement times are in the range of 5 – 6 minutes providing accurate results for a wide range of industrial minerals and geological samples. The precision is excellent in the range of less than 1 % rel.

GEO-QUANT Basic and GEO-QUANT Advanced solutions contain a set of standard samples to prepare the calibration curve, predefined methods for sample preparation as fused beads (additional sample preparation equipment is required such as a mill, furnace, balance and fluxer) as well as measurement methods optimized for the S8 TIGER Series 3.

The included quality check samples help to validate the application based on the certified concentrations, while the drift monitor samples ensures the maintenance of the calibration over the lifetime of the instrument, a big plus compared to other analytical methods which requires to repeat calibrations on a daily basis.

Since no further method development is required the grade control of industrial minerals can almost start directly after installation and only needs little training for laboratory personnel.

Sample ID	Na_2O (%)	MgO (%)	Al_2O_3 (%)	SiO_2 (%)	P_2O_5 (%)	K_2O (%)	CaO (%)	TiO_2 (%)	Cr_2O_3 (%)	Mn_2O_3 (%)	Fe_2O_3 (%)	SrO (%)	ZnO (%)
1	0.002	0.218	0.241	1.332	0.023	0.044	94.076	0.021	0.005	0.028	0.089	0.030	0.003
2	0.003	0.215	0.230	1.314	0.023	0.044	93.990	0.023	0.007	0.026	0.090	0.030	0.002
3	0.004	0.224	0.228	1.323	0.022	0.044	93.996	0.024	0.006	0.029	0.089	0.030	0.003
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7	0.008	0.216	0.237	1.306	0.019	0.045	94.258	0.025	0.007	0.028	0.083	0.030	0.003
Average	**0.005**	**0.217**	**0.234**	**1.316**	**0.021**	**0.044**	**94.120**	**0.023**	**0.006**	**0.027**	**0.088**	**0.030**	**0.003**
Std. Dev.	**0.002**	**0.006**	**0.005**	**0.011**	**0.002**	**0.000**	**0.108**	**0.001**	**0.001**	**0.001**	**0.003**	**0.000**	**0.001**

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