Application Note EDXRF3134

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EDXRF3134 Analysis of Rare Earth Elements in Clay

Scope

This application note demonstrates the analysis of lateritic clay rich in the rare earth elements La, Ce, Pr, Nd, and Y using NEX CG II+. Also shown is a demonstration of analyzing an expanded REE group in the more concentrated forms during processing and extraction.

Background

Rare earth elements (REE) include the lanthanide series, yttrium, and scandium. REEs are vital components in many technologies, including:

- Catalysts
- Specialty glass
- Fiber optics
- Rare earth magnets, lasers, and capacitors
- Nuclear and EV batteries
- Smartphones, computers, televisions
- New-generation light bulbs and lamps
- New-generation lenses and telescopes
- Aerospace, aviation, and advanced electronics

Mining for REEs is spread globally. The REEs are typically dispersed rather than concentrated in rare earth ores. However, various groups of REEs can be profitably mined and extracted from minerals such as bastnäsite, monazite, loparite, and lateritic clays, as well as several other mineral and rock formations.

XRF is ideal for analyzing REEs in mining, throughout processing and extraction, as well as in the final uses or products and recycling.

Rigaku RPF-SQX fundamental parameters with scattering FP and matching library

RPF-SQX, featuring Rigaku Profile Fitting technology and Scattering FP, allows semi-quantitative analysis without the need for standards. Rigorous quantitative analysis can be made using the Matching Library section of RPF-SQX with only one or a few known standards. This allows for excellent analysis for various uses in mining without the need for large sets of known standards and models variations in the base matrix more accurately.

Rigaku Scattering FP is an advanced approach using the Compton and Rayleigh scatter peaks to estimate the percentage of the sample base matrix balance that is unmeasurable and is effective for samples whose balance component is difficult to set by defining a single compound.

The use of the Matching Library is demonstrated for the analysis of REEs in laterite clay in situ during the mining process. One or more samples of the clay are obtained and assayed using a referee technique such as ICP. These “type standards” are then used to easily make a Matching Library, which tunes the XRF to exact material and referee numbers, allowing for a high degree of accuracy when measuring the unknown samples from the mining process, such as feed and residue.

Results – Laterite clay

The following results demonstrate the measurement of La, Ce, Pr, Nd, and Y using Scattering FP and a 2-point Matching Library.

Sample: Clay Feed			
Element	**ICP Assay (ppm)**	**NEX CG II+ Result (ppm)**	**Stat. Error**
La	124	121	1.8
Ce	191	182	2.2
Pr	27	23	1.3
Nd	98	100	2.9
Y	74	74	0.2

Sample: Clay Residue			
Element	**ICP Assay (ppm)**	**NEX CG II+ Result (ppm)**	**Stat. Error**
La	81	81	1.7
Ce	154	153	2.2

Pr	14	18	1.3
Nd	50	58	2.8
Y	20	19	0.1

Results – Processing

The following results demonstrate the use of standardless semi-quant FP without the need for any assayed samples or Matching Library for screening and trend analysis during processing as the REEs become more and more concentrated.

Grade	La (ppm)	Ce (ppm)	Pr (ppm)	Nd (ppm)	Sm (ppm)	Gd (ppm)	Dy (ppm)	Y (ppm)
Very Low	412	567	158	667	75	ND	ND	775
Low	955	907	277	1325	101	ND	ND	1031
Medium	3203	1286	772	3792	354	214	193	3741
High	7845	4394	2093	11322	1089	1185	1143	10436

Conclusion

The combination of 100 W power and 65 kV excitation, along with Cartesian Geometry secondary targets for background removal and a high-performance large-area SDD, gives the Rigaku NEX CG II+ superior performance beyond 50 kV systems for the analysis of the high energy REE K-lines. RPF-SQX FP software is simple to use yet powerful, making NEX CG II+ an excellent tool for non-technical operators, quality control operators, and researchers alike, ideal for mining and processing and throughout the various needs in testing finished products and in recycling and recovery of REEs.

Related products

NEX CG II Series

High-performance *indirect excitation* EDXRF for complex ap
plications with trace elements and variable base matrices