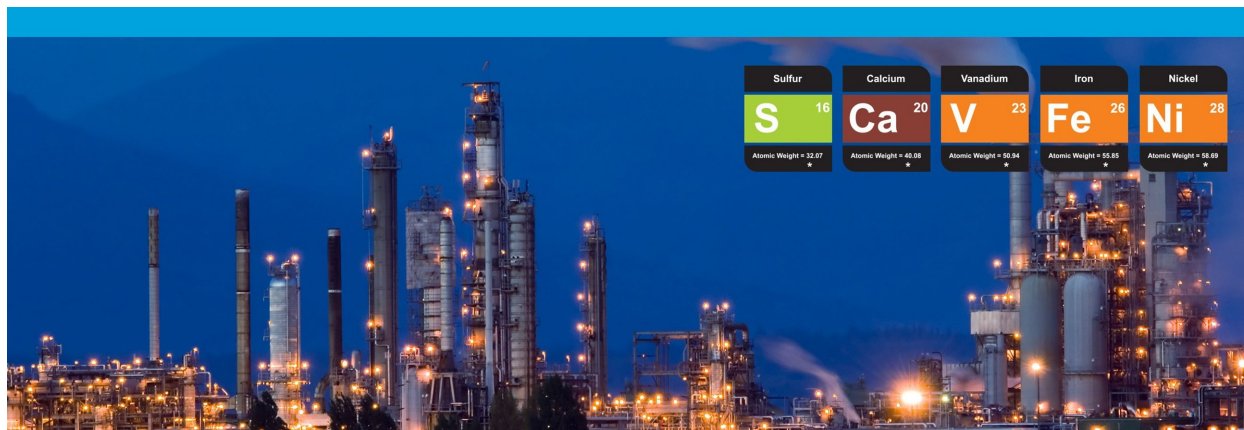


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EDXRF1521 - Analysis of S, Ca, V, Fe, Ni in crude oil



Scope

The analysis of sulfur, calcium, vanadium, iron, and nickel in crude is demonstrated. The measurement is also applicable to residual oil, bunker fuels, and other heavy hydrocarbon oils.

[NEX DE](#) complies with ASTM D8252-19, Standard Test Method Vanadium and Nickel in Crude and Residual Oil by X-ray Spectrometry.

NYMEX/CME specifications allow for maximum levels of 8 mg/kg Ni and 15 mg/ kg V for light sweet crude oils futures contracts. NEX DE is used as a simpler, faster alternative to ICP to meet the NYMEX/CME requirements.

Background

Sulfur, vanadium, and nickel occur naturally in crude oil, and their concentrations vary depending on the geographical region of the oil deposits. Depending on the region, some crude may also contain measurable levels of calcium and iron. High metal content can foul the refining process during cracking, and so low-metal crude is desirable. At the refinery as well as midstream at pipelines, transportation, gathering points, and during blending, a quick and easy means of screening and monitoring the metal content is a valuable tool in characterizing the quality of the crude before refining. Rigaku NEX DE EDXRF analyzer is an ideal multi-element tool for monitoring the concentrations of not only sulfur and metals in crude, resid, and other heavy hydrocarbons.

Calibration

Empirical calibrations were built using a suite of 10 commercially available mineral oil calibration standards that represent crude, resid, and other heavy hydrocarbon oils.

Element	Concentration range
S	0.30 – 4.00%
Ca	50 – 800 ppm
V	5 – 50 ppm
Fe	5 – 100 ppm
Ni	5 – 50 ppm

Repeatability

To demonstrate repeatability (precision), three calibration standards were measured in 10 repeat analyses.

Sample: Std 1				
Element	Standard value	Average value	Std. dev	% Relative dev
S %	2.000	2.020	0.017	0.9
Ca ppm	310	301	2	0.6
V ppm	50	50.3	0.2	0.4
Fe ppm	5	4.9	0.5	10
Ni ppm	5	4.8	0.2	4.0

Sample: Std 3				
Element	Standard value	Average value	Std. dev	% Relative dev
S %	3.000	3.040	0.024	0.8
Ca ppm	700	706	6	0.9
V ppm	5	5.1	0.2	4.0
Fe ppm	100	103	1	1.0
Ni ppm	40	41.3	0.6	1.5

Sample: Std 4				
Element	Standard value	Average value	Std. dev	% Relative dev
S %	1.500	1.521	0.016	1.1
Ca ppm	50	48.7	1	2.0
V ppm	20	19.1	0.2	1.0
Fe ppm	30	31.1	0.9	0.3
Ni ppm	25	25.3	0.4	1.6

Conclusion

The Rigaku NEX DE gives technical and non-technical operators a simple yet powerful and versatile system for quantifying multi- elemental composition using the empirical approach. The results indicate that given stable samples, proper sample handling, and calibration technique, the NEX DE achieves excellent performance for monitoring sulfur and metals in crude and other heavy hydrocarbon oils.

Related products



NEX DE Series

High-power 60 kV EDXRF systems delivering speed, precision, and small spot measurements