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Elemental Analysis at a Fingertip – From Drill Cuttings in Mobile Labs to Catalyst Elements in Refineries to Ultra-Low Sulfur in Automotive Fuels

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Bruker offers best-in-class turnkey solutions for the entire production chain of the petrochemical industry – from discovery, development, up to final process and quality control – contributing to an increase in productivity and profit.

The Upstream Sector

The upstream sector involves the exploration for and extraction of petroleum crude oil and natural gas, also known as the exploration and production (E&P) sector.

Exploration: Elemental and Mineral Phase Analysis

Elemental Analysis is an important tool for field and petroleum geologists to characterize and identify petroleum or gas bearing formations. Drill cuttings, mud, or drill cores can be analyzed by X-Ray Fluorescence (XRF). The benchtop **S2 PUMA** reaches low detection limits on prepared drill cuttings in a mobile lab by using the Energy Dispersive XRF (**EDXRF**). The analysis of majors and traces in the lab is best performed by the floor standing **S8 TIGER Series 2** Wavelength Dispersive XRF (**WDXRF**) spectrometer using either the GEO-QUANT package or customized calibrations.

Additional information on the mineralogical composition of the sediment or formation offers

X-Ray Diffraction (XRD). XRD allows distinguishing minerals with the same or similar chemistry by their crystal structure. Bruker's dedicated software package, DIFFRAC.EVA, makes phase identification easy, fast, and accurate. Standardless quantification is possible by the Rietveld approach. Even non-crystalline phases may be quantified using this method. It enables pinpointing of potential reservoirs and host formations. A major advantage is the rather simple and quick sample preparation. The analysis of drill cuts can be done in a mobile lab using Bruker's benchtop **D2 PHASER**. In a stationary lab, the **D8 ENDEAVOR** or the **D8 ADVANCE** is the optimal choice.

The Downstream Sector

The downstream sector involves the refining of petroleum crude oil to finished petrochemical products and the distribution to end customers.

Refinery Applications: Elemental Analysis

Elemental analysis is a crucial process control tool for the petrochemical refining industry. Bruker's PETRO-QUANT is a universal calibration package for the quantification of 30 elements by XRF in all kinds of hydrocarbons. Whether XRF is employed as a technique to quantify sulfur from the crude oil to refined products or to analyze refinery process impurities such as metals and catalysts: PETRO-QUANT is your tailor-made solution!

Since XRF can directly analyze petrochemical samples, without digestion or dilution, it is widely employed as monitoring method: Sulfur levels in fuels are regulated, norm-compliant analysis can be performed with the benchtop WDXRF **S6 JAGUAR**



Dedicated elemental analyzers for petrochemical applications (from left to right): S2 POLAR, S2 PUMA, S6 JAGUAR, and S8 TIGER.

(e.g. ASTM D2622 and ISO 20884). For the lowest detection limits as well as for analyzing traces or solids such as petcoke directly in a laboratory environment, the **S8 TIGER** WDXRF spectrometer is the optimal choice.

The benchtop **S2 POLAR** with polarized optics is ideal for refineries and regions where regulatory compliance for Sulfur and Ultra-Low Sulfur (ULS) can be done with EDXRF, along the downstream supply chain in oil terminals, petrol stations, or service labs (e.g. ISO 13032, ASTM D7220 and D4294). Due to the multi-element capability, the instrument is also able to quantify Ni and V or Cl in crude oils (ASTM D4929).

Oil and Lubricants: Elemental Analysis

Oils and lubricants need to fulfill different tasks in engineering. Beside lubrication they are needed to cool pistons in car engines and while metal milling, to protect against corrosion and to bind particles: Precise and reliable analysis of additives at the

minor and trace level is the key for high product quality. XRF is the most important analytical method for the analysis of additives and impurities, no matter if oils, greases or waxes need to be qualified (ASTM D6443, DIN 51361) and to detect engine debris in the form of wear metals (DIN 51399).

Plastics and Polymers

The final properties of a polymer like PE, PP, PET or ABS can be tuned by adding defined amounts of additives. Bruker's POLYMER-QUANT package allows for the quantification of the 10 most used additives and catalyst residues in all CH based polymer types.

Simple Analysis at a Fingertip

The entire portfolio of Bruker's XRD and XRF instruments for petrochemical applications has in common the simple and fast sample preparation and intuitive TouchControl offering analytical solutions at a fingertip.