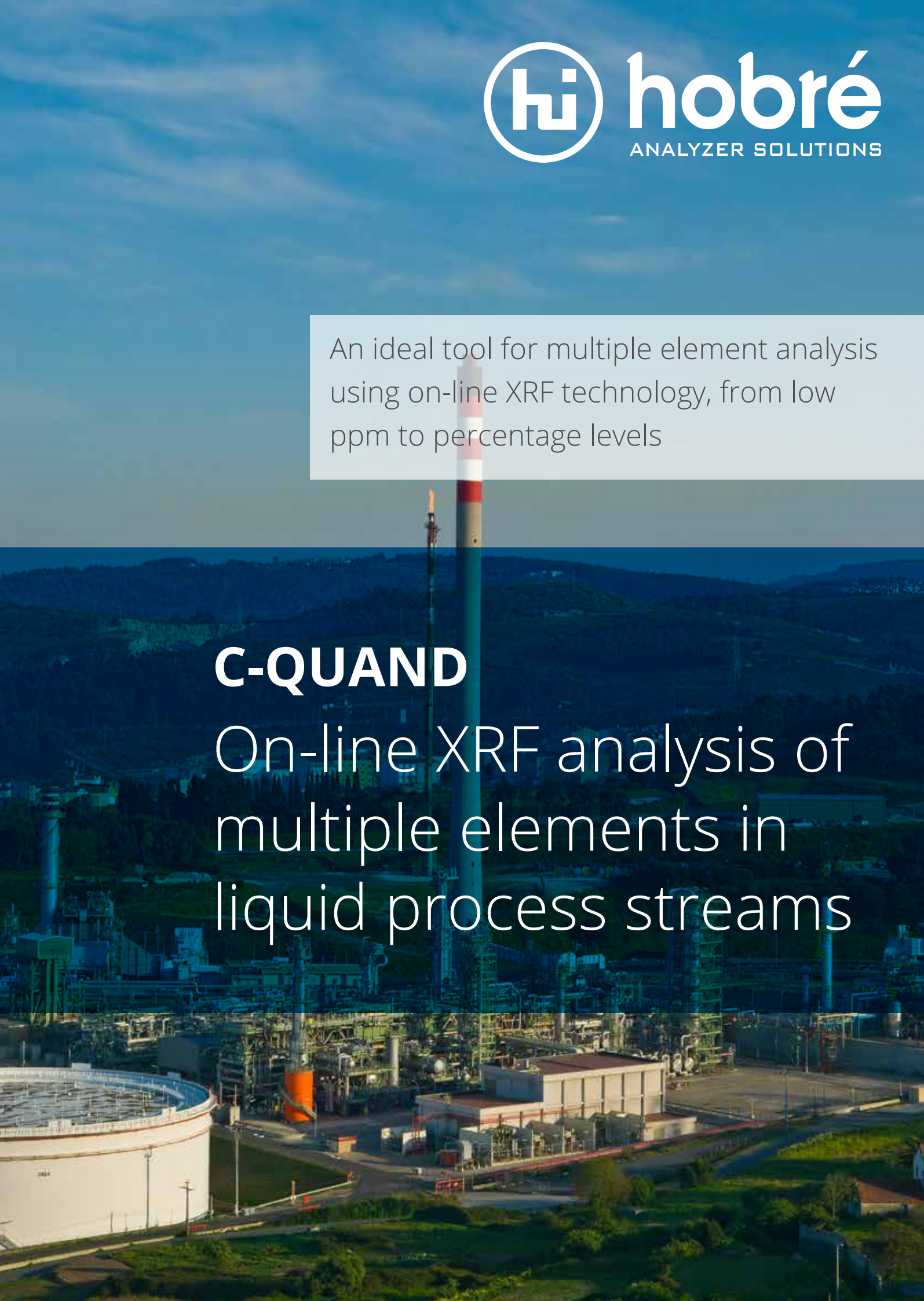
hobré
ANALYZER SOLUTIONS

An ideal tool for multiple element analysis using on-line XRF technology, from low ppm to percentage levels

C-QUAND

On-line XRF analysis of multiple elements in liquid process streams



Introduction

The C-QUAND is the latest Hobré on-line XRF analyzer. The C-QUAND is an ideal on-line solution for elemental analysis in liquids. The C-QUAND is capable of measuring multiple elements starting from silicon (Z=14) and from ppm to percentage levels. It is a continuous, non-destructive, low-maintenance analyzer without the need for additional reagents. C-QUAND also offers considerable savings in analysis time and operational costs compared to alternative analytical techniques.

Principle of operation

The C-QUAND analyzer is designed to measure multiple elements in liquid samples. Using Energy Dispersive X-ray Fluorescence (EDXRF) technology, a well-known element measurement principle, which measures the characteristic X-rays generated by the atoms in the sample.

X-Ray Fluorescence principle

The C-QUAND has a powerful 15 watt, 0-50 kV X-ray source, with a silver (Ag) anode. The X-rays knocks the inner electron out of the K or L orbit of the atom, leaving a void. The now unstable atom will fill the void with an electron from the outer orbits. The difference in energy is emitted as a photon with a distinct energy level, unique to the element. The fluorescence is collected by the silicon drift detector (SDD). The detector collects these events as counts, which are directly proportional to the concentration of the element of interest.

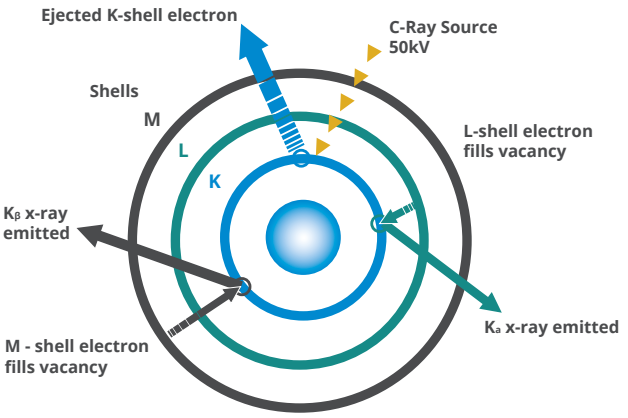


Figure 1. X-ray fluorescence principle

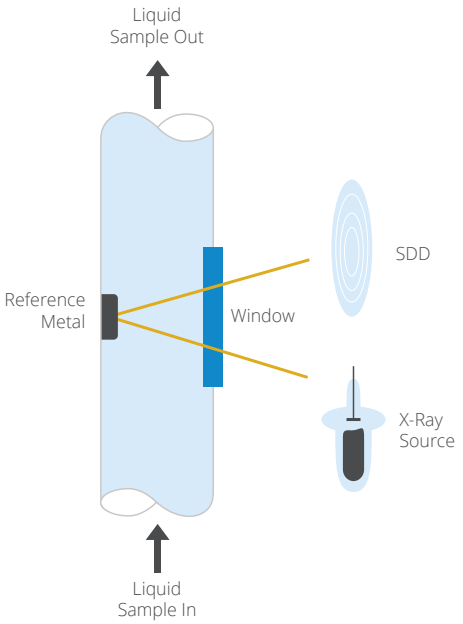


Figure 2. Measuring cell

Measuring cell

The X-rays generated by the source are first filtered by one of six different optical filters. The X-rays then travel through a thin window before hitting the actual sample. The window material can be beryllium for sulfur measurement in hydrocarbons, or a polyimide such as Kapton® or Upilex® for the measurement of metals in aqueous solutions.

The measuring cell is constantly flushed with fresh samples. Importantly, this method of measurement is continuous throughout the entire measurement, not just at the beginning. The measuring cell also contains a solid reference metal, which is used for automatic gain correction.

Easy low-maintenance operation

Easy Operation with Routine Usage

Fast start-up with automatic stabilization and an optional validation system ensure that the system will operate with minimal attention from the operator. Specially-coated cell windows minimize window contamination, which allows longer periods of operation without maintenance. Process trends are directly showed on the HMI display.

Simple Calibration

The C-QUAND gives a very linear response, over a wide range of concentrations. In this example, the sulfur analyzer was calibrated using a blank and a 1000 ppm standard to measure samples of 10, 20 and 100 ppm.

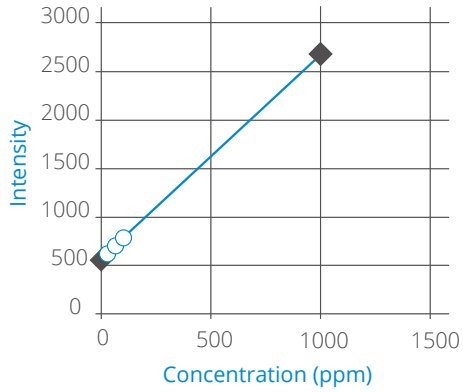


Figure 3. Calibration graph

In some cases, the application requires a three-point calibration, which can be achieved simply by injecting the sample into the cell with a syringe and verifying the spectrum.

Cell Cleaning / Calibration Validation

In some systems, it may be necessary to clean the cell and revalidate the calibration. The C-QUAND can be supplied with an automatic system for just this function. This system automatically, on user-defined timing, flushes the cell and introduces a known standard. By measuring this standard, the C-QUAND can automatically adjust the calibration and continue to provide accurate results without operator intervention.

Analysis with Minimum Maintenance

The EDXRF analysis method is a direct measurement without the need for extensive sample preparation or conversion reactions. It does not require additional chemicals or buffers that need frequent replacement. The analyzer has no moving parts that need periodic maintenance or that are likely to block.

The sample cell can operate at a temperature up to 80°C (176°F) so precipitation reactions in the analyzer can be avoided. Gain adjustment and normalization are routinely done by the analyzer itself. Flushing of the sample cell, and periodic validation can be fully automated.

Therefor the C-QUAND analyzer has very low operating costs, and requires minimum operator interference or maintenance. Together with a proper designed sample conditioning system, up-time of the on-line EDXRF analyzer is high compared to other techniques.

Benefits & Features

- On-line analyzer fit for harsh environments
- Highly sensitive silicon drift detector (SDD)
- Continuous non-destructive analysis
- Close to zero maintenance; only cleaning of the flow cell window
- Flow cell can be removed easily
- Analyzer data available via 4 - 20 mA, MODBUS RS485 or TCP/IP, Optical Fiber
- Unlimited number of elements per analysis
- Linear results from ppm to percentage levels
- Automatic drift correction

Applications

- Metals in production process control
- Fe, Ni, Co, Cu, Mo, V, W, As, Zn, Sn & PGM in metal mining / refining / recycling
- Catalytic processes in liquid phase (suh as PTA & PIA)
- Waste liquids monitoring
- Uranium monitoring in mining and nuclear plants
- Sulfate in injection water
- Sulfur, chlorine and metals in refinery processes
- Pipeline monitoring and fuel blending (total sulphur & metal measurement)

Metals mining, refining and recycling

Process streams from metal mining, refining and recycling can contain a mixture of elements in various concentrations and chemical forms. This is where XRF fluorescence proves to be valuable.

Most UV-vis methods require multiple steps and reagents for metal in solution to be in a single oxidation state before analysis. It is best avoided with an on-line analysis method.

On the other hand, the C-QUAND online XRF does not require any maintenance nor additional reagents. XRF fluorescence is a direct measurement at an atomic level, therefore it does not matter in which form the element is presented, the analyzer will measure it.

The C-QUAND can measure in acids, oxidizers or caustic streams, at any pH.

Total sulphur measurement

The XRF method is the most suitable method for total sulphur analysis in petroleum products. Other techniques based on injection techniques and conversion methods to SO_2 and H_2S will not work when the final boiling point of the products exceeds 450°C (842°F). Such methods also experience issues with FAME in biodiesel; when the sample is heated, esterification can occur and block the injection valves.

X-ray absorption techniques are not considered due to matrix effects and their poor sensitivity in the low ppm range.

Sample systems for metal processing

Hobré has developed autonomous sampling systems customised for the Metal Refining industry, from simple straight forward measurements up to sample systems for streams heavily loaded with particles, offering the possibility to choose whether or not to include solids in the measuring liquids.

PTA and PIA plants

The oxidation of p-xylene to produce (Purified) Terephthalic Acid (PTA) is enhanced by Co-Mn acetate and tetrabromo-ethane catalyst addition. Continuous measurement of the Co-Mn acetate and tetrabromo-ethane catalyst in PTA production enables better control of the process thus enhancing yields, improving product quality and increasing throughput.

The process conditions are challenging, with high temperatures, high solid content, possible precipitation or sample freezing, and a corrosive medium. It is therefore critical for the success of the operation to use a well-designed sample conditioning system. Hobré Instruments has extensive experience with this application.

"The C-QUAND measures elements starting from sillicon (Z=14)"

Turnkey solutions

The key to success of the on-line XRF analysis is the sample system. A well-designed sample system will ensure maximum measurement availability. Hobré Instruments has unique proprietary solutions for challenging environments, such as highly corrosive liquids and samples with high particle load. Our in-house XRF laboratory would be happy to review your specific application.

Relevant industries

- **Oil & Gas**
- **Metals & refining**
- **Mining & minerals**
- **Petrochemicals**
- **Polymers**
- **Environemental**
- **Food & pharmaceuticals**
- **Drilling and wells**
- **Steel industry**
- **Waste water**

Technical Specifications

ANALYTICAL	
Measurement principle	Energy dispersive X-ray fluorescence
Element range	From Si (Z=14)
Measurement range	From 0.5 ppm to % levels (application specific)
Simultaneous elements	Unlimited number of elements per analysis
Filter wheel	6 filters
Accuracy	Appropriate to application
Calibration	Less than 5 samples

CENTRAL PROCESSING AND CONTROLLING UNIT	
Industrial PC	Linux operating system, custom touch keyboard with 8” TFT color display
Analog outputs	2 or 4 x 4-20mA active
Communications	4 - 20 mA, MODBUS via RS485 or TCP/IP, Optical Fiber
Ambient temperature	5 – 40°C / 41 – 104°F

MEASUREMENT HEAD	
X-ray detector	Sillicon drift detector, resolution 135 eV (equals 2.3% at 5.89keV)
HV power supply	0-50kV
Source	15 W X-ray tube, Ag anode
Stability	Automatic drift and back scatter peak correction; temperature and ambient pressure correction
Sample window	Kapton®, Upilex®, beryllium

UTILITY REQUIREMENTS	
Power supply	110-230 VAC 50/60 Hz
Power consumption	100 VA (150 VA with heated sample cell)
Instrument air	<4 L/min for Exp. version and required for standard pneumatic valve (electrical actuated valve optional)

SAMPLE CONDITIONS	
Sample flow rate	0,2 - 0.5l/min
Sample cell temperature	< 80°C / 176°F
Sample cell pressure	Atmospheric drain
Viscosity	Less than 100 cSt at cell temperature (Heated sample cell available)

GENERAL	
Size	HxWxD = 1000 x 400 x 360 mm / 39,4 x 15,8 x 14,2 inch
Valve control	Automatic stream switching, automatic cell flushing, automatic validation Liquid Sample Recovery Control done by analyser (optional)
Inputs	Flow and level alarms (optionally) read by analyser
Diagnostics	High level of diagnostics
Remote supervision/control	External control of analyser possible
Hazardous Area Clasification	ATEX and IECEx Zone 1 (II 2 Ex pxb ICC T4 Gb)

HOBRÉ INSTRUMENTS

SINCE 1978 HOBRÉ IS A WORLDWIDE MARKET LEADER IN THE DESIGN, MANUFACTURING AND MAINTENANCE OF ONLINE ANALYZERS AND SAMPLING SOLUTIONS. HOBRÉ SERVES THE OIL, GAS, DAIRY, METAL MINING & REFINING, ENERGY, RENEWABLES, STEEL AND GLASS INDUSTRIE. ENSURING OUR CUSTOMERS OPTIMAL EFFICIENCY, WHILE CONTRIBUTING TO ENVIRONMENTAL PROTECTION.

HOBRÉ SERVICES

- FEASIBILITY STUDY & ENGINEERING
- COMMISSIONING, SAT AND START-UP
- TRAINING
- PREVENTATIVE AND CORRECTIVE FIELD SERVICES
- IN-HOUSE MAINTENANCE AND REPAIR
- SPARE PARTS AND SUPPLY
- REMOTE SUPPORT

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