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Climate-Neutral Steel Production with Process and Quality Under Control

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Introduction

Nowadays, our world is made of steel, which is used to make everything, from roads and bridges to automobiles and buildings. A growing global population, an increasingly higher standard of living and greater urbanization will trigger a rise in global steel demand. The steel industry accounts for 8% of CO_2 emissions globally, says consulting firm McKinsey [1], since each ton of steel produced in 2018 emitted on average 1.85 tons of carbon dioxide. The carbon footprint in the steel industry is thus a challenge for Europe, Asia and the rest of the world.

Net Zero Emission Steel Production

To reach the global climate goals under the Paris Agreement, the world's leading steel makers have announced pledges to reduce emissions, aiming for net-zero by 2050 or sooner. The list is impressive and includes ArcelorMittal (the world's #1), ThyssenKrupp, Voestalpine, SSAB/LKAB/Vattenfall, Nippon Steel, POSCO and others [2]. They are committing to various new technologies still not proven at scale:

- Making steel with (green) hydrogen, instead of coal/coke
- Strategies that include carbon capture

The next decades we will also see an increased use of steel scrap in the production process. Steel scrap becomes available when steel reaches the end of its working life, which varies by application – from a few months for packaging steel to closer to 100 years for steel used in buildings. All the steel that cannot be reused will be returned for recycling. This will play one role in reducing sector emissions although recycled scrap will not sufficiently meet the demand for new steel.

"Surging carbon dioxide prices and decreasing hydrogen prices are crucial to ensuring the economic viability (according to cash cost) of pure hydrogen-based steel production," says the McKinsey [1] report. "Conventional steel production still retains a cash cost advantage. However, this scenario changes as soon as hydrogen prices drop or prices for carbon dioxide emissions increase. Following this logic, pure hydrogen-based steel production is expected to be cash cost-competitive between 2030 and 2040 in Europe", the report concludes.

Metalworks

Quality Matters
In addition to reducing CO_2 emissions, a further top priority of the leading makers is not to compromise on quality and steel grades. High-quality steel is a driver of innovation and an essential material for numerous sectors – including those that are relevant for a successful climate change, such as electro mobility or wind energy.

Quality and Process Under Control

One key success factor for primary metal manufacturers on their way to reach ambiguous goals, is a complete elemental analysis. Bruker AXS is committed to support the metals by supplying state-of-the art metal analyzers. With optical emission spectrometry (OES) being the workhorse for all metal analysis tasks, the recent introduction of the **Q4 TASMAN Series 2** is just one example. Some of its many enhancements include:

- **Enhanced Analytical Performance:** New element sets, and extended ranges increase the analytical value. SmartSpark™ for enhanced speed and stability.
- **Enhanced Flexibility:** MultiVision™ the innovative dual optics concept fulfills individual analytical needs with reduced cost of ownership.
- **Enhanced Usability:** Next generation software combines high-functionality with ease-of-use.

More detailed information about the new **Q4 TASMAN Series 2** can be found in the product **launch webinar.**

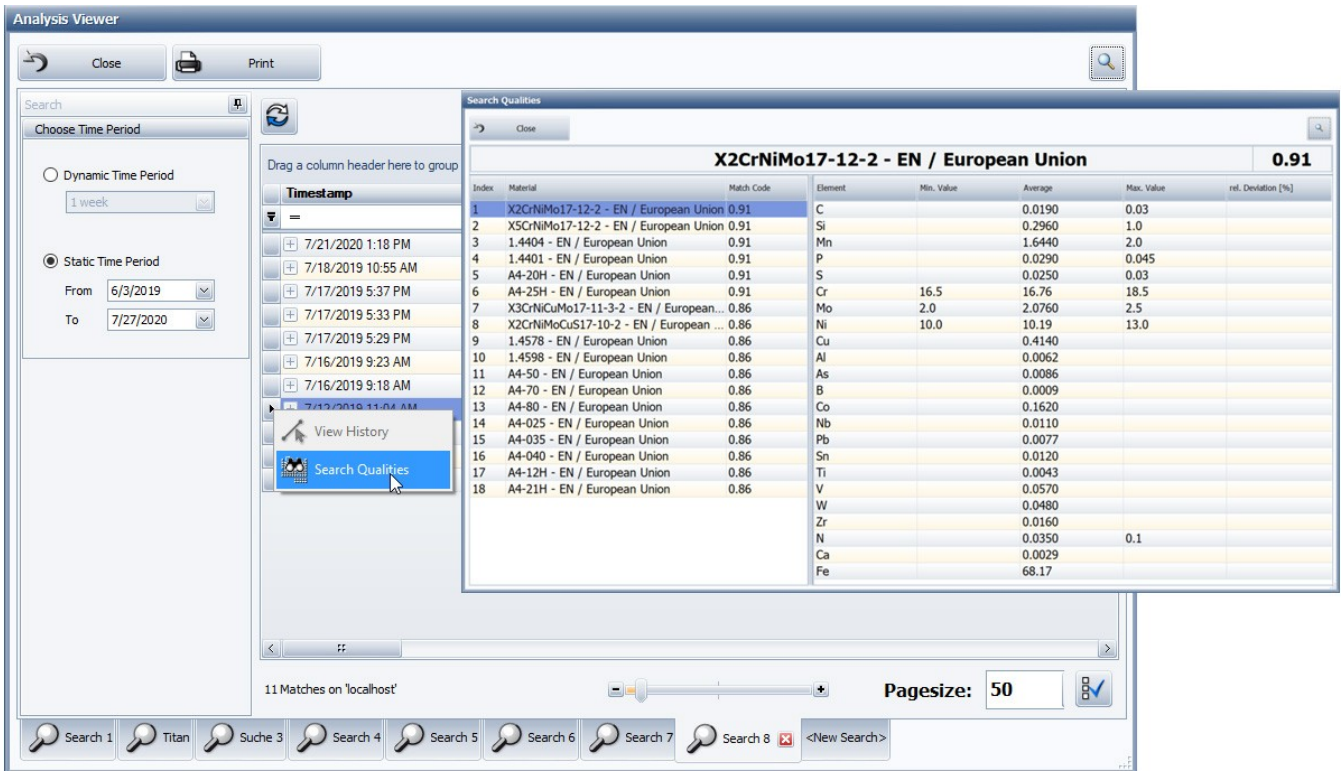
Q4 TASMAN Series 2 optical emission spectrometer

Steel blast furnace taphole spewing molten iron.

Analysis of Iron and Steel
The most prominent analytical application for today's spark spectrometers is the analysis of iron and steel. Find out more about this application including sample preparation, available analytical solution packages and typical analytical precision achieved with the **Q4 TASMAN Series 2** in the **Lab Report OES 23**.

Alloy Type Classifications
It became clear from the introduction that a sustainable and environmentally friendly metals production requires a recycling rate of scrap metals close to 100%. In fact, the perfect recyclability of metals with a high yield rate – not compromising material quality – is a distinctive feature that metals have over other materials like polymers, concrete, ceramics, and even glass. Following this logic, the analytical demand for fast and reliable scrap sorting, identification and full analysis will increase. Bruker offers a competitive range of techniques for this task, starting from handheld XRF "guns" to small, portable benchtop OES systems.

The metal world thinks in "grades" and unfortunately the world is more complex: The classification of metals, developed by numerous standards organizations, is complex, convoluted and internationally not harmonized. Additionally, industrial associations, like SAE International for automotive, have created their own standard alloy numbering system. Fortunately, there is a solution helping you to maintain an overview.



Total Materia integration inside ELEMENTAL.SUITE

Beyond Grade Libraries: ELEMENTAL.SUITE and Total Materia

Total Materia is the ultimate solution for metals properties, cross-referencing, and knowledge, by integrating information from 74 Standard Development Organizations, and hundreds of producers and other sources into the most comprehensive database in the world, powered with a superfast search engine. Its combination with OES analyzers forms an ideal tool not only for scrap sorting, positive material identification or grade determination or answering the basic question: "Is my material within the specification?", but also for more advanced questions for engineers:

- Finding equivalents to foreign materials and comparing alternatives side by side
- Searching for materials worldwide by specific chemical composition or mechanical properties
- Deciphering material specifications and finding the correct grade for a specific application

Total Materia integrated with ELEMENTAL.SUITE

Find out more in this webinar recording, where we demonstrate the benefit of having Total Materia integrated within ELEMENTAL.SUITE. See the combination in action for basic tasks, before an expert from Key To Metals AG unleashes the power of Total Materia.

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