Thermo Fisher
SCIENTIFIC

Iron and steel

ARL iSpark Plus Optical Emission Spectrometer
Basic inclusion analysis

Benefits

- Ultra-fast evaluation of some main inclusion types

- Close to real-time inclusion check in up to hundreds of samples a day

- More effective control of inclusion-dependent steel properties

- Helps reduce the number of costly issues caused by inclusions

Non-metallic inclusions dramatically affect steel properties and cause process issues like nozzle clogging. The costs associated with bad steel properties, process issues or customer complaints may amount to several hundred thousand dollars every year. Controlling the formation and the modification of non-metallic inclusions has therefore become essential to the production of modern steels as demanded by today's markets.

The Thermo Scientific ARL iSpark Plus is a high-end metal analyzer that allows precise and accurate elemental analysis of steel. It also enables ultra-fast analysis of non-metallic inclusions, enabling a steel plant to control steel quality and production process even more effectively, and considerably reduce the costs associated with unwanted inclusions.

The Basic Inclusion Analysis Spark-DAT (Spark Data Analysis and Treatment) option is the entry-level method for standard inclusion analysis in low alloy steel. It reports the amounts of some of the most common types of non-metallic inclusions together with the elemental concentrations, helping steel plants to guarantee the quality and the properties of the steel product, as well as the smooth running of the production process.

Principles and details on Spark-DAT inclusion analysis can be found in the application note of the Standard Inclusion Analysis (AN41219).

thermo scientific

The Basic Inclusion Analysis Spark-DAT method is combined with the elemental analysis, so that inclusion data and elemental concentrations are obtained simultaneously. As inclusion analysis adds much less than a second to the time required for elemental analysis alone, it can be performed on all steel samples measured with the ARL iSpark Plus, i.e., in up to a few hundred samples in 24 hours.

The number per mm^3 of steel of the following types of inclusions are obtained:

- Al, Ca, Mg and S bearing inclusions

- Al oxides, Ca aluminates, Ca oxides, spinels, Ca sulfides and Mn sulfides

For each of these types, the total number of inclusions and also the number of small (S), medium size (M) and large (L) inclusions ("SML counts") are reported. This gives the ability to know not only how many inclusions a sample contains, but also, for example, to find out how many of them are not or moderately critical S inclusions, critical M inclusions and very critical L inclusions.

ARL iSpark Plus OXSAS analytical software displays the results of the inclusion analysis and allows them to be printed and stored along with the element concentrations. The results can also be exported in Excel format, transmitted to statistical process control (SPC) software or to a LIMS.

In addition, a specific inclusion analysis report is created, allowing clear and concise reporting of the inclusion data.
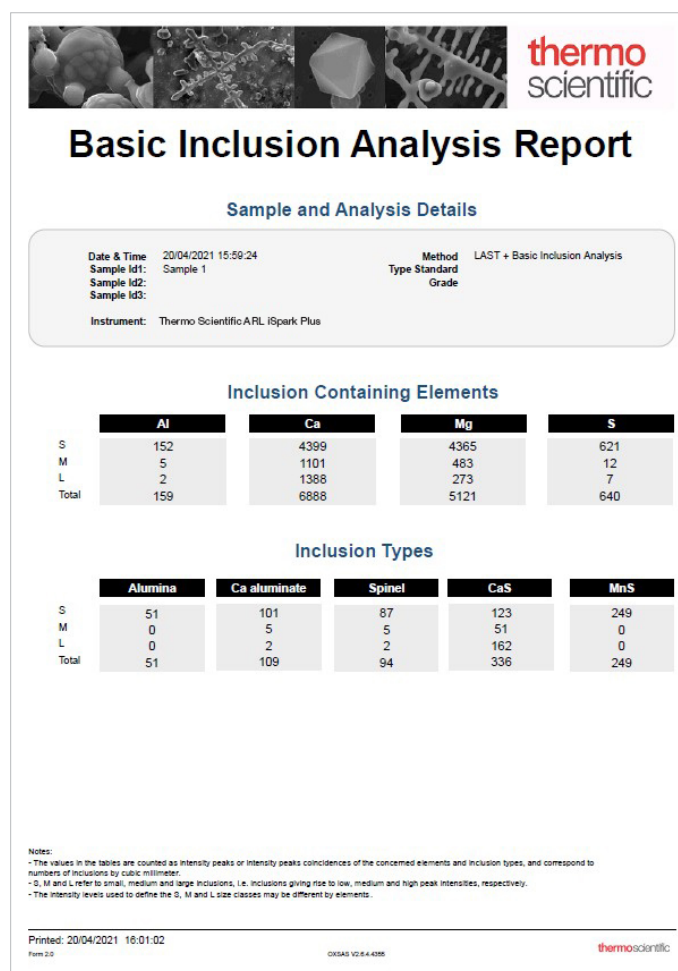

Figure 1: Inclusion analysis report included with the Basic Inclusion Analysis Spark-DAT option.

Specifications

Methods	• Analysis of inclusions combined with elemental analysis of low alloy steel • Analysis of inclusions only
Inclusion data	Total number, and number of small, medium-size and large inclusions for the following types: • Al, Ca, Mg and S bearing inclusions • Al_2O_3, Al_2O_3-CaO, CaO, Al_2O_3-MgO, CaS and MnS inclusions
Reporting	• Standard reporting in OXSAS software (includes elemental composition and inclusion data) • Dedicated inclusion analysis report in PDF format with numbers of inclusions per mm^3
OES spectrometer models concerned	ARL iSpark Plus Series optical emission spectrometers
Requirements	• PMT channels for Al, Ca, Mg, Mn and S • Low alloy steel calibration
Sample preparation	Same as standard elemental analysis, i.e., grinding or milling
Maintenance	Same as standard elemental analysis
Upgrade	Upgrade to Standard Inclusion Analysis and Advanced Inclusion Analysis possible

Learn more at **thermofisher.com/isparkplus**

thermo scientific